7 Land, Soils and Geology

7.1 Introduction

This chapter comprises an assessment of the land, soils and geology within the vicinity of the site and the surrounding environs. The potential impacts posed by the construction and operational phases of the Proposed Development are investigated, and suitable mitigation measures are recommended to minimise impacts on the local soil and geological receptors.

The objectives of this chapter are:

- To provide a baseline assessment of the receiving environment in terms of land, soils and geology.
- To identify any potential negative impacts posed by the construction and operational phases of the Proposed Development.
- To propose suitable mitigation measures to prevent or reduce the significance of the negative effects identified.
- To consider any significant residual effects of cumulative impacts posed by the Proposed Development.

7.2 Consultation

ORS have been commissioned to assess the potential impacts of the Proposed Development in terms of Land, Soils, and Geology during the construction and operational phases.

The principal members of the ORS EIA team involved in this assessment include the following persons:

- **Project Scientist and Lead Author:**
  Jack Wilton – B.Sc. (Microbiology), M.Sc. (Environmental Sustainability). Current Role: Environmental Consultant. Experience *ca*. 2 years

- **Project Scientist and Reviewer:**
  Cathal Tighe – B.Agr.Sc (Agricultural-Environmental Science). Current Role: Senior Environmental Consultant. Experience ca. 5 years

- **Project Coordinator and Reviewer:**
  Oisín Doherty – B.Sc. (Geography with Environmental Science), MSc. (Environmental Management), CEnv, MIEnvSc. Current Role: Chartered Environmental Consultant. Experience *ca.* 15 years.

Consultation between ORS and other members of the planning/design team was made in order to obtain information required to assess the potential construction and operational phase impacts on local Land, Soils, and Geology.

7.3 Assessment Methodology and Significance Criteria

The methodology used to produce this chapter included a review of relevant legislation and guidance, a desk study, a site walkover, an intrusive investigation (in the form of trial pits, and laboratory tests), an evaluation of potential effects, an evaluation of significance of the effect and an identification of measures to avoid and mitigate effects.

This chapter was carried out in accordance with the following guidance documents:

- EPA, (2022). Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.
- EPA, (2004). Land spreading of Organic Waste – Guidance on Groundwater Vulnerability Assessment of Land.
- EPA, (2004). Guidance Note on Storage and Transfer of Materials for Scheduled Activities.
- EPA, (2012). Guidance to Licensees on Surrender, Cessation and Closure of Licensed Sites.
- European Commission, (2017). Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report.
- Institute of Geologists Ireland, (2013). Guidelines for Preparation of Soils, Geology and Hydrogeology Chapters in Environmental Impact Statements.
- National Road Authority, (2008). Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.
- Transport Infrastructure Ireland, (2019). Cross Sections and Headroom, Design Standards (DN-GEO-03036)
- CIRIA, (2001). C532 - Control of Water Pollution from Construction Sites – Guidance for consultants and contractors.
- UK CIRIA Report C552 (2001). Contaminated Land Risk Assessment: A Guide to Good Practice
- IGI, (2002). Geology in Environmental Impact Statements – a Guide (Institute of Geologists of Ireland.
- Department Agriculture, Food and Marine, (2017). Nitrate Explanatory Handbook for Good Agricultural Practice For The Protection Of Waters Regulations 2018
- DAFM, (2022). Code of Good Practice for Poultry Litter Hauliers - Legal Obligations and Good Practice Guidelines for Poultry Litter Hauliers in Relation to the Use and Disposal of Poultry Litter.
- Nitrates Directive (91/676/EEC)
- Groundwater Directives (80/68/EEC) and (2006/118/EC).
- EU Soil Strategy 2030
- EU Common Agricultural Policy
- Waste Management Act 1996.
- Möller, K., and Müller, T. (2012). Effects of anaerobic digestion on digestate nutrient availability and crop growth: a review. Engineering in Life Sciences, 12(3), 242-257.
- Doyeni MO, Stulpinaite U, Baksinskaite A, Suproniene S, Tilvikiene V. (2021) The Effectiveness of Digestate Use for Fertilization in an Agricultural Cropping System. Plants (Basel). 2021 Aug 22;10(8):1734.

7.3.1 Desktop Study

A desk study was undertaken in order to collate and review background information in advance of the site survey and to develop a baseline of the land, soil and geology. The following documents and sources were referenced:

- Geological Survey of Ireland (GSI) maps and datasets
- Environmental Protection Agency (EPA) maps and datasets
- National Parks and Wildlife Service (NPWS) maps and datasets

- Ordnance Survey of Ireland (OSI) maps and datasets
- Met Eireann meteorological data
- Office of Public Works (OPW) maps and datasets
- Waterford City and County Development Plan (CDP) 2022-2028
- Strategic Environmental Assessment CDP 2022-2028
- Review of the County Geology of Ireland: Waterford
- Aerial Photography from ESRI (ArcGIS).
- 1:50,000 Discovery Series Maps and 6" maps
- South Eastern River Basin District River Basin Management Plan (DoEHLG)
- Teagasc ISIS GIS maps
- General Soil Map of Ireland 2nd Edition, (1980), The National Soil Survey, An Fóras Taluntais
- An Foras Talúntais (1980). Soil associations of Ireland and their land use potential.
- County Waterford Groundwater Protection Scheme – Main Report (1998).

7.3.2 Field Survey

Fieldwork commissioned December 2023 consisted of the following elements:

- Trial Pit Excavations
- BRE Digest 365 Percolation/Soakaway Testing

A site walk-over was conducted by ORS geotechnical consultants on the 13th of December 2023 to verify the finding of the desktop study and identify baseline features on the Proposed Development site including:

- Drainage patterns and distribution
- Exposures
- Drainage Infrastructure
- Flora and fauna identification and distribution
- Identification of "Poached" ground.

7.3.3 Impact Assessment Methodology

Chapter 1, **Section 1.7** and **1.8**, outline the impact assessment methodology and rationale applied to each chapter of the study. This section describes some further criteria applied to the assessment of soil and geological receptors.

Risk Appraisal Methodology

The Conceptual Site Model (CSM) identifies potential contaminants, receptors and exposure pathways that may be present based on the construction and operational phase of the Proposed Development. The identification of potential "contaminant linkages" is a key aspect of the evaluation of potentially contaminated land and in quantifying the potential risk associated with Proposed Developments. As such this assessment has been undertaken in line with the Source - Pathway - Receptor Model as per the "Guidelines on the information to be contained in Environmental Impact Assessment Reports" 2022 and IGI 2013 guidance notes. At the impact assessment stage, any potential beneficial or adverse impacts associated with the development are identified and assessed with reference to the baseline environment. This

requires consideration of:

- Quality of effects (sensitivity of receptor)
- Significance of effects (severity)
- Description of extent and context of effects (character/ magnitude)
- Probability of effects
- Duration and frequency of effects
- Type of effect (direct, indirect, residual, etc.)

Table 1.1 in **Chapter 1** presents the criteria for the description of effects, as outlined in the EPA guidance report 2022.

Evaluation of Geological Receptors

The 13-step approach to impact assessment proposed in the IGI guidelines (2013) is adopted for the evaluation of potential effects. The baseline environment is assessed by characterising the site topographical, geological and geomorphologic regimes from the data acquired. Following on from the identification of the baseline environment, the available data is utilised to identify and categorise potential effects on the soils and geological environment as a result of the Proposed Development.

These assessments include:

- Undertaking preliminary materials calculations in terms of volumetric soil and subsoil excavation and reuse associated with development design,
- Assessing ground stability risks,
- Assessing the combined data acquired and evaluating any likely effects on the soils, geology, and ground stability,
- Identifying effects and considering measures that would mitigate or reduce the identified effect.

The significance of effects of the Proposed Development has been assessed in accordance with the EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports, 2022. The effects associated with the Proposed Development are described with respect to the EPA guidance in the relevant sections of this chapter.

Magnitude and Significance of Impact

An impact rating has been developed for each of the phases of the Proposed Development based on the Institute for Geologists Ireland (IGI) Guidance for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements. In line with the IGI Guidance the receiving environment (Geological Features) was first identified. Using the National Road Authority (NRA) (2008) rating criteria the importance of the geological features is rated in **Table 7.1** followed by an estimation of the magnitude of the impact (**Table 7.2**). This determines the significance of the impact prior to application of mitigation measures as set out in **Table 7.3**.

Table 7.1: Sensitivity/ Value of the Site's Geological Features (NRA, 2008)

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

The assessment of the severity/ magnitude of an impact incorporates the timing, scale, size, and duration of the potential effect. The magnitude criteria for geological effects are defined in **Table 7.2**.

Table 7.2: Severity/ Magnitude of Impact on Geological Features (NRA, 2008)

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

Based on the determination of the findings from the above **Tables** (**7.1** and **7.2**) the following matrix is used to establish the significance of the impact.

Table 7.3: Rating the Significance of the Impact in Geology (NRA, 2008)

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

7.4 Description of the Receiving Environment

7.4.1 Background

This section of the chapter provides the baseline information in terms of geomorphology (landscape and topography), superficial and solid geology. The regional review of geological and hydrogeological conditions covers a zone of at least 2 km from the Proposed Development site, as suggested in the IGI guideline.

The Proposed Development occupies a total area of 7.7Ha and is situated in the townlands of Curraghnagarraha and Reatagh and Curraghballintlea, Co. Waterford. The Proposed Development is situated to the north of a pig farm (Industrial Emissions License: P0573-01) with agricultural lands to the north, east and south of the site. The L4031, a single-lane local road is located beyond the western boundary of the site. The road is adjoined to the south by the R677 regional road, Scrouty Road and the Rath Road. A facility access road will be constructed along the southwestern boundary of the site. The access road will connect the facility to the Scrouty Road to the south and the wider road network of the surrounding area. The Proposed Development lies approximately 3km southeast of Carrick-on-Suir.

The underlying geology has a major influence on topographical, hydrogeological and hydrological features within the Proposed Development vicinity, hence this chapter is closely linked to **Chapter 8 – Hydrology and Hydrogeology**.

The receiving environment is described below for the Proposed Development under the following headings:

- Topography
- Drift (Quaternary) Geology
- Bedrock Geology
- Soils and Subsoils

7.4.2 Topography

Co. Waterford has a varied and unique landscape. It includes a diversity of landscape types, ranging from coast and lakes rolling hills and lakes to peatlands, farmlands, fertile lowland valleys, woodlands and uplands. The range of different landscapes found in Co. Waterford each have varying visual and amenity values, topography, exposure and contain a variety of habitats. Each landscape type also has varying capacity to absorb development relative to its

overall sensitivity. The landscape in County Waterford contains views and prospects worthy of protection.

The Landscape Character Assessment undertaken to inform the review of the Waterford City and County Development Plan 2022-2028 has divided the county into 7 no. Landscape Character Units based on the local landscape features which include:

1. Coastal
2. Farmed Lowlands
3. Rivers
4. Estuaries
5. Foothills
6. Uplands
7. Settlement

The proposed site is located in Landscape Unit 5 – Foothills adjacent to Landscape Unit 7 – Farmed Lowlands. See **Figure 7.1**.

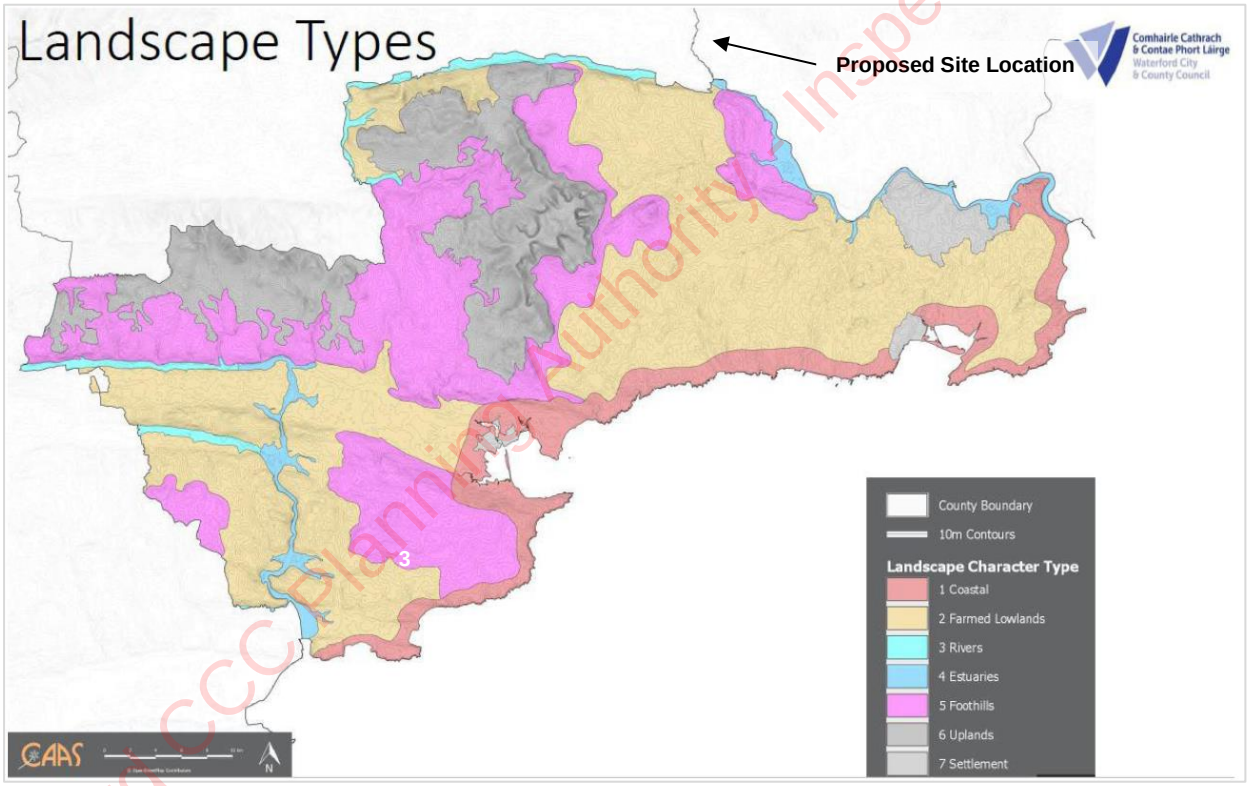


Figure 7.1: Landscape Types (Map A8.1 of Appendix 8 of the Waterford City and County Development Plan 2022-2028)

The aforementioned landscape characters are further differentiated into 29 no. Landscape Character Units. See **Figure 7.2**. overleaf.

Table 7.4: Table 8.1 of Appendix 8 of the Waterford City and County Development Plan 2022-2028)

Landscape Types and Character Units in Waterford		
Type	**Key**	**Name**
1. Coastal Landscapes	1A	Lower Waterford Estuary
	1B	Tramore Bay
	1C	Copper Coast East
	1D	Copper Coast West
	1E	Dungarvan
	1F	Helvic Head
	1G	Ardmore Head
2. Farmed Lowland Landscapes	2A	Rathgormack Lowlands
	2B	Kilmacthomas Lowlands
	2C	East Waterford Lowlands
	2D	Clashmore and Newport Lowlands
	2E	Blackwater and Bride Lowlands
	2F	Kinsalebeg
3. River Corridor Landscapes	3A	Blackwater and Bride River Corridor
	3B	Suir River Corridor
4. Estuaries	4A	Blackwater Estuary
	4B	Suir Estuary
5. Foothill Landscapes	5A	Knockaturnory Munsboro
	5B	Ballymacarbry / Nire Valley
	5C	Tooraneera Foothills
	5D	Knockmealdown Foothills
	5E	Drumhills
	5F	Glendine
	5G	Portlaw Foothills
6. Upland Landscapes	6A	Comeragh Mountains
	6B	Knockmealdown Mountains
7. Urbanising Landscapes	7A	Waterford City Environs
	7B	Tramore Environs
	7C	Dungarvan Environs

The Proposed Development is located in the Landscape Character Unit 5G: Portlaw Foothills and is adjacent to unit 2A: Rathgormack Lowlands.

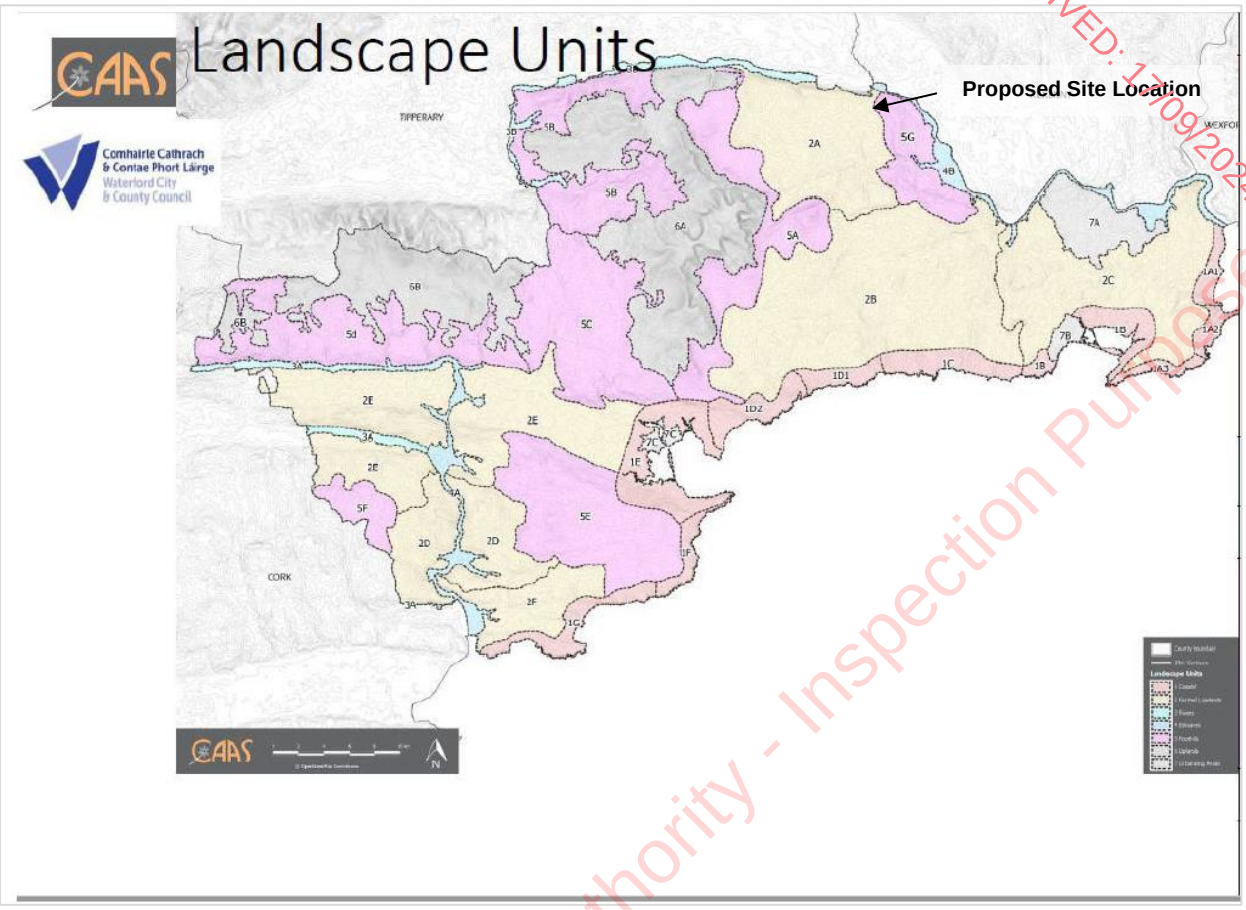


Figure 7.2: Landscape Units (Map A8.2 of Appendix 8 of the Waterford City and County Development Plan 2022-2028)

According to the GSI Viewer the site is characterised as “Rolling to gently undulating glacial sediments”, in keeping with the Landscape Character Type description for the area.

