

## 7 Soils & Geology

### 7.1 Introduction

This chapter comprises an assessment of the 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 & geological receptors.

The objectives of this chapter are.

- To provide a baseline assessment of the receiving environment in terms of 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, geology and hydrogeology during the construction and operational phases.

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

- **Project Scientist & Lead Author:**  
Cathal Tighe – B.Agr.Sc (Agricultural-Environmental Science). Current Role: Environmental Consultant. Experience *ca.* 4 years
- **Project Manager & Co-Author:**  
Luke Martin – B.A. (MOD) (Natural Sciences), M.Sc. (Sustainable Energy and Green Technology), CEnv, MIEEnvSc. Current Role: Senior Environmental Consultant. Experience *ca.* 10 years.
- **Project Scientist & Reviewer:**  
Oisín Doherty – B.Sc. (Geography with Environmental Science), MSc. (Environmental Management), CEnv, MIEEnvSc. Current Role: Senior Environmental Consultant. Experience *ca.* 12 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 & 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, rotary cores, 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 & 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 & 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

### 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
- Meath County Development Plan (CDP) 2021-2027
- Strategic Environmental Assessment CDP 2021-2027
- Review of the Geological Heritage of Meath (2007) and Soils of Meath (1983)
- Aerial Photography from ESRI (ArcGIS).
- 1:50,000 Discovery Series Maps and 6" maps
- 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 (1983). Soils of County Meath

The following site technical reports completed in support of the planning application for the proposed development were also consulted to further assess baseline soil percolation rates.

- Trinity Green Consultants, October 2022. – Site Characterisation Report.

### 7.3.2 Field Survey

Fieldwork commissioned September 2022 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 5<sup>th</sup> October 2022 to identify baseline features on 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 1.8**, outlines 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. 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)**

<b>Magnitude</b>	<b>Criteria</b>	<b>Example</b>
<b>Very High</b>	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). <ul style="list-style-type: none"> <li>• Large existing quarry or pit.</li> <li>• Proven economically extractable mineral resource</li> </ul>
<b>High</b>	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 <ul style="list-style-type: none"> <li>• Large recent landfill site for mixed wastes</li> <li>• Geological feature of high value on a local scale (County Geological Site)</li> <li>• Well drained and/or high fertility soils</li> <li>• Moderately sized existing quarry or pit</li> <li>• Marginally economic extractable mineral resource</li> </ul>
<b>Medium</b>	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 <ul style="list-style-type: none"> <li>• Small recent landfill site for mixed wastes</li> <li>• Moderately drained and/or moderate fertility soils</li> <li>• Small existing quarry or pit</li> <li>• Sub- economic extractable mineral resource</li> </ul>

<b>Low</b>	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	<p>Large historical and/or recent site for construction and demolition wastes</p> <ul style="list-style-type: none"> <li>• Small historical and/or recent landfill site for construction and demolition wastes</li> <li>• Poorly drained and/or low fertility soils</li> <li>• Uneconomic extractable mineral resource</li> </ul>
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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 & Example
<b>Large Adverse</b>	Results in loss of attribute	<p>Loss of high proportion of future quarry or pit reserves</p> <ul style="list-style-type: none"> <li>• Irreversible loss of high proportion of local high fertility soils</li> <li>• Removal of entirety of geological heritage feature</li> <li>• Requirement to excavate / remediate entire waste site</li> <li>• Requirement to excavate and replace high proportion of peat, organic soils and/or soft mineral soils beneath alignment</li> </ul>
<b>Moderate Adverse</b>	Results in impact on integrity of attribute or loss of part of attribute	<ul style="list-style-type: none"> <li>• Loss of moderate proportion of future quarry or pit reserves</li> <li>• Removal of part of geological heritage feature</li> <li>• Irreversible loss of moderate proportion of local high fertility soils</li> <li>• Requirement to excavate / remediate significant proportion of waste site</li> <li>• Requirement to excavate and replace moderate proportion of peat, organic soils</li> </ul>
<b>Small Adverse</b>	Results in minor impact on integrity of attribute or loss of small part of attribute	<ul style="list-style-type: none"> <li>• Loss of small proportion of future quarry or pit reserves</li> </ul>

		<ul style="list-style-type: none"> <li>• Removal of small part of geological heritage feature</li> <li>• Irreversible loss of small proportion of local high fertility soils and/or</li> <li>• high proportion of local low fertility soils</li> <li>• Requirement to excavate / remediate small proportion of waste site</li> <li>• Requirement to excavate and replace small proportion of peat, organic soils and/or soft mineral soils beneath alignment</li> </ul>
<b>Negligible</b>	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	No measurable changes in attributes
<b>Minor Beneficial</b>	Results in minor improvement of attribute quality	Minor enhancement of geological heritage feature
<b>Moderate Beneficial</b>	Results in moderate improvement of attribute quality	Moderate enhancement of geological heritage feature
<b>Major Beneficial</b>	Results in major improvement of attribute quality	Major enhancement of geological heritage feature

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
<b>Very High</b>	Imperceptible	Significant/ Moderate	Profound/ Significant	Profound
<b>High</b>	Imperceptible	Moderate/ Slight	Significant/ Moderate	Profound/ Significant
<b>Medium</b>	Imperceptible	Slight	Moderate	Significant
<b>Low</b>	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 subject site occupies a total area of 4.24 ha and is situated in Carnaross, Kells, Co. Meath. The site is situated to the northwest of an existing cattle mart and lies approximately 5.5km northwest of Kells town centre. An urban wastewater treatment plant, Carnaross, is situated ca. 850m west of the proposed site (License No.: A0043-01) in the River View housing development.

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

The receiving environment is described below for the proposed development under the following headings:

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

### 7.4.2 Topography

The centre and west of the site is dominated by a twinned peak with an elevation of 105.62m O.D. and 104.44m O.D. with the ground between plateauing at ca 103m O.D.. The ground levels on the subject site fall from an average height of 104.4 metres O.D. in the west to a height of ca. 99.1m O.D. along the eastern boundary. There is a gradual gradient (ca. 2°) over ca. 150m here with the most significant gradient occurring in the ca. 50m nearest the eastern boundary, of the proposed process facility, ca. 8-6°. Elevations to the north of the site are ca. 95.7m O.D. with a gradual gradient from the high ground in the centre and west of the site. The ground levels along the strip of land which will form the entrance/ access road to the site is 95.2m O.D. along the R147 and rises to 101.6m O.D. up to the existing tree line ca. 225m to the north-east where the proposed process facility will be located, this is a gradual consistent slope of between 1.5° to 2°.

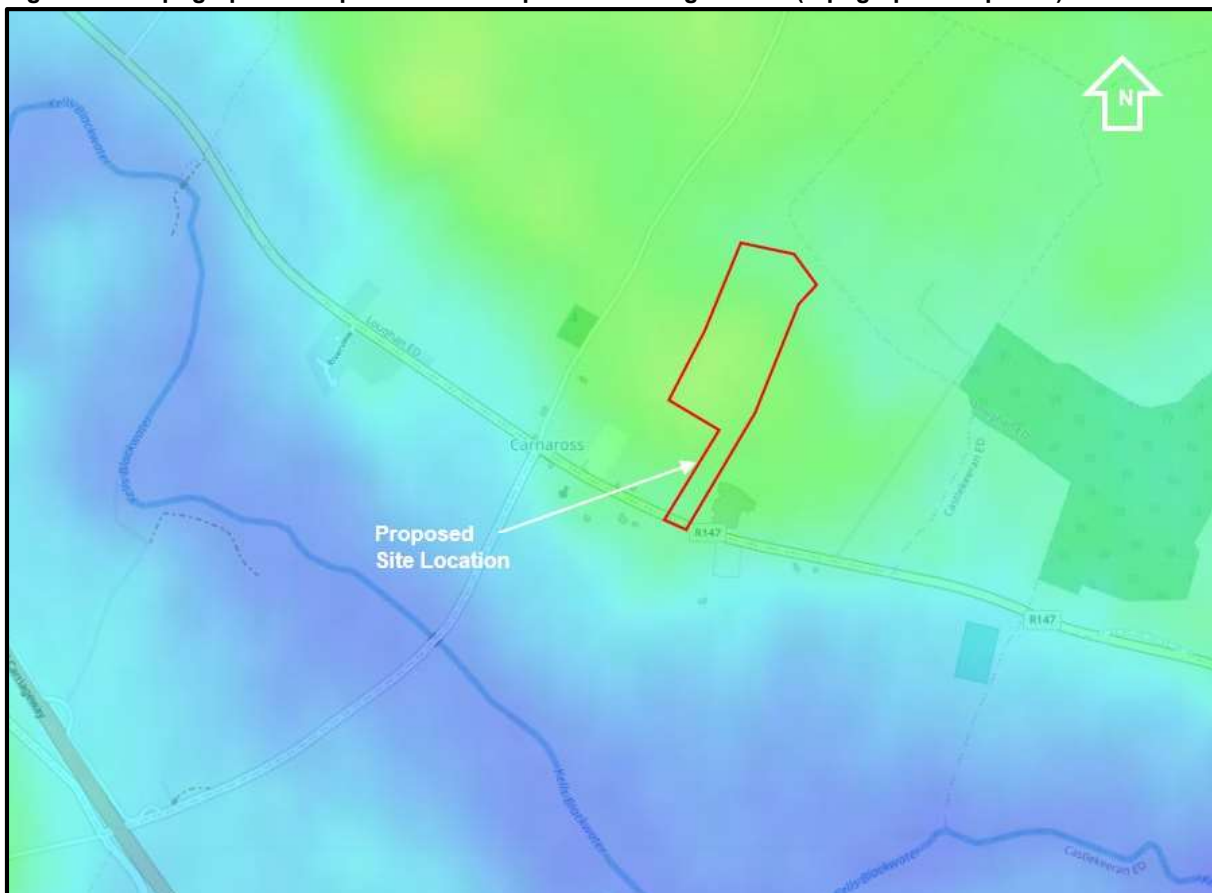
The regional topography of Co. Meath can be divided into roughly five no. topographical regions:

1. Drumlin Region to the north of the county extending from Kingscourt to Castletown.
2. Silurian Shale Hills and surrounding Lowlands extending west from Sieve na Callaigh to Slane in the east of the county.