The River Suir is a distinct and a dominant feature within the landscape of northern Waterford. The topography of the site slopes steeply from the southwest to the northeast. A peak in the site topography, 106.5m OD, is situated along the western boundary of the site with a gradual gradient eastward. This gradient becomes steep towards the centre of the site at 98m OD and continues to gradually fall eastwards to a low of 91.5m OD along the eastern site boundary. The Tinhalla stream, a small waterbody, occurs adjacent to the eastern site boundary and runs southwest underneath the route of the proposed facility access road. The stream runs in a south to north direction where it discharges into the River Suir approximately 1.9km downstream. The topography at the site entrance and location of the proposed facility access road is 102.5m OD. The lands to the south of the entrance, along the route of the access road climb to an elevation of 123m OD along the Scrouty Road. Within the field adjacent to Scrouty Road, the lands slope steeply to the northwest. This slope becomes gradual across the field adjacent to the south of the Proposed Development site, with the direction of the slope falling southeast.

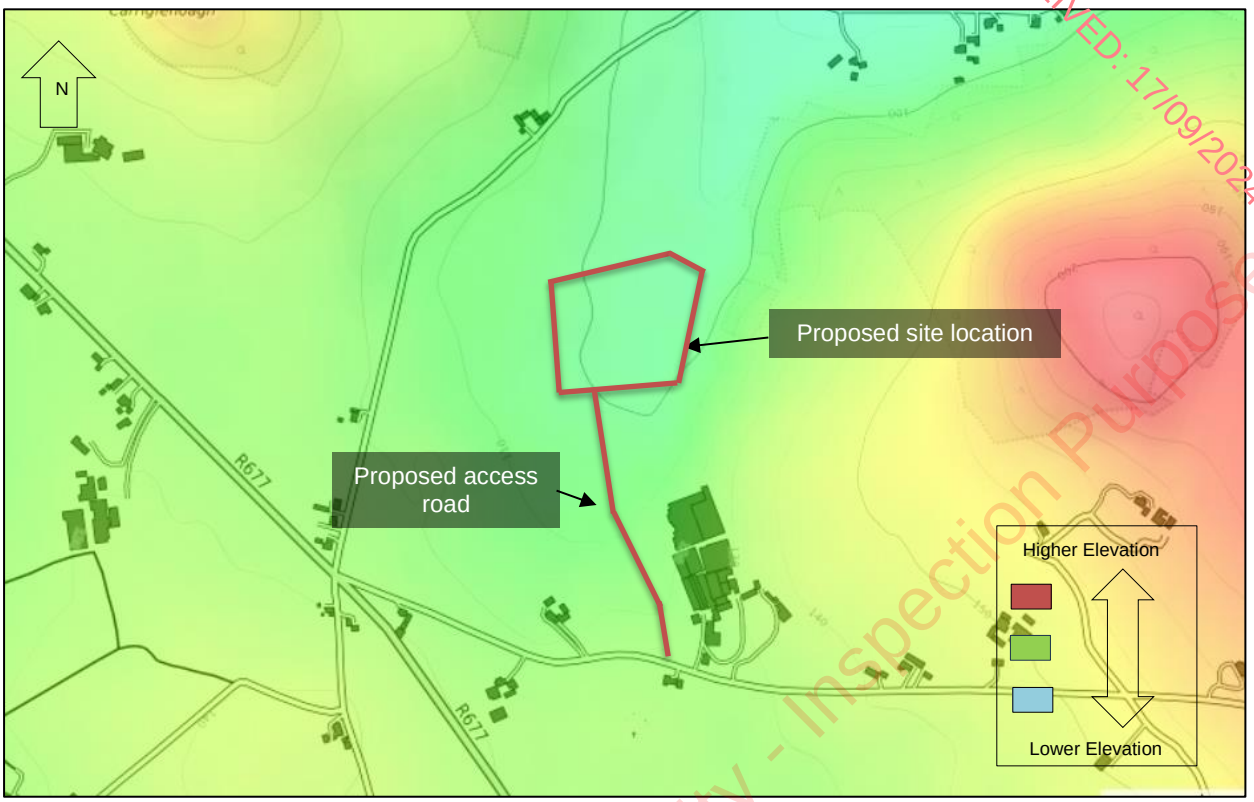


Figure 7.2: Topographical map of the landscape surrounding the site (topographic-map.com)

7.4.3 Receptors

Designated Sites

Figure 7.3 displays the spatial distribution of the Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Natural Heritage Areas (NHA) within the wider region. SAC are prime wildlife conservation areas in the country which are considered to be important on a country and European scale. Sites are selected and designated under the EU Habitats Directive and have been transposed into Irish law under EC (Birds and Natural Habitats) Regulation 2011 (S.I. No. 477/ 2011). Likewise, an SPA is an area selected for conservation due to its importance in the protection of rare or vulnerable bird species, migratory species, and wetlands. Sites are selected and protected under the EU Birds Directive.

The closest designated sites to the Proposed Development include the Lower River Suir SAC (Site Code: 002173) located *ca.* 1.7km north of the site and the Tibberaghney Marshes pNHA (000411) *ca.* 1.6km northeast of the site. There are no additional designated sites within 2km of the site.

Table 7.5: Protected Areas within 2km study area

Name	Site Code	Designation	Reason for Protection
Lower River Suir	002173	Special Area of Conservation (SAC)	• Atlantic salt meadows (Glauco-*Puccinellietalia maritimae*) [1330] • Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] • Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430] • Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0] • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] • *Taxus baccata* woods of the British Isles [91J0] • *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029] • *Austropotamobius pallipes* (White-clawed Crayfish) [1092] • *Petromyzon marinus* (Sea Lamprey) [1095] • *Lampetra planeri* (Brook Lamprey) [1096] • *Lampetra fluviatilis* (River Lamprey) [1099] • *Alosa fallax fallax* (Twaite Shad) [1103] • *Salmo salar* (Salmon) [1106] • *Lutra lutra* (Otter) [1355]

Taking into consideration the 'Source-Pathway-Receptor' model, the closest waterbody is the Tinhalla stream located to the east of the Proposed Development. The stream runs south to north, adjacent to the eastern boundary of the site and discharges into the River Suir SAC approximately 1.9km downstream of the site. Thus, there is hydrologic connectivity between the site and the aforementioned SAC. All lands within the site drain into the Tinhalla stream. The stream will receive discharge of surface-water runoff from site. This stream is likely to act as a pathway or receptor of pollution associated with the site.

An appraisal of the potential effects of the Proposed Development on the constitutive characteristics of European sites identified within 15km of the Proposed Development is set out in the Natura Impact Statement which accompanies the planning application for this project.

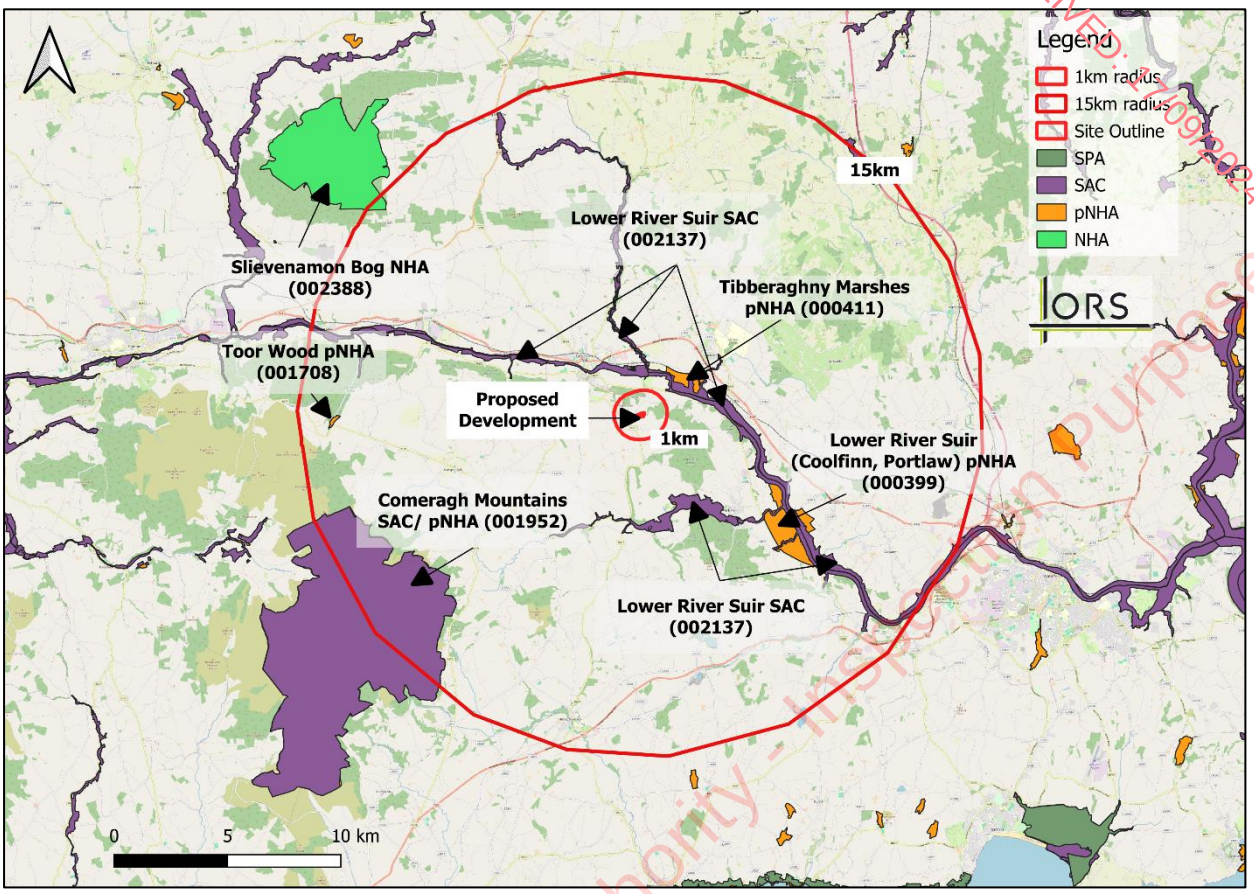


Figure 7.3: SPA, SAC and NHA sites within a 1km and 15km radius of site

Geological Heritage

The Irish Geological Heritage (IGH) Programme identifies and selects a complete range of sites that represent Ireland's geological heritage under sixteen themes ranging from karst features to hydrogeology. The IGH Programme is a partnership between the GSI and the National Parks and Wildlife Service (NPWS) and sites identified as important for conservation are conserved as Natural Heritage Areas (NHA).

Reference to the GSI online database confirms the proposed site is not within a geological heritage site and that there are no designated sites within the 2 km study area of the Proposed Development. The closest site is Piltown, which is described as "*borehole locations and a disused quarry*" located approximately 5.4km northeast of the site, which is outside the 2km study area. **Figure 7.4** overleaf indicates the Geological Heritage Site within the wider region.

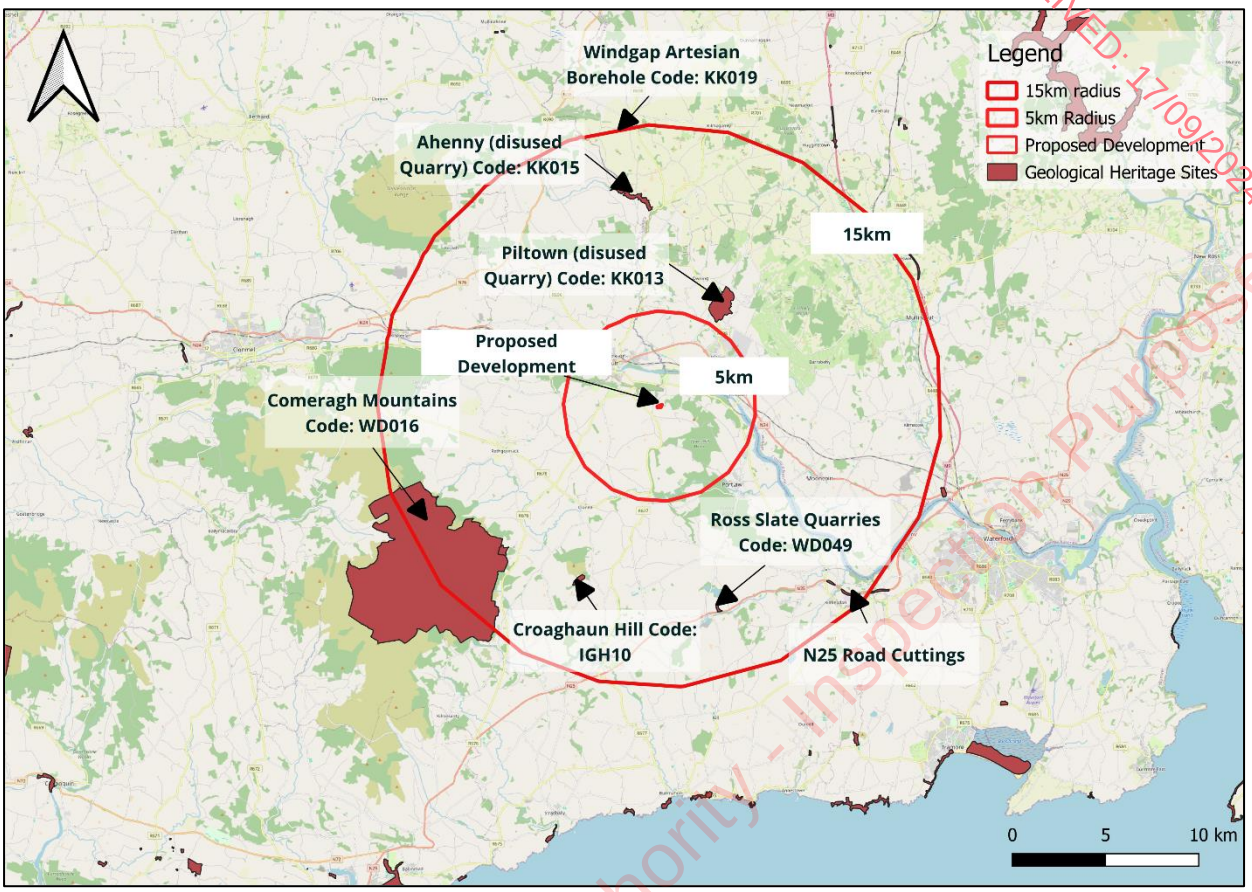


Figure 7.4: Geological Heritage Sites within the vicinity of the site

7.4.4 Drift (Quaternary) Geology

Drift is a general term applied to all mineral material (clay, silt, sand, gravel and boulders) transported by a glacier and deposited directly by or from the ice or as fluvioglacial deposits. It generally applies to deposits laid down during the Pleistocene (Quaternary) glaciations. Drift can also be included under Holocene (Quaternary) deposits. The drift geology of the area principally reflects the depositional process of the last glaciation. Typically, during the ice advance, boulder clays were deposited, sub-glacially as lodgement till over the eroded rock head surface, whilst moraine granular deposits were laid down at the glacier margins. Subsequently, with the progressive retreat of the ice sheet from the region, granular fluvio-glacial deposits were laid down in places by melt waters discharging from the front of the glacier.

The Proposed Development is located within a foothill landscape with a wider region of farmed lowlands which extend towards the Comeragh Mountains to the southwest. The foothills in the region rise along the south banks of the River Suir and extend towards the west and east to the southeast, following the course of the River Suir. The landscape in the immediate vicinity of the Proposed Development site is a lowland region ringed by rounded mountains and a mountain ice-sculpted ridge extending from the Comeragh Mountains in the southwest as shown in **Figure 7.5** overleaf.

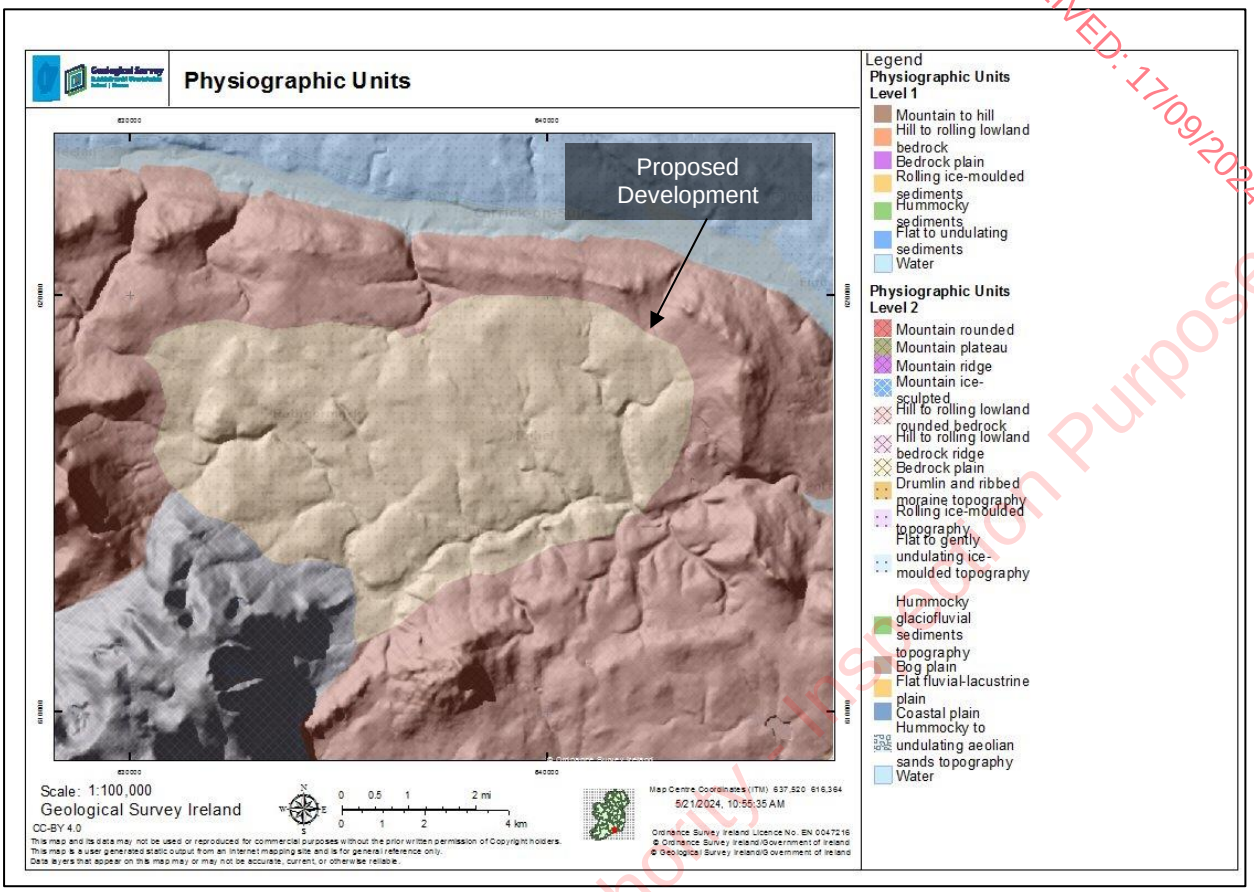


Figure 7.5: Physiographic Character of the site and surrounding landscape

The Second Edition General Soil Map of Ireland describes this region as belonging to the "mountain rounded" group of the broad physiographic divisions, comprising of Acid Brown Earths (75%) with associated soils including Gleys (15%) and Brown Podzolics (10%). Parent material is proposed to consist of Ordovician – Silurian – Cambrian shale till. The majority of the proposed site overlays till derived from Devonian sandstones. A section of the northeastern portion of the development site is noted as a "*Bedrock outcrop or subcrop'*.

In view of the Proposed Development, the soils which are likely to be affected by the development are characteristic in the local and regional context and occur in abundance.

7.4.5 Bedrock Geology

Regional Bedrock Geology

County Waterford has a wide variety of geology with rock formations dating as far back as the Pre-Cambrain to the more recent Carboniferous periods, *ca.* 600 to 300 million years. County Waterford is composed of a wide variety of rock formations that were originally formed as an ocean began to spread northwards over Ireland. These different formations ended up, side by side during the formation of Ireland. Originally Ireland was composed of two 'halves' separated by a sea called the Lapetus, with the country split in a north-east to south-west direction from Clogher head to Dingle. The northwestern part of the island was located on the continent of Laurentia, with the southeastern part of the island located on Gondwana. The collision of these

two continents resulted in the folding of both of these plates. This folding resulted in the formation of the mountain ranges located throughout Ireland today, which run in a northeast to southwest axis.

The Precambrian rocks in Waterford are 600 million years old and are now metamorphosed or altered sediments that were first deposited into an ocean and later changed during a later mountain-building event. During the Ordovician period (488-444 million years ago) shallow water limestones and some deeper-water muds were laid down in the Iapetus Ocean that divided Ireland into two. The Tramore Limestone dates from this time and contains bell-shaped fossil bryozoans called Diplotrypa. Some brachiopods (shells) and trilobites (arthropods, like Horseshoe Crabs) have also been found. As this ocean slowly closed the continents on either side were subjected to great stress and volcanoes produced lavas and ash during eruptions. Along the coast at Kilfarrassy and Bonmahon these volcanic rocks can be seen. During the Silurian period sediments continued to be deposited in the ocean that finally closed. This closure caused another mountain-building event to take place causing many of the Silurian rocks to be tilted and then eroded away.

A new continent was created in the Devonian, around 400 Ma, as the Iapetus Ocean closed. Large rivers drained from the newly formed mountains and deposited great thicknesses of sand and gravel on the flood plains. In a few places these Devonian rocks can be seen lying on an ancient erosion surface on steeply tilted older rocks. The boundary between them is called an unconformity. These sandstones and conglomerate (pebble beds) now form all of the higher ground, above 200 metres, in the county, such as the Comeragh and Knockmealdown mountains. By about 360 Ma, at the start of the Carboniferous, sea level was slowly rising and it drowned the flood plains. The limestones deposited in this warm, shallow equatorial sea now form much of the low ground across the county. After the Ice Age the rivers in southern Ireland flowed north to south. As they eroded downwards the upstream parts of rivers were reorientated by the underlying east to west trend of the landscape in south Munster. The River Blackwater flows for most of its length eastwards but at Cappoquin makes a marked right-hand turn and flows south to Youghal

The Proposed Development is located on a large terrane of Silurian metasediments and volcanics which stretches from Garravone (N), Clongam (E) and Clonea (S) to the Comeragh Mountains (W). Towards the south of the terrane a linear section of Devonian Kiltorcan-type Sandstones occurs running from east to west. **Figure 7.6** indicates the regional hydrostratigraphic rock unit groups.

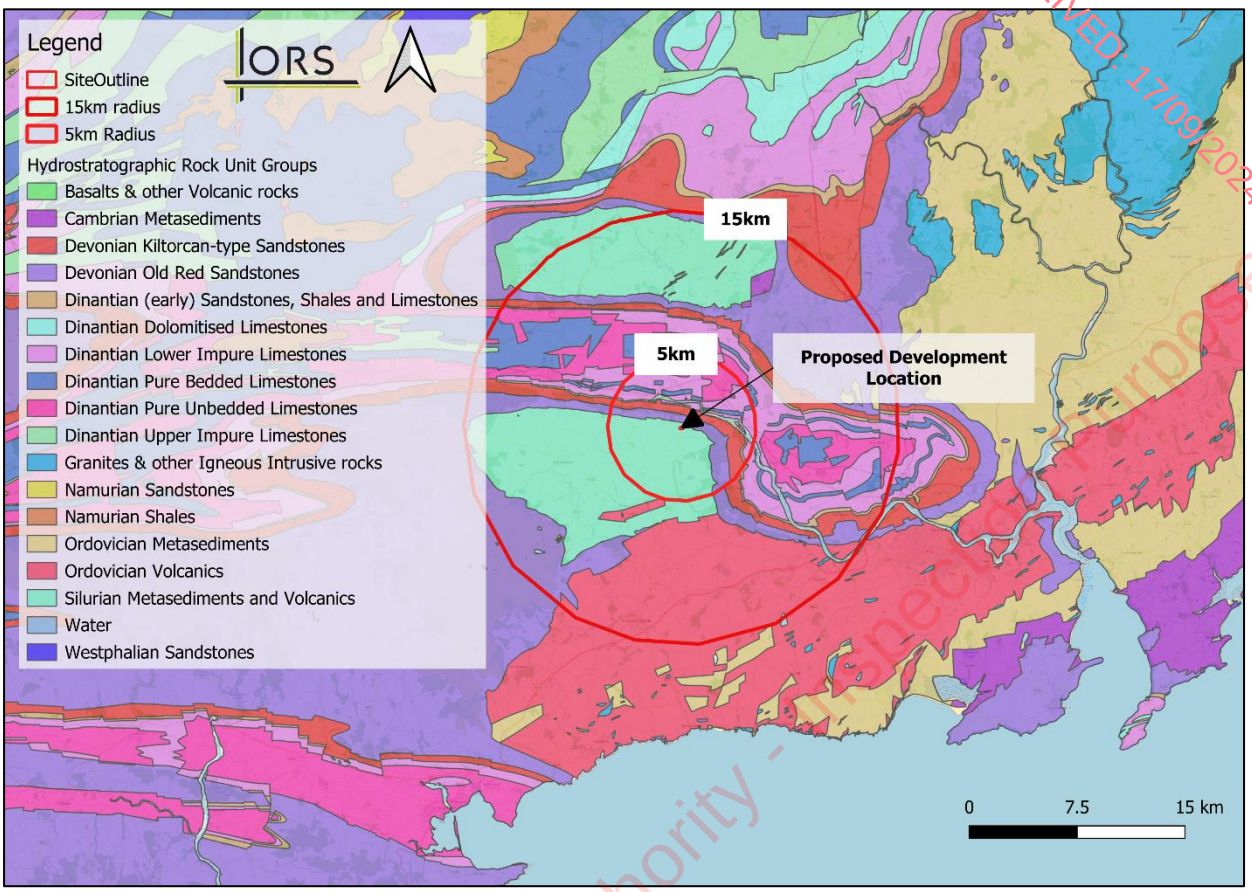


Figure 7.6: Hydrostratigraphic Rock Unit Groups Within Co. Waterford (GSI)

Local Bedrock Geology

Bedrock is defined as a consolidated aggregate of minerals underlying the ground surface and any soils present. Above the bedrock is usually an area of broken and weathered unconsolidated rock in the basal subsoil. Sedimentary rock lies in beds which may comprise different rock types and which may be horizontal or inclined, so that the rock encountered at the ground surface may change over a short distance.

According to the Geological Survey of Ireland and the National Draft Generalised Bedrock Map, the bedrock within the 2km study area of the Proposed Development, which extends to the south, southeast and west is comprised of Late Llandovery to mid Caradoc series Silurian period rocks. An area which extends 2km north and east of the Proposed Development is comprised of a variety of formations which consist of Upper Devonian series Devonian period rocks and Dinantian series Carboniferous period rocks.

The formation underlying the Proposed Development is known as the Ballindysert Formation. The 1:100,000 Bedrock Solid Geology Map indicates that the bedrock type in this formation is dark grey slate and greywackle. The lithological description of the formation is “characterised by dark grey slates. They are massive and frequently contain thin white silty mudstones”. The formation is probably lenticular with a maximum thickness of *ca.* 1900m. Exposers of the formation can be found to the west of the Proposed Development site, towards the centre of

the formation running from northeast to the southwest towards Rathgormuck. A number of exposers can be observed along the northern and eastern edges of the formation.

The Carrigmaclea Formation lies to the north of the 2km study area, bordering the Ballindysert Formation. GSI have classified this as red, brown conglomerate and sandstone. The lithology "comprises quartz cobble conglomerates, pebbly sandstones and cross-stratified sandstones; all of the units are red, brown or pink in colour. Conglomerates are particularly common towards the base of the formation".

Beyond the Carrigmaclea Formation are the Kiltorcan, Porter's Gate and Ballysteen Formations respectively. GSI have classified the Kiltorcan Formation as yellow and red sandstone and green mudstone. The lithological description of the formation is summarised as "coarse-grained white-yellow sandstone, mudflake conglomerate, red-yellow flaggy sandstone, green silty mudstone and green mudstone". GSI have classified the Porter's Gate Formation as sandstone, shale and thin limestone. The lithological description is summarised as "grey flaser-bedded sandstones, linsen, grey mudstones, thin sandstones and thin bioclastic limestones". GSI have classified the Ballysteen Formation as dark muddy limestone and shale. The lithological description is "irregularly bedded and nodular bedded argillaceous bioclastic limestones (wackestones and packstones), interbedded with fossiliferous calcareous shales".

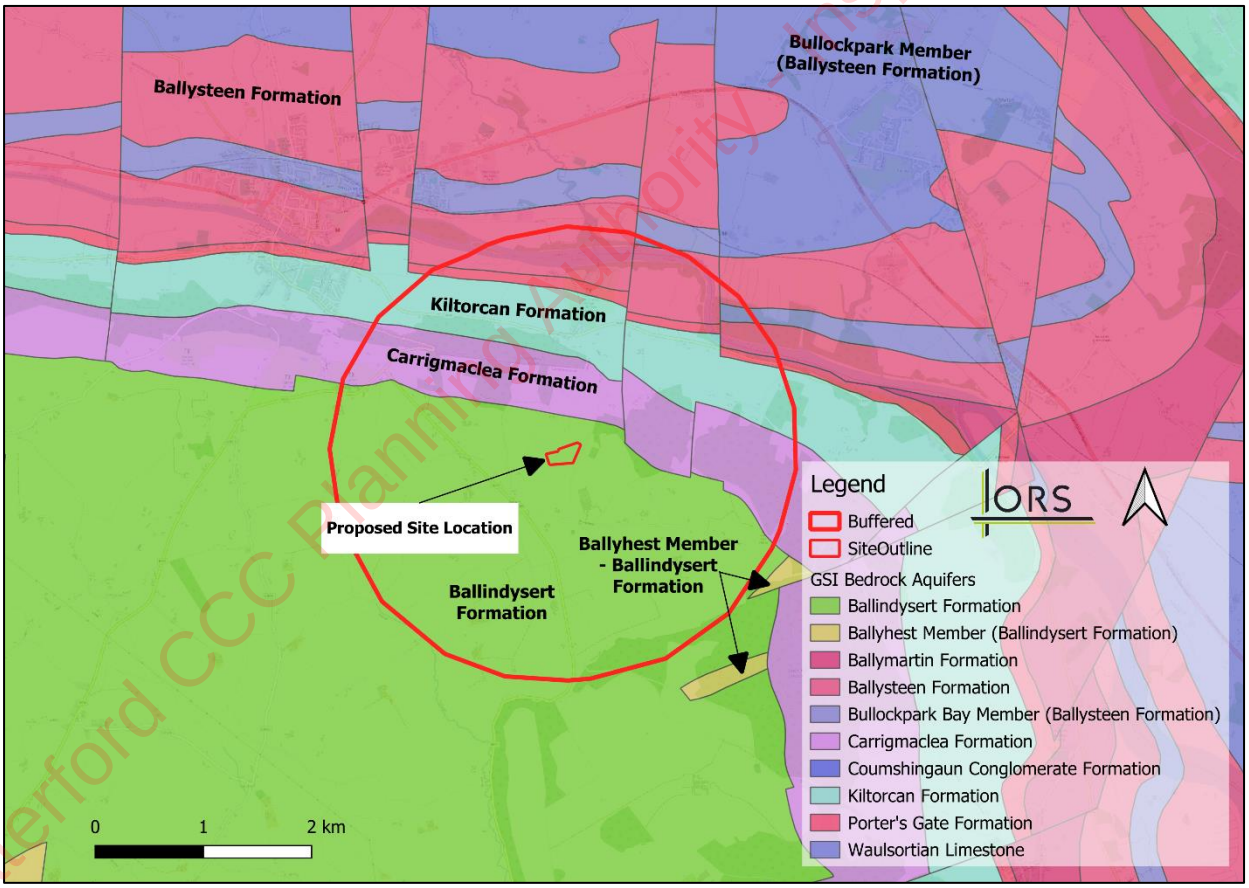


Figure 7.7 Regional Bedrock Formations (GSI)

The bedrock geology and linework on the 1:100,000 scale mapping from the GSI indicates that there are a number of geological linework (e.g. unconformity, faults etc.) within the 2km study

area. The closest unconformity is located *ca.* 400m east of the site and runs from north to south. The Carrigmaclea Formation (Red, brown conglomerate and sandstone) begins along the fault line which runs perpendicular to the formation and encroaches upon the Ballindysert formation to the south. Bedrock geology and linework can be seen in **Figure 7.7**.