3. Limestone Lowlands with Namurian and Silurian Shale Hills located towards the east of the county.
4. Limestone Lowland with Carboniferous Shale, which overlies Silurian Shale Hill division and includes the towns of Navan, Trim and Athboy.
5. Limestone Lowland with Dead Ice Features located towards the south of the county with a small section towards the northwest near Oldcastle.

Carnaross is located within the Silurian Shale Hill topographical division, and the topography is dominated by several hill ranges towards the north and west of Carnaross including Slieve Na Calliagh, 276mOD, located within the same topographical division ca.10.71km west; Aghalion Hill, 249mOD, located within the Drumlin Region ca. 17.7km northwest; and Cornasaus Hill, 339mOD, located within the Drumlin Region ca. 17km north of the proposed site location. The local topography of Carnaross is shaped principally by the Kells Blackwater River which is situated to the southwest of the town and runs in a NW to SE direction.

**Figure 7.1: Topographical map of the landscape surrounding the site (topographic-map.com)**



### 7.4.3 Receptors

#### Designated Sites

The area surrounding the site contains several protected areas. **Table 7.4** below outlines the protected areas within a 5km radius of the proposed site and is accompanied by **Figure 7.5** which displays the spatial distribution of the Special Areas of Conservation (SAC) and Special Protection Areas (SPA). 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.

**Table 7.4: Protected Areas**

Name	Site Code	Designation	Reason for Protection
River Boyne And River Blackwater SAC	002299	SAC Habitats	Alkaline fens Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, <i>Alnion incanae</i> , <i>Salicion albae</i> ) <i>Lampetra fluviatilis</i> (River Lamprey) <i>Salmo salar</i> (Salmon) <i>Lutra</i> (Otter)
River Boyne And River Blackwater SPA	004232	SPA Birds	Kingfisher ( <i>Alcedo atthis</i> )
Kilconney Bog (Cloghbally) SAC	000006	SAC Habitats	Active raised bog Degraded raised bog still capable of natural regeneration

#### Geological Heritage

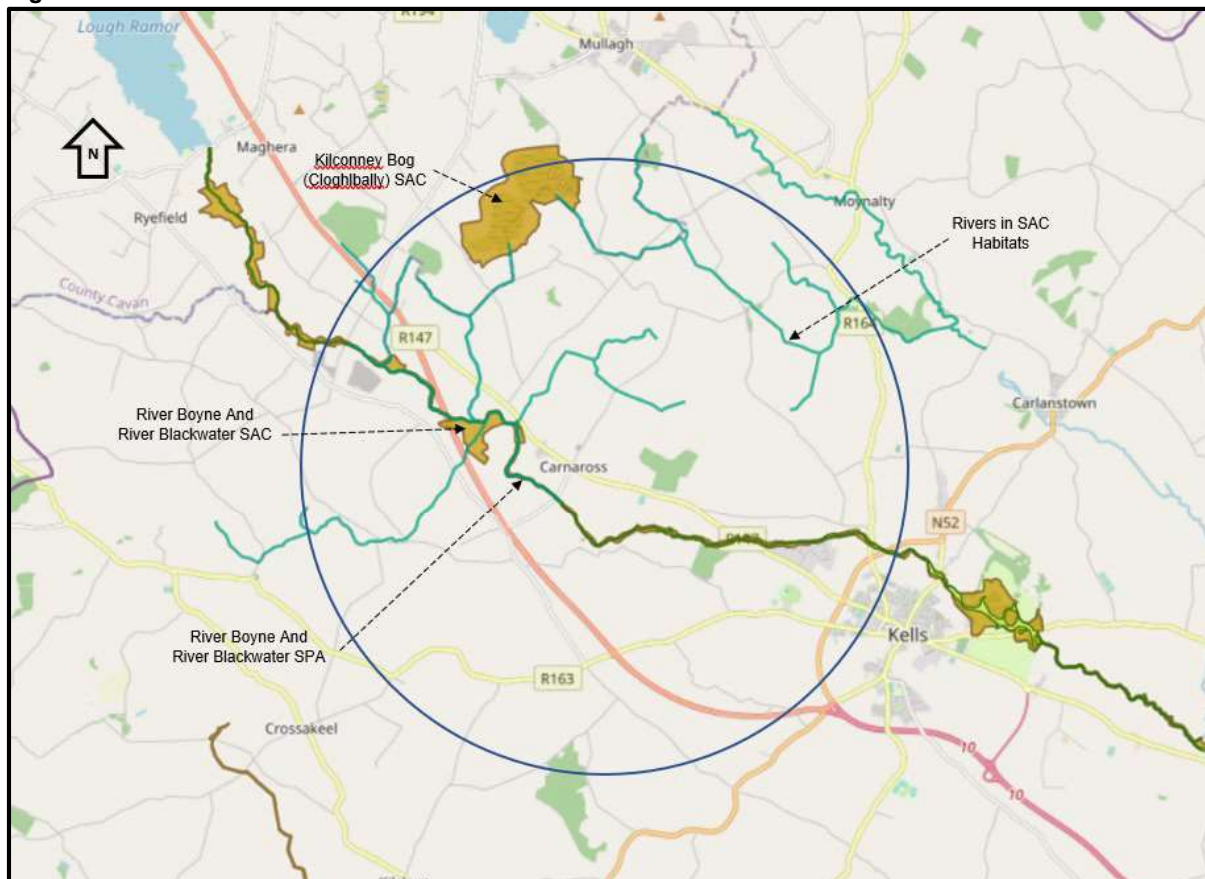
The Irish Geological Heritage (IGH) Programme identifies and selects a complete range of sites that represent Ireland’s geological heritage under sixteen themes ranging from karst features to hydrogeology. The IGH Programme is a partnership between the GSI and the National Parks and Wildlife Service (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 but that there is one within a 2 km radius of the proposed site. The Blackwater Valley is designated under the IGH7 Quaternary theme due to its pitted sandur, glacial outwash plain. According to the GSI Geological Heritage of Meath report “*The valley catchment covers over 1,000 square kilometres, but the pitted sandur that forms a striking hummocky terrain at the base of the valley is only c. 20 square kilometres in area. A sandur*

forms when glacial meltwater flowing from a melting ice sheet deposits its load (silt, sand, gravel and boulders), creating a bumpy landscape. The term ‘pitted’ refers to the small to large depressions within the glacial sediment, created by solitary blocks of melting ice. These features are generally at such a large scale that they are difficult to recognise on the ground and may only be seen from satellite imagery or high resolution aerial photography. Unusually, in the Blackwater Valley, the hollows are visible on the ground”. These sandur’s record the deglacial retreat of the ice sheet through north Meath at the end of the last glaciation.

Most of the heritage site is covered within the River Boyne and River Blackwater SAC (ID: 02299). Due to the size and scale of the geological features the site is classified as a County Geological Site (CGS).

Figure 7.2: SPA & SAC sites within 5km radius of 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 deposited by water from the ice. It generally applies to deposits laid down during the Pleistocene (Quaternary) glaciations. Drift can also be included under Holocene (Quaternary) deposits. The drift geology of the area principally reflects the depositional process of the last glaciation. Typically, during the ice advance, boulder clays were deposited 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 site is located with the Silurian Shale Hills and surrounding Lowlands. The National Soil Survey of Ireland describes this region as comprising Brown Earths and Brown Podzolic soils which, under good management, can be very productive. The slopes are negotiable by farm machinery, being no more than 10°, and only some small areas are too steep for easy cultivation. The hills and ridges seldom exceed 300 metres in height and for the most part, reach only 240 metres, while the surrounding lowlands are at an elevation of about 100 metres.

EPA Soils Classification maps identify the subject site as comprising two known soil types. The vast majority of the site consists of a deep well drained mineral (AminDW) classified as Till derived chiefly from Lower Palaeozoic rocks consisting of sandstones and shales. The Northern part of the site consists of mineral alluvium (AlluvMIN).

In view of the proposed development, the soils which are likely to be affected by the development represent a notable resource particularly in a local context. In a regional context, this soil resource is less significant as such soils occur in abundance in the area.