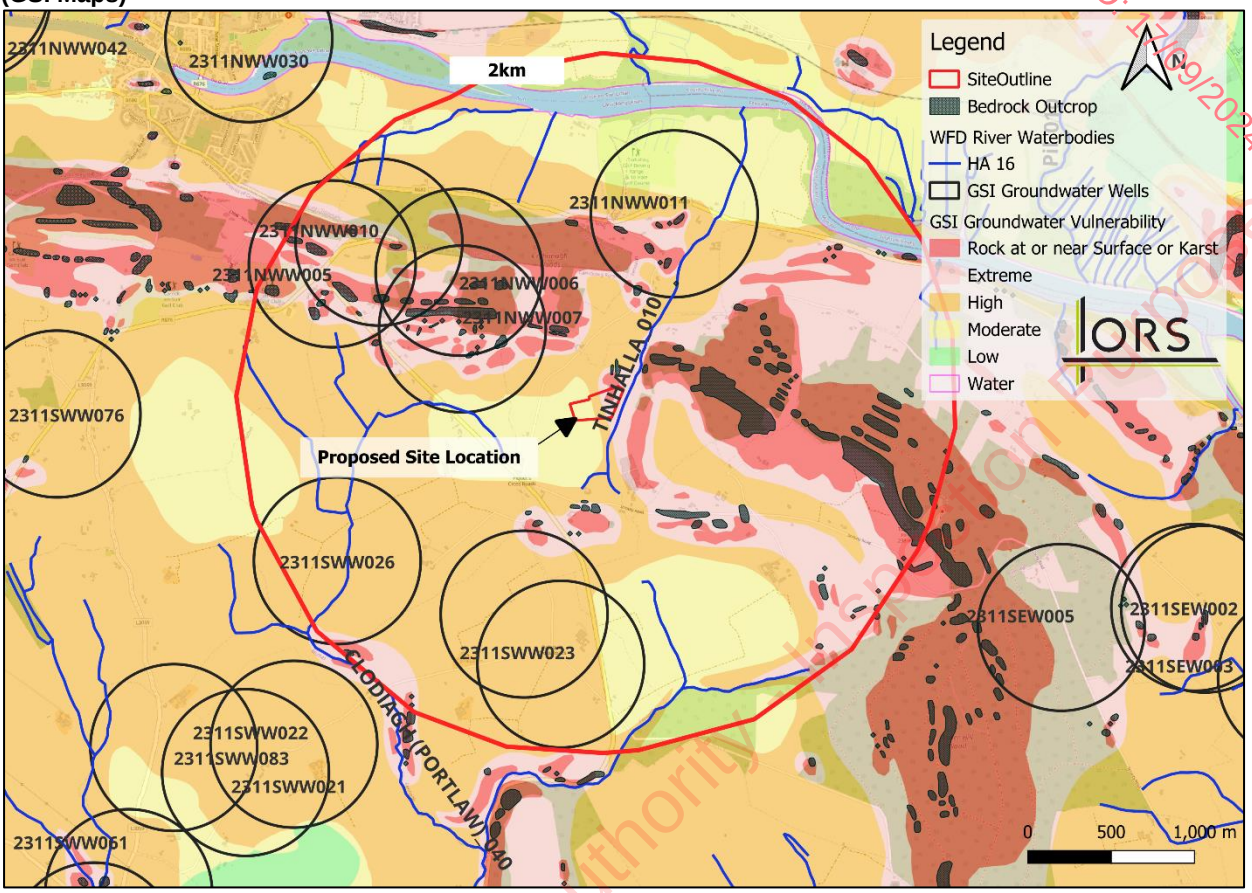
Depth to Bedrock

According to the GSI database, there are **9 groundwater wells within the 2km study area**. All of these groundwater wells are defined as Boreholes. The details of groundwater wells within 2km of the Proposed Development are outlined in **Table 7.5** below. **Figure 7.8** superimposes the approximate location of the groundwater wells listed in **Table 7.5** relative to the groundwater vulnerability rating of the area. The Proposed Development boundary is marked out in red. Groundwater wells within the wider area have a varying yield class from moderate to poor. The lands on which the site location has been proposed have been assigned variety of vulnerability ratings ranging from moderate along the western boundary, high along a central strip of the site, Extreme at the eastern boundary and X (Rock near or at surface or karst) along a northeast portion of the site. The recorded depth to bedrock encountered for the corresponding wells in the wider area are generally between 1.2 to 9.1 metres below ground level (bgl). The subject site is situated above the Comeragh Groundwater Body which is designated by the Geological Survey of Ireland (GSI) National Draft Bedrock Aquifer Map as a Regionally Important Aquifer which is moderately productive only in local zones- (Classification reference - Ll).

Table 7.5: Groundwater Wells with 2km of the site (GSI Well Database)

GSI Reference	Easting Northing	Well Type	Depth (m bgl)	Depth to Rock (m)	Well Use	Yield m^3/d	Proximity to site
2311NWW011	243000 120700	Borehole	28.1	9.1	Domestic use only	32.7	0.6 km N
2311NWW007	241730 120010	Borehole	22.9	4.6	Domestic use only	43.6	0.36 km NW
2311NWW006	241710 120350	Borehole	18.3	3.1	Domestic use only	43.6	0.59km NW
2311NWW010	241230 120530	Borehole	12.8	4	Domestic use only	76.3	1.09km NW
2311NWW005	240950 120400	Borehole	36.6	3.1	Domestic use only	58.8	1.29km NW
2311SWW026	240980 118620	Borehole	29.3	3.1	NA	32.7	1.12km SW
2311SWW024	242100 118300	Borehole	24.4	3.7	NA	27.3	0.7km S
2311SWW023	242320 118000	Borehole	19.5	3.1	Domestic use only	30	1.06km S
2311SWW084	243050 118950	Borehole	44.2	1.2	Agri and domestic use	49.1	0.65km SE

Figure 7.8: Groundwater Vulnerability and location of Groundwater Wells and associated depth to bedrock (GSI Maps)



Karst Features

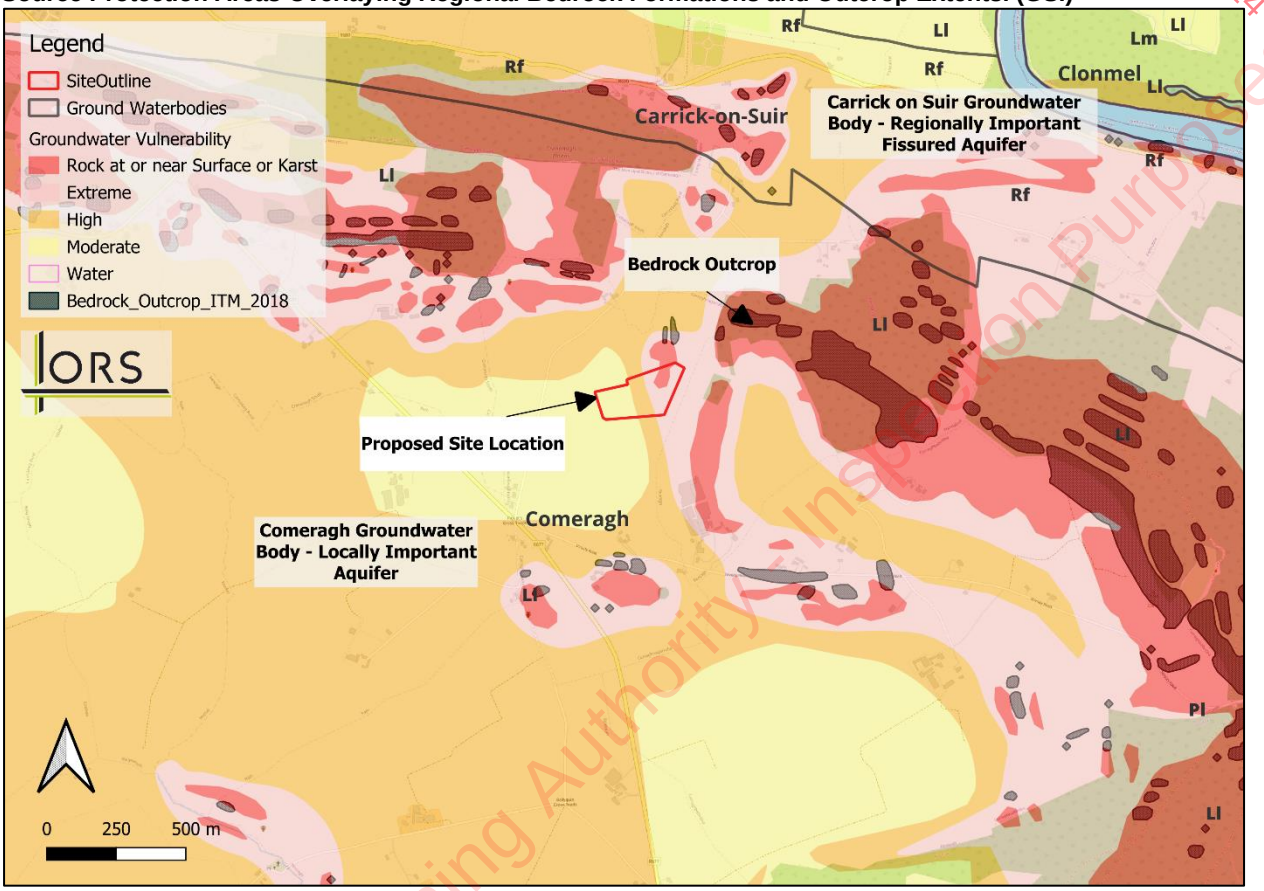
Examples of karst landforms are widespread to the northwest of Carrick-on-Suir, located in County Tipperary to the northwest of the development site. Karstic features are common in this region due to the underlying pure bedded lower carboniferous age limestone bedrock known as the Dinantian Limestones (undifferentiated) formation underlying the region *ca.* 8km west of the site, see **Figure 7.8** above. There is a high concentration of mapped karst features on the Dinantian Limestones (undifferentiated) formation.

Karst areas are characterised by landforms of dissolution. Karst aquifers can be particularly vulnerable to pollution and karst features can also give rise to flooding. **Figure 7.7** the approximate location of karstic features relative to the location of the proposed site. There are no karstic features located within the proposed boundaries of the Proposed Development or within the immediate vicinity of the site. There are no karstic features located within the 2km study area.

The closest Turlough can be found 28km northwest of the proposed site. County Waterford has a low density of karst features. In comparison to the surrounding counties due to the presence of sandstones, slate and volcanics which underlie the majority of the County. Tracing of underground flows from a cave to springs has been undertaken by GSI and indicates interconnectivity between karst features *ca.* 22km to the northwest of the study area. Traced groundwater movement through karst features to the northwest were found to have a west to

southwest flow, away from the development**.** There are no karst features within the 2km study area as shown in **Figure 7.9**. No connectivity was confirmed with features within the 5km study area to date.

Figure 7.9: Karst Features, Traced Groundwater Movements, Groundwater Vulnerability, And Groundwater Source Protection Areas Overlaying Regional Bedrock Formations and Outcrop Extents. (GSI)



Mineral Aggregate Resources

There are no active quarries on or adjacent to the Proposed Development. The nearest active quarry recorded on the GSI's online database is Ballyknockane Pit *ca.* 15km northwest of the site in Clonmel, Tipperary where RMC, concrete sand, plastering sand, blocks, aggregates, general fill is quarried and crushed for both concrete flooring/pavements, concrete (general), drainage/hardcore/fill projects.

There are no active mineral localities within the 2km study area. Within the wider region several metallic mineral localities are identified which include iron and quartz located *ca.* 2.8km to the southeast.

Radon

Radon is a naturally occurring radioactive gas formed by the radioactive decay of uranium and thorium which may be present in varying quantities in rocks, soils and groundwater. Classified by IARC (International agency for research on cancer) as Group 1 - carcinogenic to humans - Radon is second only to smoking as the leading cause of lung cancer. It is estimated that some

250 lung cancer cases each year in Ireland are linked to radon exposure and accounts for more than half of the total radiation dose received by the Irish population (EPA, 2016). The acceptable level, or Reference Level, for homes and schools in Ireland is 200 becquerel per cubic metre (Bq/m^3). For workplaces the Reference Level is 400 Bq/m^3

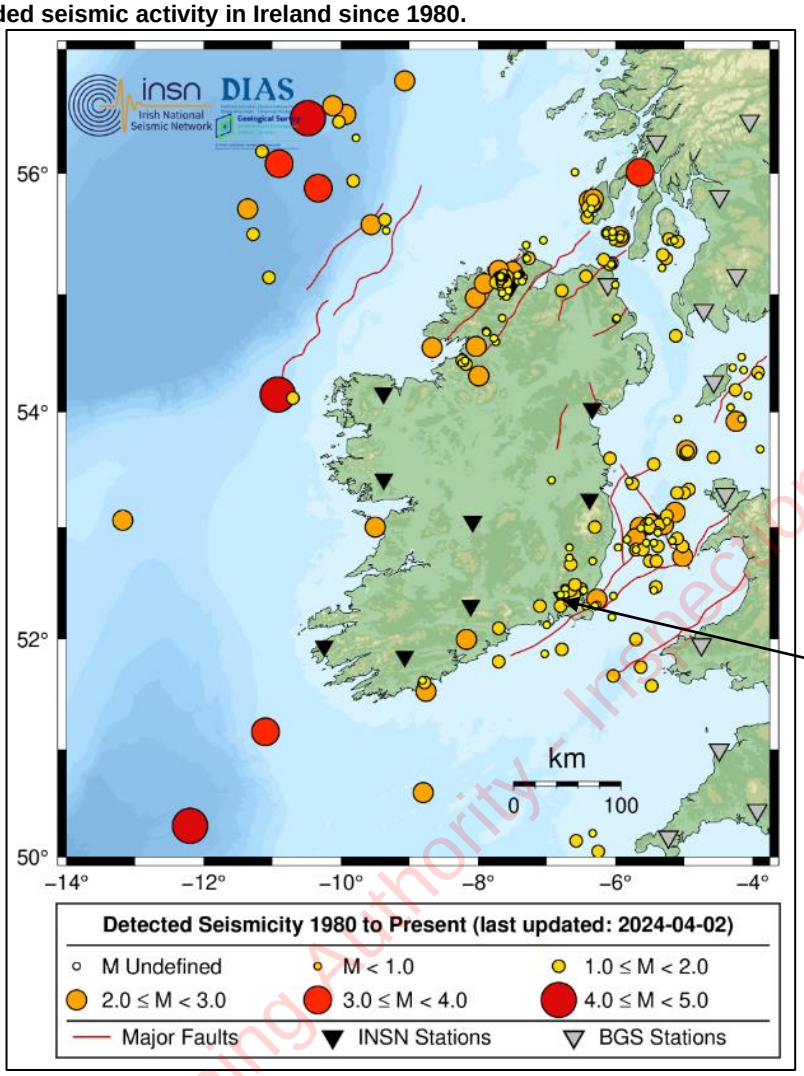
Consultation with the EPA's online Radon Map shows a prediction of the number of homes in a given grid square that exceed the national Reference Level (200 bequerel per cubic metre (Bq/m^3)). Grid squares in which the predicted percentage of homes is 10% or greater are called High Radon Areas.

The EPA's Radon Map shows that the site is located across a Moderate to High Radon area, with 10% to 20% of houses in the vicinity of the site estimated to have radon levels above the Reference Level respectively. As such all-office and canteen structures on site should be fitted with radon barriers to minimise staff exposure. Testing of radon in the workplace is a legal requirement in these zones.

Seismic Activity

No seismicity data is available from GSI online resources. Seismic activity is recorded by the Irish National Seismic Network. The Geophysics Section of the School of Cosmic Physics, Dublin Institute for Advanced Studies, has been recording seismic events in Ireland since 1978. **Figure 7.10** below illustrates historical and recorded seismic events since 1980. Ireland is not considered an area to be of high seismic risk. As can be seen below, there is no significant seismic activity recorded within the vicinity of the Proposed Development.

Figure 7.10: Recorded seismic activity in Ireland since 1980.



7.4.6 Soils and Subsoils

Soils can be referred to as topsoil or subsoil. Topsoil is the active layers at ground level where living organisms are found. Changes in soil characteristics are delineated in “horizons”. Topsoil is referred to as horizons ‘A’ and ‘B’. Subsoil is the loose uncemented (unlithified) sediments present between the soil ‘B’ horizon and bedrock. Subsoils are termed the ‘C’ horizon.

Regional Soil and Subsoil

The formation of soil is dependent upon geology, climate, vegetation, altitude, and landform shape. Soil landscapes found in Ireland are a consequence of the changing climatic conditions over the last 100,000 years (the last glacial age was *ca*.12,000 years ago) and the management of land by farmers.

The soils in Co. Waterford are mainly derived from a mixture of non-calcareous, noncalcareous, volcanic rock, mineral alluvium and peat materials. The soils range from Scree, Blanket peat; Cut over raised peat, Fen peat; Shallow, rocky, peaty/non-peaty mineral complexes (mainly acidic) (AminSRPT); Shallow, rocky, peaty/non-peaty mineral complexes

(mainly basic) (BminSRPT); deep well drained mineral (mainly basic) (BminDW); mineral poorly drained (mainly basic) (BminPD); shallow poorly drained mineral (mainly acidic) (AminSP); deep well drained minderal (mainly basic) (BminDW); mineral poorly drained (mainly acidic) (AminPD); deep well drained mineral (mainly acidic) (AminDW); shallow well drained mineral (mainly acidic) (BminSW); Shallow poorly drained mineral (mainly basic) (BminSP) and alluvial as shown in **Figure 7.11**.

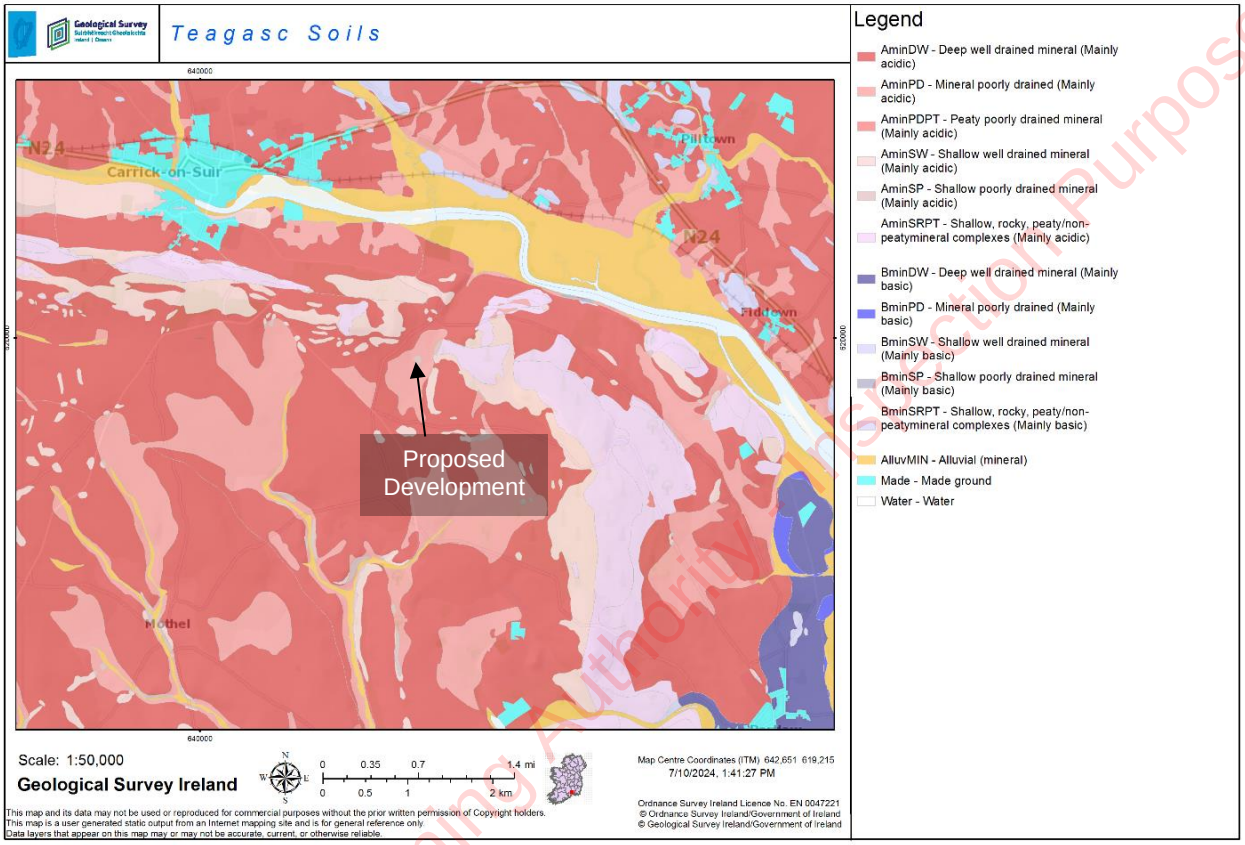


Figure 7.11: National Soil Map of South County Waterford (Source: GSI)

Local Soil and Subsoil

GSI online mapping indicates that the site overlies mineral poorly drained (mainly acidic) (AminPD) derived mainly from non-calcareous parent materials. The soil groups associated with this category are surface water gleys and ground water gleys. A bedrock outcrop is noted at the northern extent of the site. A number of bedrock areas in the surrounding area are also noted and are classified as belonging to soils groups of Lithosols, Regosols, Podzols (Peaty) and Peats.

To the north of the Proposed Development along the banks of the River Suir *ca.* 1.6km, the soil is categorised Alluvium. The soils in the greater surrounding area are categorized as Acid Brown Earths and Brown Podzolics *ca.* 0.1km west, 0.35km south, 0.15km north and 0.13km east. The built-up urban fabric around Portlaw *ca.* 1.6km southeast, are classified as Made/ Built Ground.

The Irish Soil Information System (SIS) project has developed a national association soil map

for Ireland at a scale of 1:250,000, together with an associated digital soil information system, providing both spatial and quantitative information on soil types and properties across the country. This resource groups similar soil groups together into 11 soil 'Great Groups' and associated 'Sub-Groups', allowing for the taxonomical classification of soil types throughout Ireland.

The site overlies the Clonroche Series. Under the SIS classification system, this soil group is 'Brown Earths' and the soil sub-group is classified as '1100 -Typical Brown Earths'.

Figure 7.12 Irish Soil Information System (ISIS) Map – Surface Soils. Map detailing soil types underlying the site (EPA and Teagasc)

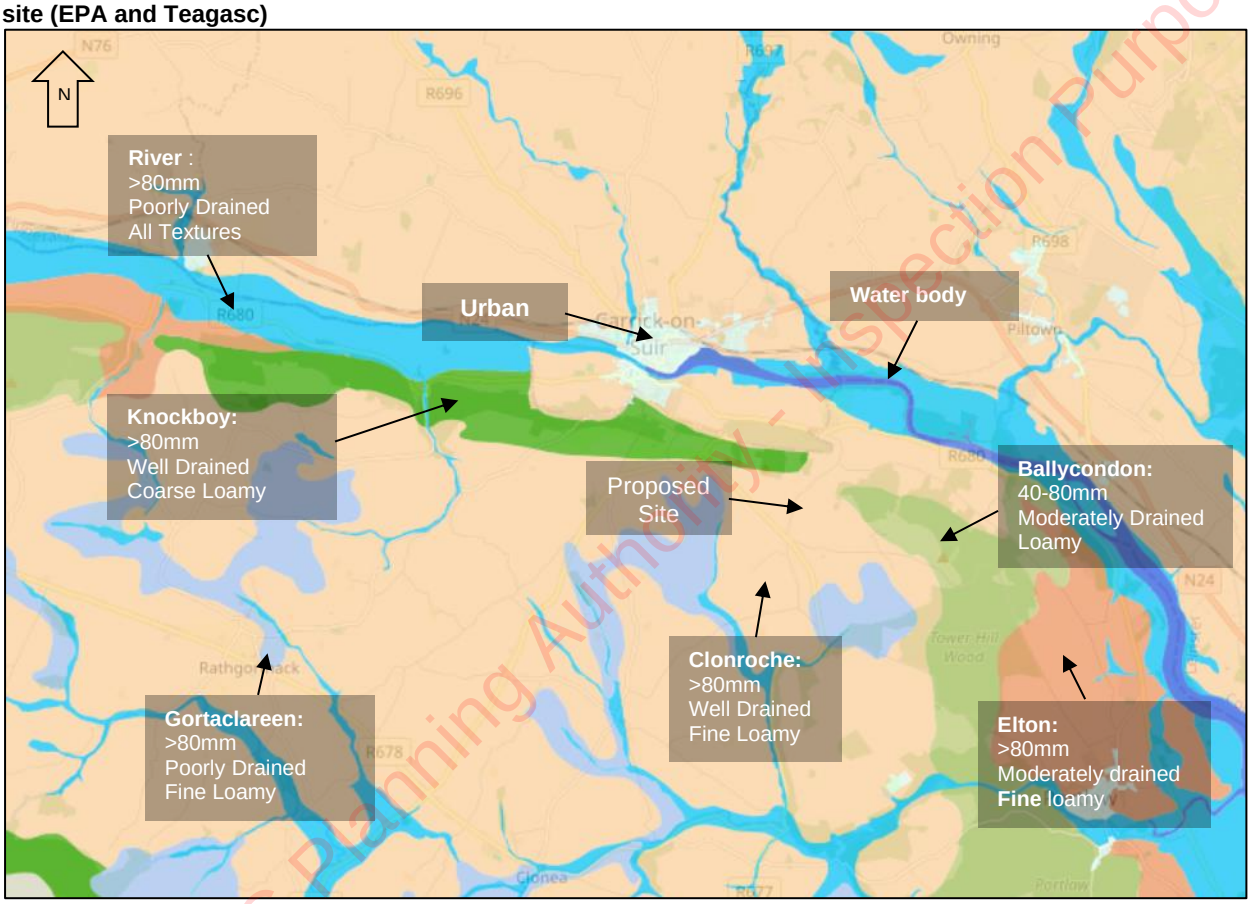
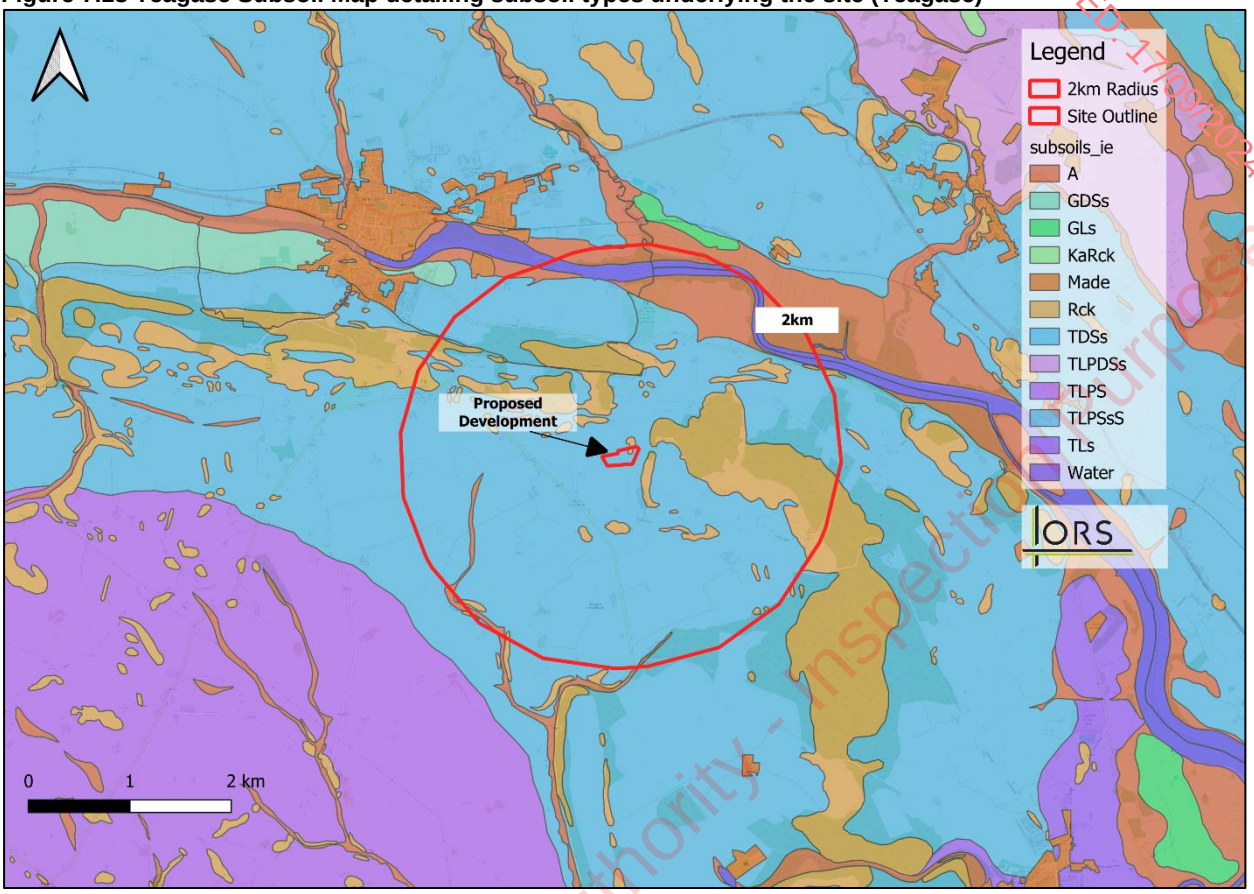


Figure 7.13 Teagasc Subsoil Map detailing subsoil types underlying the site (Teagasc)



The Teagasc representative soil profile description for the 'Clonroche' series notes it as having a fine loamy texture. The definition is fine loamy drift with siliceous stones over which contains a high proportion of sand (43%) and smaller proportions of silt (34%) sized particles with lower proportions of clay (23%) in the top horizon (0-21cm).

Throughout the lower horizons (21-100cm) this proportion of particle sizes remains relatively consistent with a minor decrease in sand and clay and a minor increase in silt. Towards the final horizon a higher proportion of sand (53%) and lower proportions of silt (33%) and clay (14%) are noted. A detailed representative soil profile description from the Teagasc SIS database of the 'Clonroche' soil series is included in **Appendix 7.1**. This representative soil description available for the 'Clonroche' series is not taken from the subject site and so will differ from the proposed site in Curraghnagarra.

The EPA databases indicate the parent material for the subsoils beneath the site are till derived chiefly from Devonian Sandstones (TDSs). The till is described as diamicton, which relates to its terrigenous sediment that is unsorted to poorly sorted and contains particles ranging in size from clay to boulders, suspended in an unconsolidated matrix of mud or sand. This unsorted matrix is due to glaciation. The subsoil in the areas delineated as alluvium are described as having undifferentiated alluvium subsoils.

The existing site is used for agricultural purposes and due to its topography is suited to pastural grazing and silage production.

Licensed Sites

A review of the EPA and DCCAE website for existing and historic, licensed and illegal waste activities, mines and industries was carried out to identify any potential contamination sources present in the area and to identify any potential contaminating activities near the Proposed Development. The desk study indicated that no illegal waste activities sites were present within a 2km radius of the proposed area. A licensed Integrated Pollution Prevention Control (IPPC) facility is located *ca.* 200m southeast of the Proposed Development. The facility is a piggery, which is classed as industry. Details of the facility are outlined in **Table 7.7** below. Assessment of historic orthographic maps show that the facility expanded between the 1995-2001. The facility layout has not changed significantly since this expansion.

No previous applications for permission on the site have been submitted. The details of significant licences granted in the immediate area of the development are also outlined in **Table 7.7**.

Table 7.7: Licensed Integrated Pollution Prevention Control (IPPC) Facilities and Industrial Emissions License applications (EPA Maps) within the 2km study area

Licence Number	Major Class of Activity	Distance from site	Name	Licence Status
P0573-01	Industry	200m SE	Mr Jimmy Foran	Licensed

There are two active IPPC licensed sites located to the northeast and the southeast of the Proposed Development site which are located outside the 2km study area. To the northeast, the closer of these, *ca.* 3km, is a piggery, Mr Robert Dowley, that is licensed under major class of activity 6.2.0/ Industry. The second facility located *ca.* 4.7km to the southeast is an Anaerobic Digestion facility, with the license being held by Messrs Pat Moloughney and Philip De Vere Hunt. This is classed under major class of activity 6.2.0/ Industry and the license is surrendered. It is not foreseen that any these licensed facilities will have an effect on the Proposed Development.

There are no mapped current licensed/ unlicensed or historic waste facilities/ dump sites within the immediate vicinity of the Proposed Development. The closest facility is located *ca.* 4.2km southeast of the Proposed Development to the east of the Tower Hill Wood. The facility is a licensed waste facility (W0212-01). Another facility is located *ca.* 14km northeast of the site and is a licensed landfill (W0019-01). Due to the significant distance (>15km) of other waste facilities in Co. Waterford to the Proposed Development. It is not foreseen that these facilities will have an effect on the Proposed Development.

Historic Land Use

The historic maps indicate no obvious sources of contamination based on previous land use within the proposed site. The 25-inch historic maps (1863-1924) indicate that the area in the immediate vicinity of the Proposed Development site consists of agricultural lands. A disused quarry is noted *ca.* 500m north of the proposed site. A disused quarry is also noted *ca.* 990m north of the site. A corn mill is noted *ca.* 975m northeast of the site. In subsequent maps of the area, none of these structures have had visibly lasting impressions or effects on the environment.

Table 7.8: Historical Land Use (https://webapps.geohive.ie/)

Date	Description
1837-1842	The proposed site and adjacent lands are greenfield. Several built structures are located in the surrounding lands to the west, south and north of the site. The piggery to the south has not yet been established. The aforementioned quarry *ca.* 990m to the north can be seen and is unlabelled. The quarry located *ca.* 500m to the north and the corn mill *ca.* 975m to the northwest have not yet been established.
1863-1924	Several of the structures in the surrounding areas to the west, south and north have been expanded during this time. A number of additional structures have also been established. The aforementioned disused quarries are located *ca.* 500m to the north and *ca.* 990m to the north. The corn mill *ca.* 975m to the northwest is established.
1995	The proposed site is greenfield. Piggery located *ca. 2*50m south. The roads and farm units in the surrounding area have been significantly expanded during this time.
2000-2003	The proposed site is greenfield. Expansion of the piggery located to the south.
2013-2018	The proposed site is greenfield. No significant changes to the surrounding environs compared to previous years.

Landslides

The GSI's online landslide database indicates there are no historic landslides recorded on the site or within a 2km radius of it. The nearest recorded landslide is *ca.* 7.4 km northwest of the Proposed Development on the slopes of the Coolnamuck Woods.

7.4.7 Ground Investigation

Ground investigation works were carried out by a chartered ORS environmental scientist for the Proposed Development at Curraghnagarraha on the 13th of December 2023. These investigations confirmed the general geology and subsoil conditions corresponded to the conditions indicated in the geological mapping. The location and depth of the trial pits is shown on **Figure 7.14**, and details of each investigation location is presented in **Table 7.9**.

The depths of trial pits varied slightly, 1.9m to 2.3m bgl. Bedrock was encountered at a depth of 1.8m in Trial Pits 4 (TP04). As stated in **Section 7.4.2** the topography peaks at 107m OD along the western boundary (trial pit 2) in the site with a gradual gradient (trial pit 3 is in the middle of this gradient) eastwards to a low of 91.5m OD (trial pit 4). The site has a gradient from west to east, which becomes slightly more pronounced towards the centre of the site. A gradient exists at the southern boundary of the site which extends towards the piggery and reaches a low of 103m AOD before rising again to 106 at the northern boundary of the piggery.

There was variation in the soil profile across all four trial pits. Some similarities between profiles were also noted. The topsoil across all trial pits were all of a brown in colour overlaying a layer of grey soil with a high clay content or in the case of Trial Pit 4, a layer of grey silt with an occasional shale boulder. The topsoil texture in Trial Pit 1 is referred to a clay-silt and Trial Pit 2 is referred to as gley soil. Trial Pits 3 and 4 demonstrated a larger diversity among subsoil horizons in comparison to Trial Pits 1 and 2. The findings of the site investigation correlated with the GSI soil and subsoil database mapping. The predominant soil underlying the Proposed

Development is a mineral derived from non-calcareous parent materials. The Proposed Development site is characterised by a poor draining bedrock (slate), low permeability subsoil overlain by a poorly-drained topsoil. There is a slight variation in the soil depth from which is moderately deep (1.9m) to (2.3m). The topsoil throughout the site is characterised as Brown Earth, with a variable texture consisting of clay, silt to gley. The subsoil found throughout the trial pits exhibits a variety of characteristics but typically consists of grey clayey-silt. The findings of the trial pits are presented in **Figure 7,14** overleaf. The underlying bedrock across the site is a Silurian dark grey slate. No bedrock was discovered in the Trial Pits 1 - 3. Bedrock in the form of an angular shale bed was discovered at 1.8m bgl in Trial Pit 4. The bedrock encountered is characterised by dark grey slates. They are massive and frequently contain thin white silty mudstones. Groundwater infiltration was encountered at 1.8m bgl in Trial Pit 4.

A site characterisation assessment (percolation assessment) was conducted by Site Assessor William Bolger Hynes on the 12th of April 2024. At the centre of the site, where the slope is most pronounced. The assessment encountered bedrock at 1.6m bgl, refer to **Appendix 8.2**.

Figure 7.14: Location of Trial Pits (TP) and Site Characterisation Assessment (irish.gridreferencefinder.com)

A summary of the soil profiles encountered during the ground investigation carried out as part of this report is given in **Table 7.9** overleaf.