#### 7.4.5 Bedrock Geology

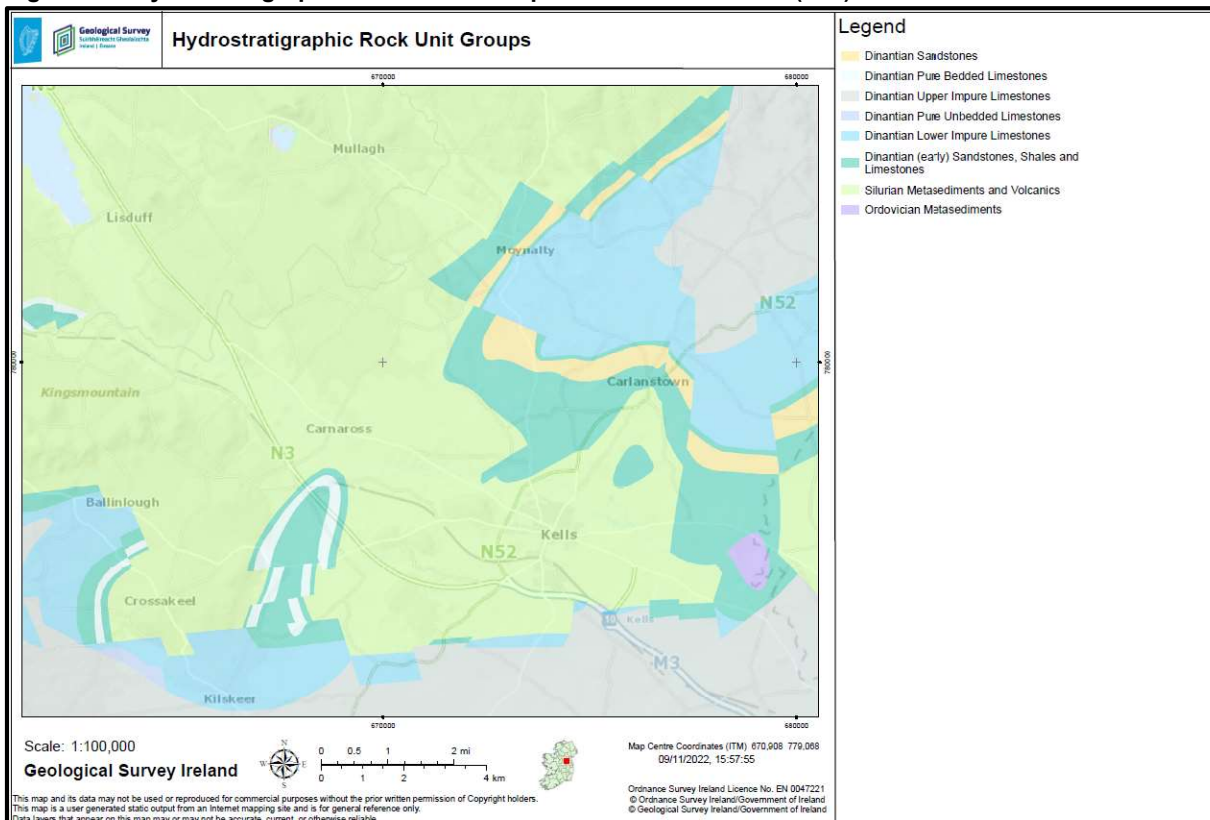
##### **Regional Bedrock Geology**

The predominant rock types in Meath are sedimentary rocks, limestone of Carboniferous age. To the north of the county is the Clontail Formation (Calcareous red-mica greywacke), the Fingal Group (Dark limestone, shale and micrite) and the Rathkenny Formation (Black mudstone, siltstone, greywacke) to the west and centre is the Lucan Formation (Dark limestone & shale), to the south the Waulsortian Limestones Formation (massive unbedded lime-mudstone) and to the east is the Loughshinny Formation (Dark micrite & calcarenite, shale).

The oldest underlying bedrock geology in Meath stems from a time when Ireland was made up of two main 'halves', with the country split in a north-east to south-west direction from Clogher head to Dingle. The collision of these two plates resulted in the formation of volcanic islands at Bellewstown and Grangegeeth areas, in the east of county Meath, with intrusive volcanic derived rock groups, granite, located as close as Navan. As the two plates of the Earth's crust came together, they closed the Lapetus ocean, 500 to 400 million years ago, which resulted in the formation of Silurian aged sandstones which formed in the shallowing sea as the ocean finally closed around these volcanic islands. The majority of the bedrock underlying the county consists of Lower Carboniferous aged rocks, which are mainly limestone. These formed on the continental shelf of a tropical sea around 340 million years ago. There were both deep marine basins and shallow water environments across Meath. A

period of shallow seas with excessive evaporation left gypsum and mudstone deposits in the Kingscourt (Cavan) area in a down warped basin. The southern end of the faulted depression is in Meath. Some of the last sediments to be deposited in Meath occurred during the Quaternary period (1.6 million years ago to present) when a series of large ice sheets moved over Ireland, and down the Irish Sea area, depositing glacial till (clay, sand and gravel) and scouring the underlying bedrock giving Meath much of its present-day geomorphological character.

**Figure 7.3: Hydrostratigraphic Rock Unit Groups of Northwest Meath (GSI)**

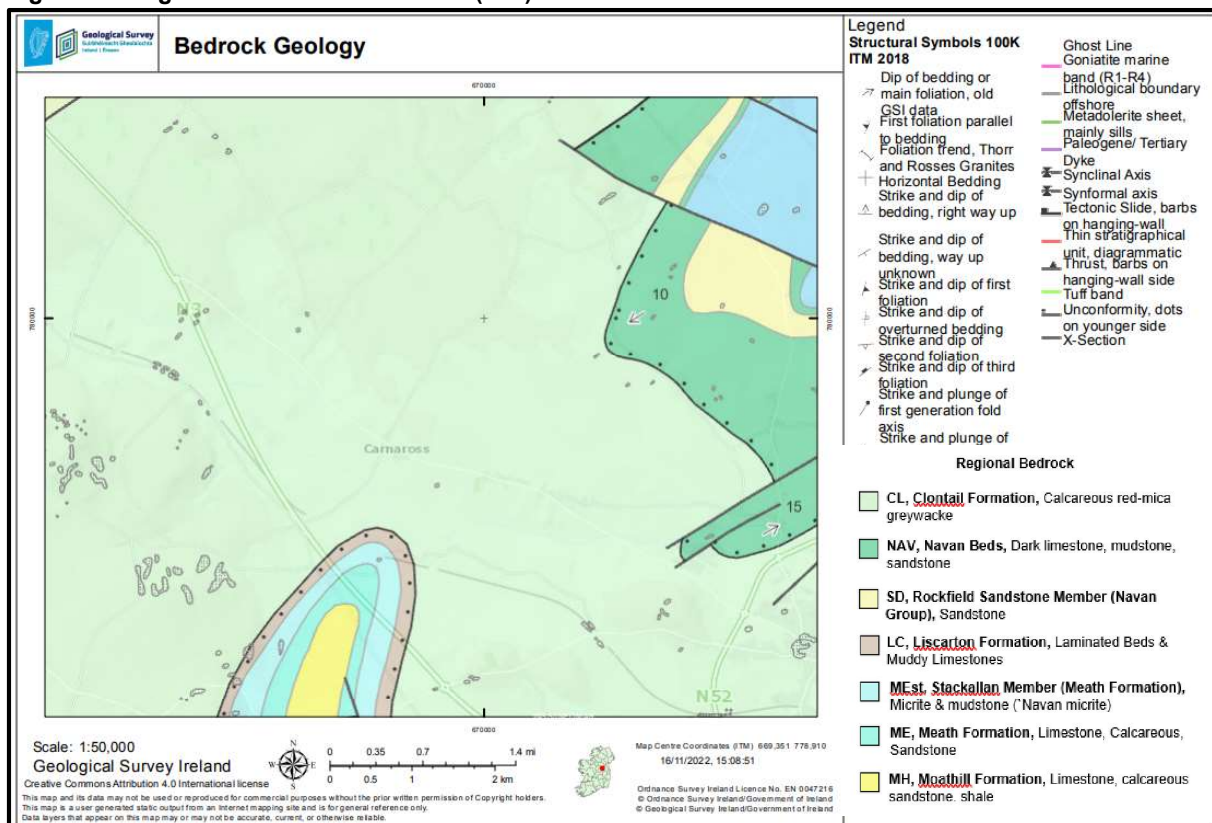


The principle hydrogeological feature in the region is the River Boyne which rises in Co. Kildare. It passes through Meath in an eastern flow and reaches the Irish Sea at Drogheda, Co. Louth. The river divides Meath into two nearly equal parts and is joined by the River Blackwater at Navan. The Blackwater is the closest hydrological feature to the proposed site and is of near equal importance to the River Boyne within the regions hydrology. It rises at Lough Ramor in Co. Cavan before flowing through Kells and onto Navan. The proposed site overlooks the entrance of the Blackwater Valley, which begins at Castlekeeran, and runs to Lough Ramor, ca. 8km north-west. This is a glacial derived valley which is flooded to the north creating Lough Ramor. South of the Lough is characterised by a glacial outwash feature known as a pitted sandur, which creates a striking hummocky terrain at the base of the valley. According to the GSI, a "sandur forms when glacial meltwater flowing from a melting ice sheet deposits its load (silt, sand, gravel and boulders), creating a bumpy landscape. The term 'pitted' refers to the small to large depressions within the glacial sediment, created by solitary

blocks of melting ice. These features are generally at such a large scale that they are difficult to recognise on the ground and may only be seen from satellite imagery or high-resolution aerial photography. Unusually, in the Blackwater Valley, the hollows are visible on the ground”

The bedrock geology on the 1:100,000 scale mapping from the GSI indicates that the region surrounding the site extents is characterised by 7 geological formations, with 4 within a 2km radius of the proposed site, as illustrated in **Figure 7.4**.