Table 7.9: Ground profile for each Trial Pit

Location	Depth (m)	Ground Profile	Comments
TP-01	0.0 – 0.25 0.25 – 0.55 0.55 – 2.30	Clay, silt. Brown topsoil Grey clay Cobbles 70mm, round sub-angular occasional shale boulder 200mm	Water infiltration at 2.1m
TP-02	0.00 – 0.25 0.25 – 0.55 0.55 – 1.00 1.00 – 2.00	Grey-brown topsoil. Gley texture Grey. Clay texture. Small cobble 20-50mm. Grey colour, round to sub-angular shape. Brown clay. Boulders, round some sub-angular.	Water infiltration at 0.9m Water level at 2m, 1.5hrs after excavation.
TP-03	0.00 – 0.10 0.10 – 0.60 0.60 – 0.70 0.70 – 1.00 1.10 – 1.20 1.10 – 1.90	Brown topsoil. Grey-brown subsoil. High clay content. Gravel, sand-clay layer. Brown hue. Possibly alluvial. Grey-brown colour. Clay with some cobbles. Black band. Brown-grey clay. Oxidised rock noted. Shale boulders, sub-angular 500mm, some cobbles also	
TP-04	0.00 – 0.25 0.25 – 0.45 0.45 – 1.10 1.10 – 1.80 1.80 – 2.10	Dark brown topsoil. Grey silt. Occasional shale boulder 100mm. Grey-brown clay. Brown-grey clay silt. Angular shale bed.	Water infiltration at 1.8m

Given the range of groundwater vulnerabilities associated with the northeast portion of the Proposed Development which range from High to Extreme (Rock near or at surface or karst), it is recommended that additional Trial Pit excavations are conducted prior to the commencement of the construction phase.

7.5 Likely Significant Effects

The assessment focuses on predicted impacts in relation to soils and geology. The assessment relates to impacts occurring during both the construction and operational phases of the development.

For a risk from ground contamination to exist, a contaminant source, pathway for migration and viable receptor must exist. The presence of all three of these elements is known as a ‘pollutant linkage’.

Based on the dataset obtained during the desk study, intrusive site investigation, and anecdotal evidence collected the following risk assessment has been carried out. This identifies the relevant sources, pathways and receptors (pollutant linkages) and assigns a qualitative risk classification of ‘Positive, Neutral or Negative/ Adverse’ risk to the identified Potential Pollutant Linkages (PPLs).

The likely potential pollutant linkages identified as a result of this assessment and specific for the site have been provided in the initial Conceptual Site Model (CSM). The model has been based upon the site setting at the time of the assessment, the land use (current and reasonably foreseen future use) of the surrounding area and the state of what the proposal is (i.e. development, ongoing use, etc.).

As well as identifying the potential pollutant linkages the model includes a preliminary assessment of risk based upon the probability of effect and the likely severity of effect in the context of the site setting and proposed future site use.

The criteria used for the risk assessment classifications in this report is detailed in the EPA guidance notes 2022, **Table 1.1** of **Chapter 1** in this report, and in the *CIRIA Report 552*.

7.5.1 Do-Nothing Scenario

If the Proposed Development does not proceed there would be no additional impact on the local soil, geology or geological heritage. The current rate of surface water percolation and runoff would continue to operate in its natural state.

Under the 'Do Nothing' scenario there would be no change to the current land use of the site which would remain as agricultural land.

In implementing this 'Do-Nothing' alternative, an Anaerobic Digestion Facility would not be developed and there would be no changes made to existing land-use practices. The site would likely continue to be used for agricultural grazing. Agricultural manures and slurries will be sourced from agricultural operators within a 15km radius of the Proposed Development. Pig slurry will be supplied to the facility from the neighbouring Piggery located 300m to the south of the Proposed Development. In the 'Do-Nothing Scenario' these agricultural wastes would not be treated locally through the AD process. Untreated and unpasteurised manures and slurries would continue to be applied direct to land at current volumes, with the continued addition of chemical fertiliser. Furthermore, the associated CH_4 emissions would not be captured within the AD process.

7.5.2 Receptor Sensitivity

The sensitivity of the receptors identified during the study of soil and geological features within the vicinity of the site are summarised in **Table 7.10**.

Table 7.10 – Receptor Sensitivity

Receptor	Receptor Importance	Receptor Sensitivity	Rationale
Topsoil	Local Level	Low	The local topsoil is a groundwater gley / surface water gley which is in abundance within the vicinity of the development. The site topsoil contains no known pollutants. The soil is of poor agricultural quality, being a poorly drained 'Gley' and would not be a highly sought-after topsoil for any infill agricultural lands.
Underlying Deposits	Local Level	Moderate	The development has been designed to utilise the existing site topography as far as possible **(31925-ORS-ZZ-00-DR-AR-200),** minimising the disturbance to the subsoil to achieve the desired site levels. Where possible drift deposits will remain on site and be utilised as infill material. The underlying till deposit is a diamicton (poorly sorted containing particles ranging in size from clay to boulder) sandstone parent material which is in abundance within the wider area. The development site is located across a GSI designated foothills with a varying range in soil depth from shallow to deep.
Bed Rock Geology	Regional Level	Moderate	The underlying bedrock is a characterised as dark grey slates which are massive and frequently contain thin white silty mudstones. Karst features have not been recorded within the site vicinity but are found within the wider region to the north of the River Suir. Karst features are not prevalent throughout Waterford as the majority of County Waterford is underlain by Sandstone bedrock. This rock is in abundance with the wider region. It is envisaged that bedrock will be encountered. The underlying aquifer is classified as being locally important.

7.5.3 Sources - Construction Phase

The construction phase is likely to yield the most potential impacts on the surrounding land, soil and geology. Potential construction phase impacts are considered in detail below and summarised in **Table 7.11**.

The Proposed Development will result in the establishment of the site across two main elevations. With the Reception Hall and processing areas located at 98.7m OD and all Digesters and Pasteurisation Tanks at 96.7m OD. Given the sites current topography this will involve limited earthworks to both cut and fill the site to a level base upon which the development can be constructed.

Figure 7.15: Site layout with proposed and existing site levels (Drawing No: 231926-ORS-ZZ-00-DR-AR-200)

Excavation works to facilitate the insertion of a *ca.* 4.9km length gas pipeline and new connection to the existing gas line will be required. The proposed excavation works will occur along the Scrouty Road, the L4031 local road and the R680 regional road. The following sections outline the potential effects to Land, Soil and Geology posed by the proposed excavation and infilling of the site.

Topsoil Removal

The initial phase of construction will involve the removal and stockpiling of the topsoil. The pre-construction geotechnical site investigations conducted indicate a topsoil horizon of approximately 0.10m to 0.25m in depth of a brown topsoil with varying degrees of silt and clay content. This inert material will be stripped throughout the Proposed Development site and be stockpiled. For the gas pipeline route the topsoil will be temporary stockpiled before being used to redress the installed pipe. The method of stripping will involve the use of a tracked excavator/ bulldozer along with the use of haul trucks.

Stockpiles in the absence of mitigation measures will be susceptible to erosion by climatic and hydraulic factors. Any excess topsoil will be removed from site and disposed of in accordance with current waste management regulations.

The most significant risk posed by the topsoil excavation is through the migration of silt, clay and other sediment off site through wind and water borne modes of transportation. If incorrectly stockpiled and under specific climatic conditions these sediments can find their way into nearby streams. In significant quantities they can pose a risk to aquatic life and result in a degradation of water quality, as outlined in **Chapter 8: Hydrology and Hydrogeology**.

In the absence of mitigation, the removal and stockpile of topsoil would result in a ***negative***, ***moderate*** and ***reversible*** effect on soil.

Excavation/Subsoil Removal

Site investigations indicate a slight variation in the depth of the subsoil horizon. In Trial Pit 1 (TP-01) the subsoil horizon was identified, with the topsoil overlaying a layer of grey clay at 0.55m bgl containing cobbles and an occasional sub-angular shale boulder. Trial Pit 2 (TP-02) demonstrated a similar composition of topsoil overlying a layer of grey clay at 0.55m bgl which contains occasional round cobbles. Water infiltration was observed at 0.9m bgl. At 1.0m bgl a layer of brown clay was observed which contains some sub-angular round boulders. In the Trial Pits 3 and 4 the subsoil horizons were demonstrated a greater variety of layers in their subsoil horizons. Shale bedrock was discovered at a depth of 1.8m bgl in Trial Pit 4 (TP-04) and was excavated. The development proposes retaining the general gradient of the existing topography with the taller structures, tanks and digesters, being installed at a lower elevation to minimise the visual impact. This will involve cutting into the existing topography, just to the east of the centre of site. It is hoped to utilise excavated onsite subsoil material where possible for infilling.

Mechanical soil compaction will be undertaken to ensure soil stability throughout the site. Excess material will be transported off site for disposal.

The soils beyond *ca.* 0.55m below ground level have been found to be relatively consistent throughout Trial Pit 1 and 2. The soils amongst Trial Pits 3 and 4 demonstrate differences in composition and depth. The site contains a heterogeneous moderately sorted drift of primarily a grey, silty clay with sub-angular to round cobbles with occasional boulders. This till drift consists of silt-sized particles which present a moderate susceptibility of becoming entrained in surface water run-off and/or to being blown out of a stockpile by moderate to strong breezes carrying a moderate risk of migrating into surface water receptors. A site characterisation assessment (percolation assessment), **Appendix 8.2**, conducted by Site Assessor Willaim Bolger Hynes on the 11th of March 2024, indicated that the soakage in the subsoil is sufficient, with a T value of 29.39. The lower horizons of the subsoil (>0.2m bgl) were recorded as being more compact with a texture of soft to firm and a structureless to subangular soil structure. Further compaction of this layer during excavation and construction works is inevitable and may increase surface water run off due to reduced infiltration rates resulting in increased sediment erosion on site. The excavation of and exposure of the subsoil layer during the construction phase will result in an increased risk to the groundwater vulnerability, as outlined in **Chapter 8**.

The preliminary Cut and Fill calculations (refer to **Drawing No. 24052-DR-0501**) for the Proposed Development indicate that a total of 40,866 cu. M of material is to be excavated, with 21,444 cu. M required to infill the site to the proposed final topography. This results in a net surplus of 19,442 cu. M which will be repurposed and redistributed on site in landscaping and earth berms within the site.

The importation of soil and stone increases the risk of introducing contaminated materials on site. Sourcing material from a licensed site that has undertaken ecological and environmental assessments and received all necessary permits/ licenses for the excavation of the material will be undertaken. All material will be transported to site using registered hauliers and records of material movements will be record in accordance with the waste legislation and guidance notes.

In the absence of mitigation, the extraction and reduction in the subsoil horizon / importation and alteration of the of subsoil horizons will have a ***negative, moderate*** and ***permanent*** effect on the subsoil.

Excavation of Bedrock

The GSI groundwater vulnerability maps have classed the entire site as overlaying a range of vulnerabilities. The western portion of the site overlies a moderate vulnerability area. The central section of the site overlies an area of high vulnerability. The vulnerability of the east / northeast of the site, the site of the proposed attenuation pond, is classified as extreme and a portion of the north of the site is classified as “Extreme” (Rock at or near the surface). The route of the proposed facility access road is underlain by areas of moderate vulnerability and high vulnerability. Based off the groundwater vulnerability guidelines this would indicate a soil depth of *ca.* 3-8m at the portions of site where vulnerability is described as moderate and 1-3m where vulnerability is described as high.

Based off the guidelines, a soil depth of *ca.*0-1m is indicated where vulnerability is classified as extreme. The site investigation encountered bedrock at 1.8m bgl to the centre of the site, similarly the site suitability assessment encountered bedrock at 1.6m bgl on site. Groundwater was encountered at 1.8m bgl in Trial Pit 04 towards the centre of the site. The findings of the site investigations indicate a gradual deepening of the underlying deposits to the east (>1.8m bgl) with bedrock found closer to the surface in the centre of the site, as shown in **Figure 7.10**.

A potential effect of the construction stage could be the exposure of the underlying bedrock. Excavations of up to 6.3m bgl will be required to reach the finished floor level (FFL) of the Digesters (53, 54, 55), Digestate Storage Tanks (56, 63), Reception Hall (51), west of bunded area (8, 9) and the attenuation pond. When excavation to FFL has been achieved, further earthworks will then follow to facilitate the construction of foundations and the installation of services/drainage infrastructure. Foundations of up to 2m below the FFL will be required along the structural outline of buildings.

It should be noted that the Digestion tanks (53, 54, 55), Digestate Storage Tanks (56, 63), will all have a FFL of 96.5m. Foundations and hard core will be a further *ca.* 0.7m below the FFL. These structures are planned for the east and northeast of the site where the currently ground level is nearer the proposed ground level. Maximum excavations of 4m bgl at the wetland to the northeast are required to achieve the desired ground level. Refer to the proposed Cut and Fill drawing in **Appendix 7.2** and relevant structural site layout drawings as referenced in Section 2.2, Chapter 2 – Project Description

In the absence of mitigation, encountering bed rock will have a ***negative, significant***, and ***permanent*** effect.

Access Road and installation of Gas Pipeline

During the initial stages of the construction phase, enabling works will consist of stripping and stockpiling of topsoil and subsoil at the proposed compound area, as outlined above. Similarly, excavations are required for the construction of the passing bays at the site entrance, located at the southwest of the site and to install the gas pipeline to the nearby Scrouty road.

An access road will be constructed to facilitate the connection of the proposed facility to the surrounding road network. This connection will be constructed at the site entrance, located at the southwest which will join Scrouty Road located to *ca.* 500m south of the site. See **Figure 7.16.**

There are two existing small watercourses that require culverts under the access road to allow surface water to maintain its natural drainage course. Please refer to **Drawing Ref: 24052-DR-0502** for the locations of the culverts. Culverts are to be sized and designed with final construction documents.

Figure 7.17: Site Layout Plan – Access Road

The proposed gas pipeline connecting the Proposed Development to the existing Gas Networks Ireland pipeline along the R680 will be installed underneath the new access road, the Scrouty Road and the L4031 local road. This is an indicative routing of the pipeline to the site and is subject to change pending detailed network modelling and design. Installation of the pipeline will involve temporary excavation work and will result in disturbance of the underlying soil and subsoil. This may have an effect on the exposed soil and subsoil with implications for the soil surface with regard to stock piling and mobile plant. The trenches will be backfilled shortly after excavation following the installation of each section. Trenching along a road network will give rise to asphalt waste material. If unproperly managed these materials can pose a risk to the environment due to the presence of Polycyclic Aromatic Hydrocarbons (PAHs). PAHs are organic pollutants that persist in the environment and are considered potentially dangerous with side effects related to cancer development (A. Nagalli, 2015).

In the absence of mitigation, the access road and gas pipeline installation would have a ***negative, slight*** and ***temporary*** effect on the existing surface level materials and subsoil.

Construction of Built Structures

The construction of the Anaerobic Digestion Plant will result in the conversion of permeable soils to hard standing surfaces. This sealing/ capping of land has a long-term impact on the underlying soil's structure and function to the wider environment. It reduces the water infiltration to the underlying soil/ bedrock and alters the structure and functionality of the soil over time.

The construction of the built structures requires excavations of up to 4m below current ground levels. As is common practice with the construction of foundations a compressed infill gravel base/ pad is required on top of which a concrete blinding is poured. Steel reinforcements will be installed, with shuttering erected around this to facilitate the final concrete pour. Infilling and compaction of excavations around structures is then conducted to ensure structural integrity. The infill material and concrete poses a risk of contaminating the subsoil and bedrock if installed in adverse weather conditions.

In total, the Proposed Development will result in the construction *ca.* 22,420 m^2 of hard standing, inclusive of built structures and concrete/ asphalt aprons.

The use of plant and machinery during the construction stage will involve the use of hydrocarbon-based fuels and oils. There is a risk of contamination to soils and eventual percolation to the underlying bedrock. Hydrocarbons should be stored in bunded facilities, and the use of hydrocarbons should be contained to bunded areas with spills cleaned up immediately.

In the absence of mitigation, the impact of the construction of built structures would have a ***negative, moderate*** and ***long-term*** effect.

Attenuation Pond

The Proposed Development includes establishing an attenuation pond to the northeast of the site which will be used for attenuation of surface war run-off from roads, yards, roofs and the impermeable bunded area. The soil on site is a poorly drained gley soil and may be suitable for creating an impervious barrier to retain the contents of the ponds. The use of such material may mitigate the risk posed to the underlying bedrock aquifer which will be at an increased vulnerability due to a reduction in the overlying burden.

No material will need to be imported to site in order to line the location of the proposed attenuation pond. Excavated material will be re-used on site and may be used in the construction of the proposed attenuation pond. As no importation of soil / clay material is required, the associated risk translocating invasive species and contaminated materials is **not significant**.

The construction of an attenuation pond will result in the degradation of the underlying soil quality and ensure anaerobic conditions. On the contrary the wetlands will result in the addition of a new Fossitt designated habitat within the locality, FL8 “Other artificial lakes and ponds”. Its implied, if appropriately managed, wetlands will result in an increase in flora, fauna and biodiversity. Increased food availability may entice burrowing fauna to establish in the locality. Burrowing animals have a positive effect on soil quality on a localised level.

The constructing of the attenuation ponds is foreseen to have a ***negative-neutral*** and ***permanent*** effect.

Contaminated Soils

The excavation and construction activities will cause quantities of excavated materials to be reused on site or removed from site for disposal or recovery. The site is a greenfield and historical mapping does not suggest any incidences of land use which might result in the contamination of soils. Furthermore, a geotechnical site investigation conducted at the site in December 2023 did not detect any evidence of contaminated soils. It is not anticipated contaminated soils will be encountered during construction activities.

The construction management plan will include a set of procedures to be implemented in the incidence of contaminated soils encountered. Encountering contaminated soils would have a ***negative***, ***not significant*** and ***temporary*** effect.

Table 7.11 – Severity/ Magnitude of Impact during construction phase

Receptor	Potential Environmental Effects	Quality	Significance	Duration
Topsoil	Topsoil Removal	**Negative**	**Slight/ Moderate**	**Reversible**
	Passing Bays and Gas Pipeline	**Negative**	**Slight**	**Temporary**
Underlying Deposits/ Subsoil	Construction of Built Structures	**Negative**	**Moderate**	**Long-term**
	Excavation/ Subsoil Removal	**Negative**	**Moderate**	**Permanent**
	Wetland	**Negative/ Neutral**	**Moderate**	**Permanent**
	Contaminated Soils	**Negative**	**Not Significant**	**Temporary**
	Passing Bays, Drainage Pipe and Gas Pipeline	**Negative**	**Slight**	**Permanent**
Bed Rock Geology	Excavation of Bedrock	**Negative**	**Significant**	**Permanent**

7.5.4 Sources - Operational Phase

The operational phase effects anticipated and considered throughout the lifetime of the operation of the facility are considered below and summarised in **Table 7.12**.

It is not envisaged that there will be many potential sources of effects to soil, land or geology during the operation of the facility.

Hydrocarbon Contamination

It is proposed that the site will be frequented by numerous hauliers and farmers transporting both liquid and solid feedstocks for production of biomethane. There is a possible risk of vehicular accidents on the site which could result in the accidental release of hydrocarbons.

Mobile plant and fixed machinery are a potential source of contamination on site. Accidental leaks or spills of fuels and oils from hydraulics would be the source of such contaminates.

The 1,000L fuel tank is an obvious source of such contaminants and as such it will be bunded to comply with EPA guidelines.

Strict enforcement of traffic management measures, adherence to standard operating procedures (SOP's) for refuelling and regular inspection of bunds should eliminate the potential for such sources of contamination. On top of this the process area will be bunded which will further reduce the possibility of such chemicals making contact with the local soil and geology.

In the absence of mitigation, hydrocarbon leaks and spills would have a ***negative, moderate*** **to** ***significant*** and ***long-term*** effect.

Leaks of Nutrient Laden Liquids/Solids

Accidental discharge, spills or leaks of digestate, sewage, nutrient rich liquids or solid wastes from the Reception Hall, Digesters or wastewater treatment system could pose a risk to the local soil. Such nutrient rich substances have a high Biological Oxygen Demand (BOD) and would pose a risk to groundwater and bedrock aquifers by potential introducing microbial contaminants and threatening aquatic life by consuming available dissolved oxygen in watercourses. The long-term threat to soil is considered to be less than hydrocarbons as such nutrient rich substances will be biodegraded in the soil and absorbed by flora. However, excessive volumes can be detrimental to soils by killing off the microbial and microorganism populations and stunting or killing plant growth by inhibiting the absorption of micro-nutrients. The overall effect is dependent on the volume and duration of such nutrient leaks.

In the absence of mitigation, nutrient leaks to the surrounding soil would have a ***negative****,* ***slight*** and ***short-term*** effect.

Land Spreading of Biobased Fertiliser

Utilising biobased fertiliser (digestate) offers several scientific benefits over the continued use of raw manures, slurries, and chemical fertilisers. These include balanced nutrient availability, slow-release nutrients, improved soil health and a reduction in pathogens and weeds when compared to slurries and manures. These advantages support sustainable agricultural practices whilst simultaneously improving soil conditioning.

Balanced Nutrient Availability: Biobased fertiliser typically contains a balanced mix of essential nutrients, including nitrogen (N), phosphorus (P), potassium (K), and micronutrients crucial for plant growth. This balanced nutrient profile contrasts with chemical fertilisers, which often supply only specific nutrients. Studies have shown that the diverse nutrient composition of digestate supports comprehensive plant nutrition, contributing to improved crop yields and overall plant health (Möller and Müller, 2012). Digestate is particularly rich in ammonium nitrogen (NH4-N), a form of N that is readily available for uptake by plants (Doyeni et al, 2021).

Slow-Release Nutrients: Biobased fertiliser releases nutrients gradually over time as it decomposes in the soil. This gradual release mechanism ensures a sustained supply of nutrients to plants, contrasting with untreated manures, slurries, and chemical fertilisers, which can be prone to leaching or volatilisation. The slow-release nature of digestate reduces the risk of nutrient loss and enhances nutrient uptake efficiency by plants (Yao et al., 2011). Digestion of livestock slurry has also been shown to increase the plant availability of nitrogen in slurry by ca. 10%.

Enhanced Soil Health: Rich in organic matter, Biobased Fertiliser improves soil structure, promotes water retention and stimulates microbial activity. These soil health benefits contribute to improved nutrient cycling, root development, and overall soil fertility (De Vries et al., 2015).

Pathogen and Weed Reduction: Manure and slurry may contain a range of bacterial, viral, and parasitic pathogens and land application of these organic fertilisers typically occurs without prior treatment. In contrast, Anaerobic Digestion, and subsequent pasteurisation of digestate significantly reduces the presence of pathogens and weed seeds, making it safer for agricultural use compared to untreated manures and slurries (Vinneråas et al., 2006).

At full capacity it is proposed that the total tonnages for transportation off-site from the Proposed Development as biobased fertiliser to local agricultural operators will be ca. 8,000 tonnes of Digestate Fibre and ca. 17,000 tonnes of Digestate Liquid Concentrate. Of the maximum 90,000 tonnes of annual feedstock intake to the Proposed Development, ca. 53,500 tonnes of untreated manures and slurries would normally be land spread locally. Following, digestate treatment and pasteurisation there will be 8,000 tonnes of solid and 17,000 tonnes of liquid biobased fertiliser. This represents a significant reduction, ca. 28,500 tonnes per annum, in the hydraulic loading of land spreading locally.

Post pasteurisation, the biobased fertiliser will meet the standard of an EU fertilising product under Regulation (EC) No 2019/1009 under the criteria outlined for Product Function Category (PFC) 3 B: Inorganic Soil Improver. The proposed operator will apply for End of Waste Criteria.

All biobased fertilisers will be used in accordance with S.I. 113 of 2022 European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2022).

The spreading of the biobased fertiliser on the customer farms will be done in accordance with the specific Nutrient Management Plan for that farm.

If appropriately managed land spreading of biobased fertiliser has the potential to have a ***positive, slight*** and ***long-term*** effect on nutrient management and soil quality.

Attenuation Pond

The existence of the attenuation pond will result in the degradation of the underlying soil quality and ensure anaerobic conditions. However, the attenuation will result in the addition of a new Fossitt designated habitat within the locality, FL8 “Other artificial lakes and ponds”. If appropriately managed, attenuation pond will result in an increase in flora, fauna and biodiversity. Increased food availability may entice burrowing fauna to establish in the locality. At a local level burrowing animals have a positive effect on soil quality.

If inappropriately constructed the attenuation pond may pose a risk to the underlying bedrock aquifer. If contaminated materials are discharged into the wetland they may percolate into the underlying locally important bedrock aquifer. From here they can degrade the quality of the aquifer and migrate downgradient to sensitive receptors. As such, the attenuation pond will be lined with an impermeable membrane to limit the risk of contaminants leaching into the underlying locally important bedrock aquifer. There are several recorded boreholes recorded within the 2km study area.

In the absence of mitigation measures, the wetland is envisaged to have a **neutral**, **significant** and **permanent effect**.

Table 7.12 – Severity/ Magnitude of Impact during operation phase

Receptor	Potential Environmental Effects	Quality	Significance	Duration
Topsoil	Nutrient Leaks	**Negative**	**Slight**	**Short-term**
	Land Spreading of Digestate	**Positive**	**Slight**	**Long-term**
	Attenuation Pond	**Neutral**	**Moderate**	**Permanent**
Bed Rock Geology	Hydrocarbon Contamination	**Negative**	**Moderate/ Significant**	**Long-term**

7.6 Mitigation Measures and Monitoring

This section highlights the mitigation measures proposed for the operation and construction stages of the Proposed Development to mitigate potential impacts to the near and wider environment.

7.6.1 Construction Phase

General Mitigation Measures

A Construction Environmental Management Plan (CEMP) will be prepared and implemented by the main contractor during the construction phase. This is a practical document which will include detailed procedures to address the main potential environmental impacts on site, encompassing soil, geology, noise, dust, air quality, surface and ground water, and highlights the proposed construction methods, activities and procedures. Refer to the preliminary CEMP report submitted in conjunction with this EIAR (**Document No.: 231926-ORS-XX-XX-RP-EN-13d-010**). The implementation and compliance with the conditions of the CEMP will be overseen by the Project Supervisor Construction Stage (PSCS) and/or onsite Environmental or Ecological Clerk of Works (ECoW) where necessary. Proposed mitigation measures include;

- Site preparation and construction must be confined to the Proposed Development only and it must adhere to all the mitigation measures outlined in this Chapter. Work areas should be kept to the minimum area required to carry out the proposed works and this area should be clearly marked out in advance of the proposed works.
- Prior to the commencement of developments on site, the PSCS/ ECoW will ensure that contractors will be made aware of the sensitive receptors identified in this chapter and the associated mitigation factors. A signed statement saying that they have taken on board the mitigation measures contained herein should be presented to the local authority along with the Notice of Commencement.
- A wheel wash/ power wash facility will be established at the site-setup stage of construction to limit the translocation of sediment onto the local road network.
- A best practice measure in reducing the risk of the translocation of invasive species all machinery initially arriving to site will be inspected. Any dirty equipment will be refused entry to site.
- All construction waste will be removed from site by a registered contractor to a registered site. Evidence of the movement and safe disposal of the construction waste will be retained and presented to the Local Authority upon request. Removal of the construction waste will occur as soon as possible after construction works.
- The following Guideline documents should be adhered to:
    - Construction Industry Research and Information Association (CIRIA) (2005) Environmental Good Practice on Site (C692).
    - Construction Industry Research and Information Association (2001) Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors (C532).
    - Construction Industry Research and Information Association (2000) Environmental Handbook for Building and Civil Engineering Projects (C512).
    - Environmental Protection Agency (2015) List of Waste and Determining if Waste is Hazardous or Non-Hazardous.
    - Environment Agency et al. (2015) Guidance on the Classification and Assessment of Waste, Technical Guidance WM3.

Topsoil Removal

The removal of topsoil is part of the first stage of the construction process. As mentioned above the initial phase will involve the stripping and stockpiling of the topsoil layer. This material will be reused on site as far as possible during the landscaping stage to remediate slopes and soils within the vicinity of the site, including the buffer zone.

Stockpiles in the absence of mitigation measures will be susceptible to erosion by climatic and hydraulic factors.

- Excavated topsoil will be stockpiled in an area abounded by silt fencing to contain/ reduce any sediment run-off during times of inclement weather.
- Driving machinery on topsoil stockpiles is not advised as it damages the soil structure, reduces porosity, and subsequent percolation rates, and can result in ‘smearing’ of the soil surface, which prevents water infiltration into the soil.
- Any excess topsoil will be removed from site and disposed of appropriately.
- Stockpiling and slight compaction of stockpiles to minimise both hydraulic and climatic erosion.
- Running stockpiles in the direction of prevailing wind to minimise windborne erosion rates, SW-NE. (EPA, 2013).

- Construction of silt fences around topsoil stockpiles to contain sediment run-off.
- Minimise the export of topsoil off site by incorporating in the final landscape design.
- Minimise handling and tracking of material to maintain optimum soil structure.
- Landscaping to take place as soon as possible to reduce exposure of subsoil and topsoil stockpiles.
- Works will be avoided during periods of extended rainfall.
- All topsoil generated from site works should be stored within the Proposed Development until it is required for landscaping. It must not be stored outside the Proposed Development boundaries and it must not be used for the infilling of any area outside of the Proposed Development. If there is more topsoil than is needed for landscaping, it must be removed from site by a registered contractor for appropriate use elsewhere. The end location of the topsoil must be identified and records presented to the local authority if requested.

Excavation

As with all greenfield site construction projects, civil earthworks are the first stage of the construction process. Excavation work to set the site levels, foundation, drainage and buried utilities is essential in facilitating the construction of the built structures. Excavation work will be conducted in stages to minimise the exposure of unprotected soil, subsoil and bedrock.

The development is proposed to be constructed within the range of the existing contours on site. This will limit the extent of significant earth works and greatly reduce the risk of encountering bedrock. Where possible excavated subsoil material will be reworked and used on site. A geotechnical investigation of the site will be required in order to assess the potential of the underlying soil, subsoil and bedrock for reuse.

Temporary excavations which are required for the installation of drainage, gas and buried networks will be excavated and backfilled within as short a timeframe as possible to minimise exposure of surfaces to erosion. Excavation stability is important and deep excavations will employ the use of appropriate excavation techniques (e.g. temporary shoring) to ensure excavation wall stability.

The following measures will help mitigate the impacts during excavation:

- Excavation work will be conducted in stages to minimise the exposure of unprotected soil, subsoil and bedrock.
- Where possible excavated subsoil material will be reworked and used on site.
- A geotechnical investigation of the site will be required in order to assess the potential of the underlying soil, subsoil and bedrock for reuse.
- Stockpiling material in appropriate locations, away from water sources, with a silt fence surrounding it to reduce the rate of run-off from hydraulic conditions.
- Light compaction of stockpiles to minimise the rate of erosion from climatic methods.
- Stockpile heights should be kept to a minimum to ensure stockpile stability and minimise wind borne erosion.
- Excavations will be postponed in high rainfall conditions to reduce the risk of excavation collapse and erosion to soil and subsoil profiles.
- If extreme weather conditions are forecast high sediment stockpiles will be covered to minimise erosion.
- Excavations to be backfilled as soon as possible to prevent any infiltration of contaminants to the subsurface and bedrock.

- All temporary excavations will be conducted in a safe manner to ensure sidewall stability and prevent collapse of excavations. Mobile shoring equipment will be utilised to this end where required.
- All long-term soil stockpiles are to be planted with a vegetative cover to bind the soil and improve slope stability.
- Engineered retaining walls are to be installed where required to ensure stability of contiguous and Proposed Development topography.
- “Mole Plough” installation method will be utilised to install the discharge pipe to the Tinhall Stream. This will limit trenching requirements and reduce the risk of sediment laden run-off.
- The timing of installation of the discharge pipe into the Tinhalla Stream must be scheduled to ensure no instream works are carried out during the closed season for instream works. (October 1st to June 30th). IFI must be notified prior to works taking place. The timing of works shall be in accordance with to IFI (2016) Guidelines on the Protection of Fisheries during Construction Works in and Adjacent to Water. Works associated with the headwall construction should be supervised by an Ecological Clerk of Works (ECoW).

Soil Compaction

Heavy tracked and wheeled construction vehicles will be in use throughout varies stages of the construction process. The soil on site is noted as being un-compacted and soft to firm and of clay loam texture 1.6m bgl. Beyond this shale bedrock has been observed. To reduce compaction during construction the following mitigation measures will be undertaken:

- Construction of a hardcore gravel access road on and around the site.
- Confine site traffic to designated routes.
- Minimise traffic flows on site and establish a construction stage parking compound.
- Avoid the use of oversized machinery when and where possible.
- Prevent movement of vehicles on site during and after periods of rainfall.
- Driving machinery on topsoil stockpiles will be avoided as it damages the soil structure, reduces porosity, and subsequent percolation rates, and can result in ‘smearing’ of the soil surface, which prevents water infiltration.

Run-Off

Sediment laden run-off from exposed soil and stockpiles poses a risk to waterways and aquatic life. The main pollutants of site water are silt, fuel/oil, concrete and chemicals. There are a number of steps outlined below to eliminate contamination of site surface water runoff.

- As a standard best practice measure a silt fencing will be erected along the eastern extents of the Proposed Development site to limit accidental discharge of sediments into the adjacent Tinhalla Stream. The fencing is to be made of a permeable filter fabric (Hy-Tex Terrastop Premium silt fence, or similar), with the footing of the fencing to be buried into the ground and the visible fencing to be ca. 0.5m high.
- An interceptor trench will be installed in front of the silt fence.
- The silt fence will be visually inspected daily to ensure that they remain functional throughout the construction of the Proposed Development. Maintenance of the fences will be carried out regularly. Fences will be inspected thoroughly after periods of heavy rainfall.
- Excavated and/or imported material will be stockpiled and silt fencing will be constructed around stockpile locations to contain/ reduce any sediment run-off during times of inclement weather.

- Compacting of stockpiles will reduce the rate of airborne and hydraulic erosion.
- Stockpile areas for sands and gravel should be kept to minimum size, well away from storm water drains and gullies leading off-site.
- Silt Fences to be erected where excavation works are required in close proximity to water features and along depressions in land where there's increased surface water flow rates.
- Harmful materials such as fuels, oils, greases, paints and hydraulic fluids must be stored in bunded compounds well away from storm water drains and gullies. Refuelling of machinery should be carried out using drip trays.
- A temporary drainage system will be established complete with a settlement pond to remove contaminants from run-off, prior to discharge.
- Temporary staff welfare facilities will be installed on site at the pre-commencement stage. These will include toilet facilities. All foul discharges from welfare facilities will be collected in a septic storage tank. This tank will be regularly emptied, and the contents disposed of at a registered facility.

Concrete

The underlying bedrock contains a locally important karst groundwater body. To the east of the site the overlying burden/ soil is between 1-3m with a "high" risk associated. Additionally, a portion of the northeast of the site is assigned an "extreme" risk due to the reduced depth of overburden of 0.8-1.2m. The site is also located adjacent to a waterbody which is hydrologically connected to a designated SAC.

Due to its elevated pH, unset concrete possesses a risk to adjacent soil, surface waters and the underlying groundwater body. The following mitigation measures are proposed to limit the accidental discharge of concrete and to minimise waste.

- **Concrete Washout Skip**: Chutes of concrete trucks are only to be washed out into an impermeable lined (polythene) skip. The washout water is to be treated prior to discharge.
- The concrete washout skip is to be located to the east of the site, where the overburden is greater.
- Excavations lined with an impermeable liner are not permitted as concrete washout bays.
- Large excess loads of concrete are to be returned to the supplier or poured into concrete block moulds (Betonblock or similar design) in order to minimise waste and reduce the risk of contaminants leaching into the surrounding environment.
- Best practice in bulk-liquid concrete management should be employed on site addressing pouring and handling, secure shuttering, adequate curing times etc.
- Where concrete shuttering is used, measures will be put in place to prevent against shutter failure and control storage, handling and disposal of shutter oils.
- Activities which result in the creation of cement dust will be controlled by dampening down the areas.
- Raw and uncured waste concrete will be disposed of by removal from the site.