**Figure 7.4 Regional Bedrock Formations (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 underlying and surrounding the subject site comprise Silurian Metasediments and volcanics. This strata date from the Early Silurian period and would have been formed during the Llandovery epoch. These sediments are described as calcareous red-mica greywacke.

The GSI 1:1,000,000 Bedrock Solid Geology Map indicates that the site lies within the Clontail Formation. The Calcareous red-mica greywacke parent material is described as green-grey, medium to thickly bedded, coarse and very fine-grained tae greywackes, with dark grey, thinly bedded, poorly graded, quartzose fine sandstone to siltstone units. Both lithologies contain distinctive brown-red coloured biotite.

According to the GSI database, there is a high density of groundwater wells, with complete datasets located within 2 kilometres of the proposed development (**Figure 7.5**). This data is summarised in **Table 7.5** below.

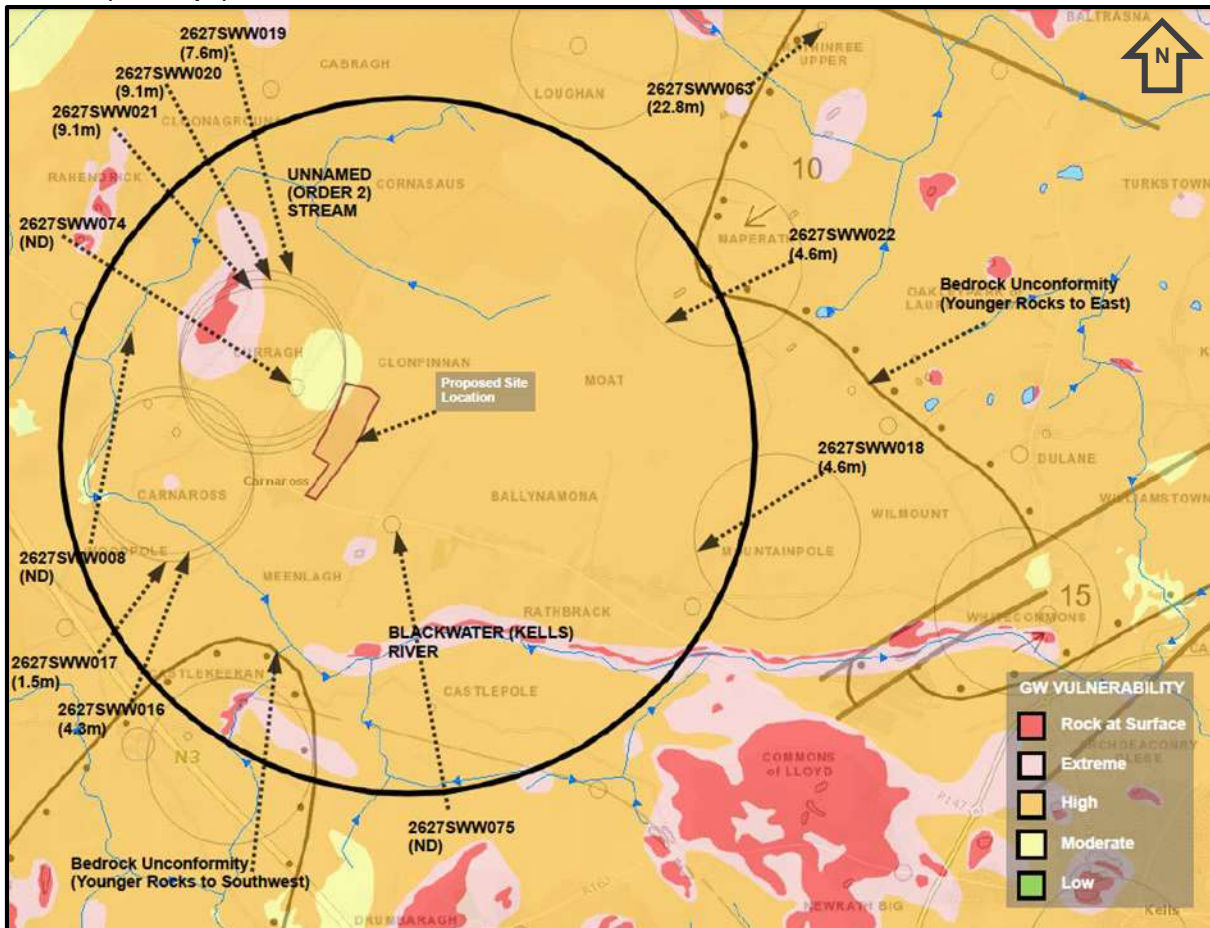
**Table 7.5: Groundwater Wells with 2km of the site (GSI Well Database)**

GSI Reference	Easting Northing	Well Type	Depth (m bgl)	Depth to Rock (m)	Well Use	Yield m <sup>3</sup> /d	Proximity to site
2627SWW021	268900, 279050	Borehole	42.7	9.1	Agri & domestic	ND	210m NW
2627SWW020	268900, 279100	Borehole	39.3	9.1	Agri & domestic	13.6	220m NW
2627SWW019	268900, 279150	Dug Well	7.6	7.6	ND	58.9	230m NW
2627SWW074	269100, 278950	Dug Well	9.1	-	Public supply (Co Co)	10	390m NW
2627SWW075	269680, 278120	Borehole	85.9	-	Public supply (Co Co)	ND	670m S
2627SWW016	268350, 278450	Borehole	36.6	4.3	ND	78.5	730m SW
2627SWW017	268350, 278400	Borehole	38.4	1.5	ND	21.8	740m SW
2627SWW008	268100, 279300	Borehole	24.4	-	Public supply (Co Co)	ND	1.45km NW
2627SWW083	267790, 279410	Dug Well	3.7	-	Public supply (Co Co)	3.5	1.75km NW
2627SWW022	271650, 279700	Dug Well	4.6	4.6	-	43.6	1.84km NW
2627SWW018	272000, 278050	Borehole	29	4.3	Domestic use only	43.6	2.05km E

<b>2627NWW063</b>	272270, 281120	Borehole	103.6	22.8	Agri & domestic	21.8	3.6km NW
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**Figure 7.5** below superimposes the approximate location of the groundwater wells listed in the table above relative to the groundwater vulnerability rating of the area. The site boundary is roughly marked out in red. Groundwater wells in the vicinity of the site are generally moderate to low yielding. The lands on which the site location has been proposed have been assigned high vulnerability rating and the recorded depth bedrock is encountered for the corresponding wells in this area are generally between 4.5 to 9.1 metres below ground level (bgl). To the northwest of the proposed site is a parcel of land that has a moderate vulnerability rating.

**Figure 7.5: Groundwater Vulnerability and location of Groundwater Wells and associated depth to bedrock (GSI Maps)**



The nearest fault to the proposed development is located approximately 3.2km away to the East with a Southwest – Northeast trend. The proposed site location is located almost equidistant between two no. unconformities:

1. Southwest approx. 1.7km – the younger Listcarton Formation (Dinantian Limestones) overlays the Clontail Formation (Silurian Metasediments).

2. Northeast approx. 2km – The younger Navan Beds Formation (Dinantian Limestones) overlays the Clontail Formation (Silurian Metasediments).

### **Karst Features**

The GSI's groundwater karst database indicates that there is two outcrop features within the 2km study area. Both are located ca. 1.5 km south, at Castlekeeran, on the opposite bank of the Blackwater River. The features include a spring, St. Kieran's Well, and superficial solution features (ID: 2627SWK001). These features are located above an unconformity line in the bedrock 100k geology.

### **Mineral Aggregate Resources**

There are no active quarries on the site. The nearest active quarry recorded on the GSI's online database is Faughan Hill Quarry ca. 13.6 km southeast of the site in Bohermeen where Limestone is quarried for both construction and road projects.

There is an inactive sand and gravel pit located ca. 2.1km west of the proposed site, which produced building sand, graded gravel and sand for golf courses according to the GSI database.

### **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<sup>3</sup>). For workplaces the Reference Level is 400 Bq/m<sup>3</sup>

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 becquerel per cubic metre (Bq/m<sup>3</sup>)). 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 in a High Radon area, with 10% of houses in the vicinity of the site estimated to have radon levels above the Reference Level. As such all-office and canteen structures on site should be fitted with radon barriers to minimise staff exposure.

#### **7.4.6 Soils & 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)

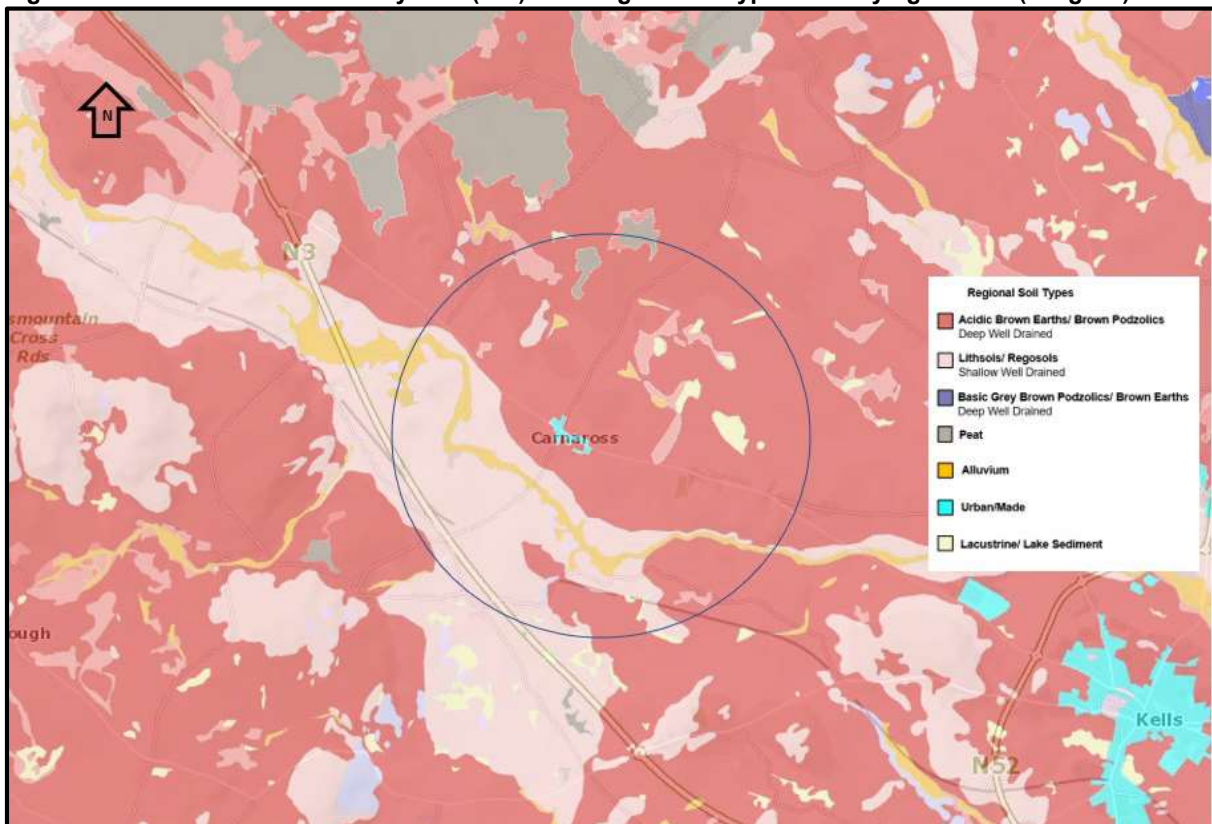


to the south and south-west is the Blackwater Valley floor where the soil is classed as shallow well drained mainly acidic soils (AminSW) derived from calcareous parent materials. The parent material in this area is glaciofluvial sands and gravels. To the east of the proposed site is an area of land flanking a stream where the soil group changes to surface water gleys and ground water gleys, which are mineral poorly drained acidic soils. Alluvial soils are noted along the banks of the Blackwater River to the south-west and ca. 0.7km the north along the convergence of an unnamed order 2 stream.

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.

Under the SIS classification system, the soil group is 'Brown Earths' and the soil sub-group is classified as '1100 -Typical Brown Earths', named the 'Broomhill' Group under the national soil series.

**Figure 7.7: Irish Soil Information System (SIS) detailing subsoil types underlying the site (Teagasc)**



The 'Broomhill' subgroup is characterised by a coarse loamy soil consisting of a medium proportion sand sized particles (44%) and lower proportions of silt (33%) & and clay (23%). Throughout the soil profile this proportion of particle sizes remains relatively consistent with

only an increase in large stones (40-80%) in the form of boulders (20-60cm) in the lowest horizon, 58-81cm. A detailed representative soil profile description from the Teagasc SIS database of the Broomhill soil group is included in **Appendix 7.1**. This representative soil description available for the Broomhill series is from a site in Kilkenny so will differ from the proposed site in Carnaross.

The EPA databases indicate the parent material for the clayey subsoils beneath the site as till derived from Lower Palaeozoic sandstones and shales (TLPSsS). 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 existing site is used for agricultural purposes and due to its topography is suited to pastoral grazing and silage production.

**Soil Contamination**

A review of the EPA & DCCA 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 or licensed Integrated Pollution Prevention Control (IPPC) sites were present within a 2km radius of the proposed area. The closest IPPC facilities are over 4 km away in Kells and outside the study area, **Table 7.6**. outlines the closest sites.

A section 4 discharge license (Reference 03/01) for Carnaross Sand & Gravel Ltd. is located 3.6 km north-west of the proposed site and is situated on the banks of the Blackwater River.

An urban wastewater treatment plant, Carnaross, is situated ca. 850m west of the proposed site (License No.: A0043-01).

No areas of particular concern were observed during the site walkover.

**Table 7.6: Licensed Integrated Pollution Prevention Control (IPPC) Facilities (EPA Maps)**

Licence Number	Distance from site	Name	Licence Status
P0475-01	4.6 km E	Complex Tooling & Molding Limited	Licensed
P0140-01	4.9 km E	ABEC Technologies Europe	Licensed
P0402-02	6.3 km SW	P Carney Limited	Licensed
P0236-02	6.9 km N	Wellman International Limited	Licensed

Tara mines is located ca. 18.2 km south-east of the proposed site, with the tailings pond located 16.4 km. Tara mines (License No.: P0516-01), Europe’s largest deposit of Zinc and Lead, was discovered in 1970 by the Tara Exploration & Development Co. Ltd. and production began in 1977.

Given the distances from the proposed site is not envisaged that the various licenced and proposed activities will be of detriment to the proposed development.

The historic maps indicate no obvious sources of contamination based on previous land use within the proposed site. A historic quarry, dating back to the 19<sup>th</sup> century, located to the southwest in the study area corresponds with an area of “Extreme” ground water vulnerability on the GSI mapping database. The cattle mart adjacent to the site may pose as a source of contamination if slurry tanks are inappropriately designed and not integrity tested. However, the addition of an above ground slurry silo between 2005-2012 would indicate appropriate slurry management is being undertaken, minimising the risk the site poses.

**Table 7.7: Historical Land Use (<https://webapps.geohive.ie/>)**

Date	Description
1837-1842	The proposed site and adjacent lands are greenfield. Gravel pit located ca. 720m SW. Quarry located ca. 620m S.
1888-1913	The proposed site and adjacent lands are greenfield. Disused quarry located ca. 620m S.
1995	The proposed site is greenfield. Cattle mart adjacent to proposed site to the SE
2000-2003	The proposed site is greenfield. Cattle mart adjacent to proposed site to the SE
2005-2012	The proposed site is greenfield. Cattle mart adjacent to proposed site to the SE with the addition of an above ground slurry tank.

### **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. 8 km east of the site on the outside bank of the meandering Moynalty River. A further landslide is recorded 8km south of the proposed site at Girley Bog, Chamberlainstown, with the event occurring pre-2000.

### **7.4.7 Ground Investigation**

Ground investigation works were carried out by a chartered ORS environmental scientist for the proposed development at Carnaross on the 5<sup>th</sup> of October 2022. These investigations confirmed the general geology and subsoil conditions corresponded to the conditions indicated in the geological mapping. The locations of the ground investigations are shown on **Figure 7.8**, and details of each investigation location is presented in **Table 7.8**.

The trial pits installed reached a maximum depth of 3m bgl with one reaching to 3.00m bgl. At no point throughout the investigation was bedrock encountered. As stated in **Section 7.4.2** the site topography is highest in the centre and west of the site, trial pits 1 and 3, with the surrounding land sloping out gradually to the south and north, with a more significant gradient, 5-8°, towards the eastern boundary, trial pits 2 and 4. The soil profile across all the trial pits was relatively similar with a slight variation noted in trial pit 5 with a larger rusty red leached band between the A and B horizon at 0.30m - 0.70m.

Figure 7.8 Site layout and locations of Trial Pits



A summary of the ground conditions encountered during the ground investigation carried out as part of this report is given in **Table 7.7**.