Construction Contaminants

A wide array of chemicals and materials will be used during the construction of the development. This includes hydrocarbons which can persist in the wider environment for decades. To mitigate the exposure of the surrounding soil and geology to these substances it is proposed to undertake the following:

- Fuels, oils and other environmental deleterious chemicals are to be stored in a bunded well-ventilated chemical stores.
- Use of such chemicals and fuels is to be contained to bunded areas, where possible.
- Fuel bowsers to be located in bunded areas which can cater for 110% of the primary vessel capacity.
- Any spills or leaks to the soil is to be immediately contained and the soil in question is to be removed by a licensed contractor and disposed of in a registered facility.
- Oil spill containment kits are to be situated near areas of potential spills.
- Regular inspections carried out on plant and machinery for leaks and general condition.
- Use of ready-mixed supply of wet cement products.
- Scheduling cement pours for dry days.
- Maintenance and repair works will be carried out at least 10m from any collection of surface water.
- No refuelling will be undertaken within 50m of the Tinhalla Stream.
- Ancillary machinery equipment such as hoses, pipes and fittings which contain hydrocarbons will be stored within a bund or drip tray.
- Any repair works required on machinery involving fuel and oil control will be carried out offsite where practical, if not possible then repairs will be undertaken on a clean hardcore area of site. Unless unavoidable, repair works carried out in the field where machinery is operational will use spill trays and absorbent materials to prevent release of contaminants to the ground.
- Daily checks prior to start-up of plant and machinery will minimise the risk of breakdown and associated contamination risks for on-site repairs. Daily pre-start checks will be undertaken and records maintained. A clean site policy and diligent housekeeping will also reduce the potential of hydrocarbon release on-site.

Importation of Contaminated Materials

The Proposed Development will involve the importation of gravel and concrete.

- All material will be sourced and transported by registered suppliers.
- All materials will be inspected prior to acceptance on site.
- Any deliveries found to be contaminated will be refused access to deposit on site. Any contaminated materials accidentally deposited on site will be removed immediately from site. If this is not possible then it will be stored in a “quarantine zone”.
- The quarantine zone is to be lined with an impermeable liner which the material will be stored on. A cover will be placed over the liner to avoid hydraulic run-off of contaminated materials. The quarantine zone is to be fenced off and surrounded by silt fencing, as a secondary containment measure.

Excavation of Contaminated Soils

The existing site consists of open pastures. At no point in the site’s history was there any development present, hence excavation of contaminated soils is unlikely. Nonetheless, during construction:

- All excavated materials will be visually assessed for contamination.

- Any contaminated material detected will be sent for analysis to a suitable environmental laboratory and subsequently quantified, segregated and transported for disposal by a licenced contractor.

7.6.2 Operational Phase

The disturbance to soil and geology at the Proposed Development during the operational phase of the Anaerobic Digestion Facility is not foreseen to result in any significant impacts. The most significant threat to the underlying soil and geology is posed by the uncontrolled release of digestate or manure and the operation of the attenuation pond.

General Mitigation Measures

An Environmental Operating Plan (EOP) will be prepared and implemented by the plant management company during the operational phase. This is a practical document which will include detailed procedures to address the main potential effects on surface water and groundwater.

The proposed facility will operate under an Industrial Emissions Licence (IEL) issued by the Environmental Protection Agency (EPA). The licence will contain several conditions which the operator must remain in compliance with for the entire duration of the facility's lifespan. Typical conditions relating to the protection of water receptors include:

- Emissions Limit Values for all emissions including surface water
- Monitoring requirements for surface waters
- Resource use and energy efficiency
- Waste management control and documentation
- Storage and transfer of substances
- Facility management
- Accident prevention and emergency response including fire water retention
- Operational Controls

Uncontrolled Releases and Spillage

Mitigation of relevance to the management of uncontrolled releases will include:

- Dedicated hard standing for off-loading areas, with a minimum separation distance from adjacent water courses.
- Use of spill kits, bunded pallets and secondary containment units, as appropriate.
- All bunds sized to contain 110% of the volume of the primary storage vessel.
- Environmental Management Plan (EMP) to include site specific standard operating procedures pertaining to waste management and emergency response.
- There will be no intentional discharge of untreated storm water to surface or ground waters during the operational phase. All stormwater discharges from site will be via the attenuation pond with all areas, with the exception of the roofs, being directed through Class 1 petrol/oil interceptors before passing through the attenuation pond prior to discharge.
- The Digestion Tanks and Digestate Storage tanks will be located within a bunded location to the east of the site, this will act as a secondary containment in the event of loss of tank contents.

- All primary pipelines and bunded structures will be inspected and integrity tested prior to handover from the appointed construction contractor. All works will be installed to Construction Quality Assurance (CQA) plan.

Land Spreading of Biobased Fertiliser

To mitigate the risk to soil, groundwater and surface water features the following measures will be complied with:

- In order to avoid any reductions in water quality within the catchment as a whole, all biobased fertilisers must be used in accordance with S.I. 113 of 2022 European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2022).
- The spreading of the biobased fertiliser on the customer farms must be done in accordance with the specific Nutrient Management Plan for that farm.
- Application of biobased fertiliser to be conducted in compliance with the Nitrates Action Programme (e.g. prohibited periods and nitrogen application rates).
- All biobased fertiliser is to be pasteurised prior to removal from the Proposed Development to comply with Regulation (EU) 142/2011 on Animal By-Products in Organic Fertilisers.

7.6.3 Decommissioning Phase

The decommissioning phase will entail similar activities to the construction phase. The construction stage mitigation measures outlined in **Section 7.6.1** above will be undertaken to limit and avoid effects to the underlying soil from compaction and contamination. The goal of the decommissioning phases is to render the site safe both physically and environmentally so that it no longer poses a risk to the surrounding population and environment. A Closure, Restoration and Aftercare Management Plan (CRAMP) will be developed as a condition of the industrial emission licences and in compliance with the Guidance to Licensees on Surrender, Cessation and Closure of Licensed Sites set by the EPA (2012).

7.7 Cumulative Effects

Within the European Commission - Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions, dated May 1999, cumulative effects are described as "impacts that result from incremental changes caused by other development, plans or projects together with the Proposed Development or developments".

The cumulative effects of the proposed construction and operation of an Anaerobic Digestion Facility at Curraghnagarraha, Reatagh and Curraghballintlea, Co. Waterford with other developments in the area is reviewed in this section with specific regard to the local and regional Land, Soil and Geology.

Excavated soils will be reused and repurposed for landscaping purposes and for the construction of earth berms on site. There will be no disposal of excess soil and subsoil from site to licensed facilities and so the Proposed Development will not have an effect on capacity at such sites. This will result in a **neutral** effect on such sites.

7.8 Residual Effects

According to Environmental Protection Agency guidelines, Residual Impact is described as 'the degree of environmental change that will occur after the proposed mitigation measures have taken place.' The mitigation strategy above recommends actions which can be taken to reduce or offset the scale, significance and duration of the effects on the surrounding land, soil and geology.

The purpose of this assessment is to specify mitigation measures where appropriate to minimise the 'risk factor' to all aspects of the soil and geological environment such as to minimise the potential for contamination effect to soil, groundwater or aquifers and reduce the risk of erosion and sediment run-off, etc. This 'risk factor' is reduced or offset by recommending the implementation of a mitigation strategy in each area of the study. On the implementation of this mitigation strategy, the potential for impact will be lessened.

A site-specific Construction Environmental Management Plan (CEMP) will be devised and implemented throughout the duration of the construction phase. This document will contain all the necessary procedures required to prevent and minimise any environmental risks posed by the project on the surrounding environment.

7.8.1 Construction Phase

A summary of the predicted impacts associated with the construction phase in terms of quality, significance, and duration, along with the proposed mitigation measures and resulting residual impacts are summarised in **Table 7.13**.

The overall impact anticipated by the construction phase of the project following the implementation of suitable mitigation measures is considered to be ***neutral to negative***, ***slight to significant*** and ***temporary to permanent***.

7.8.2 Operational Phase

A summary of the predicted impacts associated with the operational phase in terms of quality, significance, and duration, along with the proposed mitigation measures and resulting residual impacts are summarised in **Table 7.14**.

The overall impact anticipated by the operational phase of the project following the implementation of suitable mitigation measures is considered to be ***positive to neutral***, ***imperceptible to slight***, and ***temporary to long-term***.

Table 7.13: Summary of predicted construction phase impacts, mitigation measures and residual impact

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Topsoil Removal	**Topsoil** Soil structure, soil microorganism population, adjacent waterways	Erosion of stockpiles of exposed soils leading to migration of silt into surface water receptors via dust and run-off. Damage to soil structure	***Negative***	***Moderate***	***Reversible***	• Silt fencing and interceptor trench to be installed along the eastern extents of the site • Stockpiles of topsoil to be used in landscaping works as soon as is practicable • Silt fence erected along catchment lines • Silt fences to be installed around stockpile locations to reduce run-off rates and to prevent vehicles driving on stockpiles, damaging soil structure • Slight compaction of stockpiles to minimise run-off and airborne erosion • Running stockpiles in direction of prevailing wind, to reduce windborne erosion • Minimise handling of material • Keep stockpile heights low to minimise compaction and windborne erosion • Topsoil is to remain within the Proposed Development site • Wheel wash/ Power hose facility will be available on site to limit the migration of sediment off-site via vehicles • Machinery will be clean on arrival to site, and will undergo inspection • Site welfare facilities will be established prior to removal of topsoil	***Neutral, Slight, Reversible***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Excavations/ Subsoil Removal	**Subsoil** Adjacent waterways, Underlying Locally Important Aquifer	Reduction in subsoil horizon by up to 4m will increase groundwater vulnerability and threaten Aquifer. Migration of silt into adjacent lands and waterways via dust and run-off	***Negative***	***Moderate***	***Permanent***	• Stockpiling material in appropriate locations, away from water sources, with silt fencing surrounding it to retard the rate of erosion from hydraulic conditions. • Light compaction of stockpiles to minimise the rate of erosion from airborne and hydrological methods. • Stockpile heights should be kept to a minimum to ensure stockpile stability and minimise wind borne erosion. • Excavations will be postponed in high rainfall conditions to reduce the risk of excavation collapse and erosion to soil and subsoil profiles. • If extreme weather conditions are forecast high sediment stockpiles will be covered/ dampened to minimise erosion. • Excavations to be backfilled as soon as possible to prevent any infiltration of contaminants to the subsurface and bedrock. • Excavate and backfill temporary excavations within a short timeframe to minimise exposure to erosion and contamination • Installation of silt fencing to capture hydraulic erosion • Risk of contaminating underlying exposed material 'naturally' mitigated by the presence of the of the low permeability subsoil throughout the site • "Mole Plough" installation method for piping proposed where applicable.	***Neutral, Slight, Permanent***
	Bedrock Locally Important Aquifer	Exposure of bedrock, and/or excavation of bedrock	***Negative***	***Significant***	***Permanent***		***Neutral, Moderate, Temporary***
Passing Bay, Drainage Pipe and Gas Pipeline	**Topsoil and Subsoil** Underlying Geology Moderately Productive Aquifer	Exposure and removal of soil and subsoil. Stockpiling of excavated and imported material. Migration of silt into adjacent lands Contamination of subsoil and underlying geology	***Negative***	***Slight***	***Permanent***	• "Mole Plough" installation method for piping proposed where applicable. • Excavations to be backfilled as soon as possible to prevent any infiltration of contaminants to the subsoil • Landscaping to take place as soon as possible to reduce weathering • Installation of drainage headwall to be undertaken outside of the closed season for instream works (October 1st to June 30th) • Ecological Clerk of Works will supervise the installation of the headwall and discharge pipe to the Tinhalla Stream.	***Neutral, Slight, Long-term***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Construction of Built Structures	**Topsoil, Subsoil and Bedrock**	Conversion of permeable soil into hard standing. Compaction of soil and subsoil from plant machinery Contamination of subsoil and bedrock from hydrocarbons, concrete, etc.	***Negative***	***Moderate***	***Long-term***	• Construction of access roads to confine plant machinery to designated routes • Construction of site car park to reduce traffic and compaction on site • Chemicals/ hydrocarbons to be stored and used in bunded areas. • Spill kits to be located throughout site • Scheduling and use of ready mixed concrete on site • Chutes of concrete trucks are only to be washed out into an impermeable lined (polythene) skip which will be located in the east of the site • Excess concrete is to be returned to the supplier here possible. If not possible it will be poured into concrete block moulds (Betonblock or similar) to minimise waste and reduce the risk of contaminants leaching into the surrounding environment • Best practice concrete handling measures will be employed • Temporary site welfare facilities will be established • All foul effluent from welfare facilities will be collected in a septic tank prior to disposal at a register waste facility	***Neutral, Slight, Long-term***
Attenuation Pond	**Subsoil and Bedrock**	Anaerobic soils. Percolation of contaminants into the underlying locally important aquifer	***Negative/ Neutral***	***Significant***	***Permanent***	• No soils will be imported to site. • Any contaminated materials will be refused entry to site • Quarantine zone will be available to isolate any contaminated soils identified. The area will have an impermeable linear, cover and surrounded by silt fencing • The pond will be lined with an impermeable geotextile liner to limit percolation of the contents into the underlying groundwater	***Neutral, Slight, Permanent***
Excavation of Contaminated Soils	**Topsoil, Subsoil and Bedrock**	Excavated materials, intended to be reused on-site for landscaping purposes and establishment of earth berms. Potential for soils to contain contaminants from accidental	***Negative***	***Not Significant***	***Permanent***	• Greenfield site with no previous industrial activities noted at the site meaning incidences of contaminated land unlikely • No contaminants identified during Site investigations	***Positive, Slight, Short-term***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
		spillages or legacy contamination and leach into surface water receptors				• Procedure in place for incidence of contaminated land within CEMP • Contaminated soils encountered to be tested, quantified, segregated and transported for disposal by a licenced contractor • Quarantine zone will be available to isolate any contaminated soils identified. The area will have an impermeable linear, cover and surrounded by silt fencing	

Table 7.14: Summary of predicted operational phase impacts, mitigation measures and residual impact

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Hydrocarbon Contamination	Topsoil	Accidental release from vehicular crash, leaks from hydraulics, fuel tanks, fuel stores, bunds into the surrounding soil	***Negative***	***Moderate to Significant***	***Long-term***	• Drainage systems will be designed to attenuate excess surface water runoff with suitable storage volumes • Reduction of outflow rate to below the existing greenfield runoff rate before discharging • Installation of Sustainable Urban Drainage Systems (SuDS) features such as Sumps in gullies and catchpits collect silts in run-off from roads, filter drains, discharge bypass separator and an attenuation pond. • Environmental Management System • Bunded production area • Regular inspection of bunds • TOC monitors and automated valve shut offs to avoid contamination accidentally being discharged from site.	***Neutral, Imperceptible, Long-term***
	Subsoil and Bedrock Poor Aquifer	Accidental releases outlined above percolating downwards into lower soil horizon and bedrock aquifer	***Negative***	***Moderate to Significant***	***Long-term***		***Neutral, Imperceptible, Long-term***
Nutrient Leaks	Topsoil	Accidental discharges of high BOD demanding digestate/ feedstock/ sewage into soil. Poses threat to adjacent surface water	***Negative***	***Moderate***	***Short-term***	• All sewage/ pipe/ tank infrastructure to be installed in accordance with the relevant industry standards and pressure tested/CCTV surveyed prior to commissioning to ensure absence of defects • Programme of inspection and maintenance to ensure any defects in tanks or bunds are repaired	***Neutral, Imperceptible to slight, Short-term***
	Subsoil and Bedrock Poor Aquifer	Leakage of high BOD sources outlined above into lower soil horizon and bedrock aquifer	***Negative***	***Slight***	***Short-term***	• The process area on site will be completely bunded. This will catch and retain and spills preventing percolation into the lower horizons • TOC monitors and automated valve shut offs to avoid contamination accidentally being discharged from site	***Neutral, Imperceptible to slight, Permanent***
Land Spreading of Digestate	Topsoil, Watercourses Animal welfare	Application of processed digestate to agricultural land Transmissible diseases	***Negative***	***Significant***	***Temporary***	• Biobased fertilisers will be used in accordance with S.I. 113 of 2022 European Communities	***Positive, Imperceptible, Temporary***

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
						(Good Agricultural Practice for Protection of Waters) Regulations, 2022). • Nutrient management plans to avoid excess fertiliser application • Farmers to comply with the Nitrates Action Plan • "Lay-off" period of 21 days for grazing or harvesting following application • Biobased fertiliser will be pasteurised in accordance with Regulation (EU) 142/2011 on use of animal by products as organic fertiliser	
Wetland	Subsoil and Bedrock Moderately Productive Aquifer	Discharge of contaminated materials into the wetland may have the potential to percolate into the underlying aquifer	***Neutral***	***Moderate***	***Permanent***	• Installation of Sustainable Urban Drainage Systems (SuDS) features such as Sumps in gullies and catchpits collect silts in run-off from roads, filter drains, discharge bypass separator and an attenuation pond. • Environmental Operating Plan • Impermeable membrane liner will be installed under the ponds to limit percolation of contents into the underlying locally important karstified aquifer	***Neutral, Moderate, Long-term***

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7.9 Monitoring

The Construction Environmental Management Plan (CEMP) and Environmental Operating Plan (EOP) will include provision for the monitoring of construction and operational related activities including the following:

- Water Quality Monitoring of the surface water receptors adjacent to the site boundary and discharge point
- Daily inspections for housekeeping and site cleanliness
- Continuous noise, vibration and dust monitoring
- Dust Suppression on dry days or during concrete cutting
- Risk assessment for the prevention of fuel spillages
- Monitoring of stockpiles to determine if further measures are required to prevent erosion
- Daily inspection of concrete washout and waste management facilities

Daily site inspections to ensure procedures outlined within the CEMP are adhered through throughout the site.

7.10 Summary of Significant Effects

The receptors for this assessment are considered to be shallow soils, the underlying drift, bedrock geology and waters. Whilst the development proposals have the potential to cause detriment to the sensitive receptors identified, the recommended mitigation measures will ensure that the risk of potential impacts are reduced to ***slight to moderate***.

7.11 Statement of Significance

The significance of effect upon shallow soils, drift deposits, and bedrock geology have been assessed for both during the construction and operational phases. The results of the assessment are presented on **Table 7.11** and **Table 7.12**.

Where a potential effect has been identified, the significance of effect upon these receptors ranges from slight to moderate.

Where a potential effect has been identified, mitigation measures have been provided which if implemented reduces the effect of significance to ***imperceptible*** *to* ***moderate.*** The mitigation steps are presented in **Section 7.6** and summarised in **Table 7.13** and **Table 7.14**.