Table 7.8: Ground profile for each Trial Pit

Location	Depth (m)	Ground Profile	Comments
TP-01	0.0 – 0.30	Firm loamy topsoil with a rich dark brown colour	End trial pit at 2.4m
	0.30 – 1.30	Light brown/ grey clay SILT with subangular to round cobble (rusty red sandstone/ mudstone cobble). This is a firm horizon with a blocky structure.	No water seepage noted
	1.30 – 2.40	Light brown/ grey sand SILT with cobble (rusty red sandstone/ mudstone cobble). This is structureless with a firm to hard density.	
TP-02	0.0 – 0.30	Dark brown loam topsoil	End trial pit at 2.4m
	0.30 – 0.70	Rusty red colour clayey silt with some cobbles	No water seepage noted
	0.70 – 1.20	Grey/ brown clay SILT with subangular to round cobble	

	1.20 – 1.70	Grey/ brown gravelly, clay, SILT with higher cobble	
	1.70 – 2.4	Light brown silt clay with subangular to round cobble containing flecks of rust colour. Highly compacted structureless horizon.	
<b>TP-03</b>	0.0 – 0.30	Dark brown loam topsoil	End trial pit at 2.4m
	0.30 – 0.60	Rusty red colour clayey silt with some cobbles	No water seepage noted
	0.60 – 1.00	Grey/ brown sand SILT with some gravel	
	1.00 – 2.40	Grey/ brown gravelly, sandy, SILT with higher cobble of subangular to round.	
<b>TP-04</b>	0.0 – 0.30	Dark brown loam topsoil	End trial pit at 2.4m
	0.30 – 0.70	Rusty red colour clayey silt with some cobbles	No water seepage noted
	0.70 – 1.20	Grey/ brown sand SILT with cobble	
	1.20 – 1.70	Grey/ brown gravelly, sandy, SILT with higher cobble	
	1.70 – 2.4	Rust coloured silt sand with gravel	
<b>TP-05</b>	0.00 – 0.30	Dark brown firm loam topsoil with a crumb structure	End trial pit at 3m
	0.30 – 0.70	Rusty red colour clayey silt with low cobbles of subangular to round. Firm with a blocky structure	No water seepage noted Mottling noted at 1.2m
	0.70 – 3.00	Grey/ brown slightly sandy gravelly SILT with higher cobble. Structureless and heavily compacted. Mottling noted at 1.2m	

## 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 run-off 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.

However, the 'Do Nothing' scenario does infer negative environmental impacts. The proposed development is focused on capturing and utilising methane, which is currently being emitted from the anaerobic production of silage and land spreading of farmyard manure and slurry on livestock farms throughout the country. According to the UNECE, over a 100-year period methane has 28-34 times the global warming potential of carbon dioxide, this increases to 84-86 times over a 20-year period. Capturing and utilising this methane by burning it to produce carbon dioxide and heat, which can be used or converted to electricity, significantly reduces its global warming potential. Climate change poses a serious threat to soils by increasing the

frequency of extreme weather events such as droughts and storms. The combination of droughts followed by heavy rainfall results in significant soil erosion.

In terms of soils, anaerobic digestion of farmyard manure and other feedstocks is advantageous as it improves its fertiliser potential, through the mineralisation of organic compounds which increases the available nitrogen and phosphorus content. This can help reduce the requirement for inorganic fertilisers which can have adverse impacts on soil structure by altering soil chemistry and microorganism populations.

The 'Do Nothing' scenario may result in the continued pollution of soils and groundwater throughout the local region from damaged farmyard infrastructure and poor agricultural practices. The construction of the anaerobic digester will reduce the storage time in such facilities.

The proposed development plans on utilising a combination of grass silage and slurry feedstocks. Grass and grass silage are the primary feedstock of livestock based agricultural enterprises in Ireland, which contrasts with the predominantly grain based business model employed elsewhere. Grass is the key to the success of the Irish livestock and dairy industries, in particular the latter, providing a cheap reliable feed source which enables smaller farm enterprises to remain financial sustainable in comparison to the high-cost grain-based systems, which requires farms of scale in order to maintain profitability. The proposed development will result in a diversion of grass feedstock destined for livestock production, and its associated GHG emissions, and will instead be channelled into the sustainable production of renewable biogas.

Convincing farmers to part way with their grass will not be possible unless a fair price is offered to compensate farmers to cover the cost of alternative feedstocks or a reduction in the farm herd number is undertaken to reduce the feed requirements of the farm. The latter is a more likely option and will help the government achieve its 2030 GHG emission reduction of 50%. These reductions include a commitment to reduce emissions from the agricultural sector by 25%. It's anticipated that a reduction in the national herd is required to achieve this. Estimates vary, but the Irish Farmers Journal have said a beef herd reduction of 13%, and 11% for dairy, is required to achieve this reduction.

The 'Do Nothing' scenario would result in a continuation of the status quo with grass being used to produce GHG intensive beef and dairy products. There would be no alternative option available to farmers to reduce emissions and diversify their business portfolio away from livestock production whilst maintain profit and long-term employment. The overall cattle herd number would remain at record levels in the state, with over 7.3 million cattle as of the 2020 agricultural census. Inflated herd numbers coupled with bad farming practices poses a risk to soils and hydrology features in the form of soil compaction, over grazing, increased soil exposure, soil degradation, run-off and eutrophication of waterways.

### 7.5.2 Receptor Sensitivity

The sensitivity of the receptors identified during the study of soil & geological features within the vicinity of the site are summarised in **Table 7.9**.

**Table 7.9: Receptor Sensitivity**

Receptor	Receptor Importance	Receptor Sensitivity	Rationale
Topsoil	Local Level	Moderate-High	The local topsoil is an acidic brown earth (AminDW) which is in abundance within the vicinity of the development. The soil contains no known pollutants. The soil is of good agricultural quality, being a free draining 'Brown Earth' and would be a highly sought-after topsoil for any infill agricultural lands.
Underlying Deposits	Local Level	High	Given the sites topography the proposed development will involve a considerable amount of civil works to level the site. Where possible drift deposits will remain on site and be utilised as infill material.  The underlying till deposits is diamicton, indicating that they are poorly sorted and contain particles ranging in size from clay to boulder.
Bed Rock Geology	County Level	Low	The underlying bedrock is greywacke sedimentary deposits which are known to be unsorted sedimentary bedrocks. This rock is in abundance and the proposed development is not envisaged to encounter the bedrock. The underlying aquifer is classified as poor.

### 7.5.3 Sources - Construction Phase

The construction phase is likely to yield the most potential impacts on the surrounding soil and geology. Potential construction phase impacts are considered in detail below and summarised in **Table 7.10**.

The proposed development requires the process facilities to be constructed at the same site level. Given the sites current topography this will require extensive earthworks to both cut and fill the site to a level base upon which the development can be constructed. Excavation works for an access road connecting the site to the R147 and the insertion of a gas pipeline and new connection to the existing gas line near the R147 is required. The following headings outline the excavation and infilling anticipated on 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 0.30m in depth of an Acidic Loamy Brown Earth topsoil. This inert material will be stripped throughout the proposed compound and site access road locations and stockpiled. The method of striping will involve the use of a tracked excavator/ bulldozer along with the use of a wheeled articulated haul truck.

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**.

The removal and stockpile of topsoil would result in a **negative, slight to moderate and reversible effect** on soil.

### **Excavation/ Subsoil Removal**

Given the sites uneven topography a significant layer of subsoil, up to depths of 4.08m on current site levels, to the west, will be excavated to create a level base upon which the proposed development compound will be constructed. Engineered infill will be required at lower parts of the site to achieve the proposed ground level and it is hoped to utilise excavated onsite subsoil material where possible for infilling. Refer to the Cut & Fill Drawing No. **220732-ORS-ZZ-00-DR-CE-410** in the accompanying civil report. Mechanical soil compaction will be undertaken to ensure soil stability throughout the site. Excess material will be transported off site for disposal.

Soils beyond ca. 0.30m below ground level have been found to be relatively consistent throughout the site, containing a heterogeneous unsorted drift of primarily a clayey silt with angular to sub-angular cobble less than 150mm in size with occasional boulders. This loamy drift consisting of silt-sized particles presents 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, conducted by Dr. Eugene Bolton of Trinity Green Environmental Consultants indicated that the soakage in this lower horizon is slower than anticipated for the site, natural compaction of the clay and silt layers which have a blocky structure and are noted as being heavily compacted. The report is included in the accompanying Civil Report. Further compaction of this layer during excavation is inevitable and may further increase surface water run off due to reduced infiltration rates resulting in increased sediment erosion on site. The excavation of significant volumes of the subsoil layer will result in an increased risk to the groundwater vulnerability, as outlined in **Chapter 8**.

The preliminary Cut & Fill Drawings for the proposed development indicate that a total of 66,258 cu. M of material is to be excavated at the process facility, with only 6165 cu. M required for infilling. This results in a net of 60,093 cu. M which will need to be transported and disposed of off-site at a licensed facility. Refer to the Cut & Fill Drawing No. **220732-ORS-ZZ-00-DR-CE-410** in the accompanying civil report.

The extraction and reduction in the subsoil horizon will have a **negative, profound and permanent effect** on the subsoil horizon.

### Excavation of Bedrock

A further potential impact of this stage could be the exposure of underlying bedrock outcrops. The exact depth to bedrock is unknown at the site, with trial pits indicating no bedrock at depths of 3m and assessment of the nearby groundwater wells, **Table 7.5** and **Figure 7.5**, indicating bedrock at 4.6m - 9.1m below ground level (bgl). Excavations of up to 4.08m bgl are required to reach the finished floor level (FFL) of the propane tank compound (05) and roofed silage clamp (06) to the west of the site. 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 the roofed silage clamp.

It should be noted that the combined primary and secondary digester (09), secondary digester (13), underground tank in the digestate separation storage unit (27) and digestate tank (35) will all have a FFL of 2m below the finished ground level. 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 1.63m to 1.38m bgl to the west and infilling of up to 1.11m are required to achieve the desired ground level. Refer to the Cut & Fill Drawing No. **220732-ORS-ZZ-00-DR-CE-410** in the accompanying civil report and relevant structural site layout drawings as referenced in Section 2.2, Chapter 2 – Project Description.

Encountering bed rock will have a **negative, significant, and permanent effect**.

### Access Road & 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 access road to the R147. The road will closely follow the contours of the existing topography, so excavation of the subsoil horizon will be less extensive. Hard-core inert infill material will be imported to site to facilitate the construction of the access road. The installation of drainage networks will also result in soil disturbance.

The proposed gas pipeline connecting to the existing Gas Networks Ireland pipeline along the R147 will be installed underneath the proposed access road. This will involve temporary excavation work and will result in disturbance of the underlying 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.

The proposed excavation, drainage network and infilling of hard-core material along the proposed access road and gas pipeline would have a **negative, slight and long-term effect** on the topsoil and subsoil.

### **Construction of Built Structures**

The construction of the AD biogas facility 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 overtime.

The construction of the built structures requires excavations of up to 4.06m below current ground levels. As is common practice with the construction of foundations a compressed infill gravel base 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.

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.

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

### **Slope Stability**

There will be an inclining slope to the southwest of the proposed compound, beside the Gas Grid Entry Metering Unit (03), connecting to the existing ground level in the adjacent agricultural land. A soil berm will envelope the site to the east and double up as a part of the site bund network. Wind and hydraulic erosion of the exposed sloped surfaces poses a risk to the adjacent drainage network to the east if berms constructed steeper than the designed 1:1.5, vertical to horizontal. Slope failure would result in significant outwash onto adjacent land. The berm to the east of the site would be at risk of blocking the open drainage network running to the unnamed order 2 stream to the north.

A concrete retaining wall will be constructed to the west (max of 4m in height) and northwest with a separate one to the southwest of the site to ensure soil stability in the existing ground level of the adjacent agricultural lands. A retention wall to the northeast of the site, near the Combined Primary and Secondary Digester (09), with a max height of ca. 2.6m, will be constructed to support infilling in this area, as will a smaller wall to the southeast of the development. These will be engineered retaining walls with stability guaranteed in the design.

The proposed development will result in the construction of several sloped embankments and retaining walls which will have a **neutral, moderate and permanent effect**.

**Excavation of 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 site 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 October 2022 did not detect any evidence of contaminated soils. It is not anticipated contaminated soils will be encountered during construction activities.

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

**Table 7.10 – Severity/ Magnitude of Impact during construction phase**

<b>Receptor</b>	<b>Potential Environmental Effects</b>	<b>Quality</b>	<b>Significance</b>	<b>Duration</b>
Topsoil	Topsoil Removal	<b>Negative</b>	<b>Slight/ Moderate</b>	<b>Reversible</b>
	Slope Stability	<b>Neutral</b>	<b>Moderate</b>	<b>Permanent</b>
	Access Road & Gas Pipeline	<b>Negative</b>	<b>Slight</b>	<b>Long-term</b>
Underlying Deposits/ Subsoil	Construction of Built Structures	<b>Negative</b>	<b>Moderate</b>	<b>Long-term</b>
	Excavation/ Subsoil Removal	<b>Negative</b>	<b>Profound</b>	<b>Permanent</b>
	Excavation of Contaminated Soils	<b>Negative</b>	<b>Not Significant</b>	<b>Temporary</b>
	Access Road & Gas Pipeline	<b>Negative</b>	<b>Slight</b>	<b>Long-term</b>
Bed Rock Geology	Excavation of Bedrock	<b>Negative</b>	<b>Significant</b>	<b>Permanent</b>

**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 7.11**.

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

**Hydrocarbon Contamination**

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 contaminants.

The 5000L fuel storage 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.

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 silage clamps, feedstock reception building, digesters or septic 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.

Nutrient leaks to the surrounding soil would have a **negative, slight and short-term** effect.

### **Land Spreading of Digestate**

Spent digestate will be separated into its solid and liquid components via both a screw press and centrifugal separator. The majority of the liquid component will be reused in the biogas production process as an inoculant. The separated solids will be pasteurised and sent for land spreading. The separated solids material could pose a threat to waterways and groundwater if inappropriately spread. The effect of the substrate on soil and water quality is positive when applied within the parameters of the Nitrates Action Programme (NAP) and in conjunction with a Nutrient Management Plan, which gives effect to the Nitrates Directive. The consumers of this substrate will be based in Co. Meath, which under the conditions of the NAP are prohibited to spread organic fertilisers between the 15<sup>th</sup> of October and the 15<sup>th</sup> of January, of the following year.

Digestate is an excellent organic fertiliser. The nitrogen content within the digestate is in a readily available form for plants to uptake and it is a good source of phosphorus and potassium, the main components of in-organic fertilisers. Overall, if inappropriately managed digestate has the potential to be a **negative, significant and temporary effect**.

### Sub-Division of Farmland

The proposed development involves the sub-division of a ca. 4.5 ha parcel of land to the south. This proposed access road from the R147 will run in a southwest to northeast direction, nearly parallel to the boundary line to the east. This will result in the creation of two land parcels of ca. 2.7ha and 1.4ha, to the west and east, respectively. This will have an impact on the agricultural potential of the soil by limiting the mechanisation potential of the land. The land is currently in use as a mixed grazing agricultural enterprise, of beef and sheep. Corine land cover maps developed by GSI classified the land is pasture.

The sub-division of the land to the south would result in a **neutral, moderate and long-term effect**.

**Table 7.11 – 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	Significant	Temporary
	Sub-Division of Farmland	Neutral	Moderate	Long-term
Bed Rock Geology	Hydrocarbon Contamination	Negative	Moderate/ Significant	Long-term

## 7.6 Mitigation Measures & 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.: **220732-ORS-XX-XX-RP-EN-13d-002**)

#### Topsoil Removal

The removal of topsoil is part of the first stage of the construction process. As mentioned above **Section 7.4.3** 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 and bunds constructed of soil will be erected around stockpiles to contain/ reduce any sediment run-off during times of inclement weather. Little compacting of stockpiles will reduce the rate of airborne and hydraulic erosion. 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.

To summarise the mitigation measures:

- 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 earthen bunds and 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.

### **Excavations/ Subsoil Removal**

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.

Significant volumes of the subsoil will be excavated on site, as mentioned in **Section 7.4.3**, to achieve a level site compound. ORS engineering consultants were contracted to develop civil groundwork drawings to optimise the cutting and filling process to minimise the volume of subsoil to be exported off site. Excavated subsoil material will be reworked and used as a base upon which the Geotextile Clay Linear (GCL) can be laid. Engineered infill will be placed on top of this GCL layer upon which the proposed built structures will be built.

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 to ensure excavation wall stability.

To summarise the following measures will help mitigate the impacts during excavation:

- Stockpiling material in appropriate locations, away from water sources, with an earthen soil bund/bank surrounding it to reduce the rate of erosion from hydraulic conditions.
- Compacting 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.

### **Soil Compaction**

Heavy tracked and wheeled construction vehicles will be in use throughout varies stages of the construction process on the site. The subsoil on the site is already noted as being compacted with a crumble structure. To reduce compaction of this layer 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.

- Excavated and imported material will be stockpiled and earthen bunds will be constructed around stockpiles to contain/ reduce any sediment run-off during times of inclement weather.
- Compacting of stockpiles will reduce the rate of airborne and hydraulic erosion.
- 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. Refueling of machinery should be carried out using drip trays.
- A temporary drainage system will be established complete with oil interceptors and settlement ponds to remove contaminants from run-off, prior to discharge off-site.
- Stockpile areas for sands and gravel should be kept to minimum size, well away from storm water drains and gullies leading off-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 100% 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.

### **Slope Stability**

The points identified to optimise the stability of the slopes to the southwest and east of the proposed compound are outlined as follows:

- Berms are to be engineered to have an angle of 1:1.5, vertical to horizontal, to ensure a stable embankment with a maximum height of 2-3m.
- Slopes are to be dressed in topsoil recovered during the initial site stripping stage and planted with a vegetative cover to bind the soil and improve slope stability.
- 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.
- Engineered retaining walls are to be installed where required to ensure stability of contiguous and proposed site topography.

### **Excavation of Contaminated Soils**

The existing site consists of open pastures. At no point in the site's history there was 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 site during the operational phase of the AD biogas 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.

### **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 & Spillage of Digestate and Feedstocks**

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. Conditions of relevance to 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 operating plan to include site specific standard operating procedures pertaining to waste management and emergency response.
- There will be no direct discharges to surface or groundwater bodies during the operational phase.
- The entire production area of the site will be underlain by an impermeable geotextile membrane liner, acting as secondary containment in the event of a catastrophic failure.
- All primary vessels, pipelines (foul & process) and bunds will be subject to integrity assessments every 3 years by a suitably qualified engineer.

### **Land Spreading of Digestate**

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

- Land spreading of the separated solid and liquid digestate will be undertaken on appropriate farms which can accommodate application with respect to their nitrogen stocking rate.
- Receiving farms will be required to have a Nutrient Management Plan.
- Application of digestate to be conducted in compliance with the Nitrates Action Programme (eg. prohibited periods and nitrogen application rates).
- All exported material to be pasteurised 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 a biogas facility at Carnaross with other developments in the area is reviewed in this section with specific regard to the local and regional land, soil and geology. The project will involve the importation of gravel and concrete which will be sourced from local quarries and will result in an increased demand at such sites. The removal and disposal of excess soil and subsoil from site to licensed facilities will have an effect on capacity at such sites. This will result in a slight cumulative 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 7.12**.

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 7.13**.

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 7.12: 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	Slight/ Moderate	Reversible	<ul style="list-style-type: none"> <li>Temporary drainage system to route run-off through interceptors &amp; settlement ponds</li> <li>Stockpiles of topsoil to be used in landscaping works as soon as is practicable</li> <li>Silt fence erected along catchment lines</li> <li>Soil bunds at base of stockpiles to reduce run-off rates and to prevent vehicles driving on stockpiles and damaging soil structure</li> <li>Slight compaction of stockpiles to minimise run-off and airborne erosion</li> <li>Running stockpiles in direction of prevailing wind, SW-NE, to reduce windborne erosion</li> <li>Minimise handling of material</li> <li>Keep stockpile heights low to minimise compaction &amp; windborne erosion</li> </ul>	Neutral, Slight, Reversible

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Excavations/ Subsoil Removal	Subsoil Adjacent waterways, Underlying Poor Aquifer	Reduction in subsoil horizon by up to 4.08m will increase groundwater vulnerability. Migration of silt into adjacent lands & waterways via dust and run-off	<b>Negative</b>	<b>Profound</b>	<b>Permanent</b>	<ul style="list-style-type: none"> <li>Stockpiling material in appropriate locations, away from water sources, with an earthen soil bund surrounding it to retard the rate of erosion from hydraulic conditions.</li> <li>Installation of a geotextile, impermeable liner beneath the process area. Early installation of this liner will also protect the underlying groundwater body during the construction phase.</li> <li>Compacting of stockpiles to minimise the rate of erosion from airborne and hydrological methods.</li> <li>Stockpile heights should be kept to a minimum to ensure stockpile stability and minimise wind borne erosion.</li> <li>Excavations will be postponed in high rainfall conditions to reduce the risk of excavation collapse and erosion to soil and subsoil profiles.</li> <li>If extreme weather conditions are forecast high sediment stockpiles will be covered to minimise erosion.</li> </ul>	<b>Neutral, Significant, Permanent</b>
	Bedrock Poor Aquifer	Exposure of bedrock, and/or excavation of bedrock	<b>Negative</b>	<b>Profound</b>	<b>Permanent</b>	<ul style="list-style-type: none"> <li>Excavations to be backfilled as soon as possible to prevent any infiltration of contaminants to the subsurface and bedrock.</li> <li>Excavate and backfill temporary excavations within a short timeframe to minimise exposure to erosion and contamination</li> <li>Installation of silt fencing to capture hydraulic erosion</li> <li>Risk of contaminating underlying exposed material 'naturally' mitigated by the presence of the of the low permeability subsoil throughout the site</li> </ul>	<b>Neutral, Significant, Temporary</b>

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
<b>Access Road &amp; Gas Pipeline</b>	Topsoil & Subsoil Underlying Geology Poor Aquifer	Exposure & removal of soil & subsoil. Stockpiling of excavated and imported material. Migration of silt into adjacent lands Contamination of subsoil and underlying geology	<i>Negative</i>	<i>Slight</i>	<i>Long-term</i>	<ul style="list-style-type: none"> <li>Excavations to be backfilled as soon as possible to prevent any infiltration of contaminants to the subsoil</li> <li>Landscaping to take place as soon as possible to reduce weathering</li> <li>Risk 'naturally' mitigated by the presence of a thick layer of low permeability subsoil throughout the site</li> </ul>	<i>Neutral, Slight, Long-term</i>
<b>Construction of Built Structures</b>	Topsoil, Subsoil & Bedrock	Conversion of permeable soil into hard standing. Compaction of soil & subsoil from plant machinery Contamination of subsoil & bedrock from hydrocarbons, concrete, etc.	<i>Negative</i>	<i>Moderate</i>	<i>Long-term</i>	<ul style="list-style-type: none"> <li>Risk 'naturally' mitigated by the presence of a thick layer of low permeability subsoil throughout the site</li> <li>Installation of a geotextile, impermeable liner beneath the process area. Early installation of this liner will also protect the underlying groundwater body during the construction phase.</li> <li>Construction of access roads to confine plant machinery to designated routes</li> <li>Construction of site car park to reduce traffic and compaction on site</li> <li>Chemicals/ hydrocarbons to be stored and used in bunded areas.</li> <li>Spill kits to be located throughout site</li> <li>Scheduling and use of ready mixed concrete on site</li> </ul>	<i>Neutral, Slight, Long-term</i>
<b>Slope Stability</b>	Subsoil	Slope failure	<i>Neutral</i>	<i>Moderate</i>	<i>Permanent</i>	<ul style="list-style-type: none"> <li>Excavations to be backfilled as soon as possible to prevent embankment failures</li> <li>Shoring of excavations to be conducted</li> <li>Construction of retaining walls</li> <li>Slopes to be dressed with topsoil and seeded down to increase soil stability</li> <li>Slopes to have a 1:2 ratio</li> </ul>	<i>Neutral, Slight, Permanent</i>

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Excavation of Contaminated Soils	Topsoil, Subsoil & Bedrock	Excavated materials, intended to be reused on-site for landscaping purposes.  Potential for soils to contain contaminants from accidental spillages or legacy contamination and leach into surface water receptors	Negative	Slight	Short-term	<ul style="list-style-type: none"> <li>Greenfield site with no previous industrial activities noted at the site meaning incidences of contaminated land unlikely</li> <li>Site investigations reinforce this assumption</li> <li>Procedure in place for incidence of contaminated land within CEMP</li> <li>Contaminated soils encountered to be tested, quantified, segregated and transported for disposal by a licenced contractor</li> <li>Risk 'naturally' mitigated by the presence of a thick layer of low permeability subsoil throughout the site</li> </ul>	Positive, Slight, Short-term

**Table 7.13: 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	<b>Negative</b>	<b>Moderate to Significant</b>	<b>Long-term</b>	<ul style="list-style-type: none"> <li>Drainage systems will be designed to attenuate excess surface water runoff with suitable storage volumes</li> <li>Reduction of outflow rate to below the existing greenfield runoff rate before discharging</li> <li>Installation of Sustainable Urban Drainage Systems (SuDs) features such as permeable paving, filter drains, and petrol interceptors</li> <li>Environmental Operating Plan</li> <li>Bunding and regular inspection of bunds</li> </ul>	<b>Neutral, Imperceptible, Long-term</b>
	Subsoil & Bedrock Poor Aquifer	Accidental releases outlined above percolating downwards into lower soil horizon and bedrock aquifer	<b>Negative</b>	<b>Moderate to Significant</b>	<b>Long-term</b>	<ul style="list-style-type: none"> <li>As above</li> <li>Risk 'naturally' mitigated by the presence of a thick layer of low permeability subsoil throughout the site.</li> <li>Installation of a geotextile, impermeable liner beneath the process area.</li> </ul>	<b>Neutral, Imperceptible, Long-term</b>
Nutrient Leaks	Topsoil	Accidental discharges of high BOD demanding digestate/ feedstock/ sewage into soil. Poses threat to adjacent surface water	<b>Negative</b>	<b>Slight</b>	<b>Short-term</b>	<ul style="list-style-type: none"> <li>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</li> <li>Programme of inspection and maintenance to ensure any defects in tanks or bunds are repaired</li> </ul>	<b>Neutral, Imperceptible to slight, Short-term</b>
	Subsoil & Bedrock Poor Aquifer	Leakage of high BOD sources outlined above into lower soil horizon and bedrock aquifer	<b>Negative</b>	<b>Slight</b>	<b>Short-term</b>	<ul style="list-style-type: none"> <li>Risk 'naturally' mitigated by the presence of a thick layer of low permeability subsoil throughout the site</li> <li>Installation of a geotextile, impermeable liner beneath the process area.</li> </ul>	<b>Neutral, Imperceptible to slight, Permanent</b>

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
<b>Land Spreading of Digestate</b>	Topsoil, Watercourses Animal welfare	Application of processed digestate to agricultural land  Transmissible diseases	<i>Negative</i>	<i>Significant</i>	<i>Temporary</i>	<ul style="list-style-type: none"> <li>Nutrient management plans to avoid excess fertiliser application</li> <li>Farmers to comply with the Nitrates Action Plan</li> <li>"Lay-off" period of 21 days for grazing or harvesting following application</li> <li>Digestate will be pasteurised in accordance with Regulation (EU) 142/2011 on use of animal by products as organic fertiliser</li> </ul>	<b>Positive, Imperceptible, Temporary</b>
<b>Sub-Division of Farmland</b>	Topsoil Agricultural potential	Reduction in the mechanisation potential and resulting arable agricultural potential of farmland to the south of compound by subdividing land	<i>Neutral</i>	<i>Moderate</i>	<i>Long-term</i>	<ul style="list-style-type: none"> <li>Land to be used for pastoral farming to maximise potential</li> </ul>	<b>Neutral, Moderate, Long-term</b>