

Limerick WWTP Upgrade and Regional Bioresource Centre

ElAR Chapter 14 - Land and Soils

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Formerly JB Barry Partners who became part of Egis in 2023

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Glossary and Defined Terms

Acronym	Description
AA	Appropriate Assessment
AASR	Appropriate Assessment Screening Report
ACP	An Coimisiún Pleanála
AD	Anaerobic Digestion
AGS	Aerobic Granular Sludge
AER	Annual Environmental Report
BOD	Biochemical Oxygen Demand
BC	Bioresource Centre
C	Carbon
CAFÉ	Clean Air for Europe Directive
CHP	Combined Heat and Power
DIN	Dissolved Inorganic Nitrogen
ECJ	European Court of Justice
EIAR	Environmental Impact Assessment Report
ELV	Emission Limit Value
EPA	Environmental Protection Agency
ESB	Electrical Supply Board
EU	European Union
FOG	Fats Oils and Grease
FST	Final Settling Tank
GHG	Greenhouse Gas
HGV	Heavy Goods Vehicle
MLPS	Main Lift Pumping Station
MCA	Multi-Criteria Analysis
MRP	Molybdate Reactive Phosphate
IDA	Industrial Development Agency
IFAS	Integrated Fixed-Film Activated Sludge
N	Nitrogen
NDP	National Development Plan
NHA	National Heritage Area
NIS	Natura Impact Statement
NPF	National Planning Framework
NSO	National Strategic Outcomes
NSS	National Spatial Strategy
NWSMP	National Wastewater Sludge Management Plan
P	Phosphorous
PE	Population Equivalent - The amount of wastewater received at a treatment plant (and its design capacity) is measured in units known as population equivalent (or PE). The wastewater received from all sources, e.g. industrial, tourism, commercial, residential, etc., is converted into these units, with one unit of PE representing the wastewater treatment load typically generated by a single person.

Acronym	Description
SEA	Strategic Environmental Assessment
SBR	Sequencing Batch Reactor
SIA	Stable Isotope Analysis
SID	Strategic Infrastructure Development
Sludge	Solid by-products of wastewater
SPA	Special Protection Area
SS	Suspended Solids
UWWTD	Urban Wastewater Treatment Directive
WFD	Water Framework Directive
WWDA	Wastewater Discharge Authorisation
WWTP	Wastewater Treatment Plant
WSPS	Water Services Policy Statement
ZTV	Zone of Theoretical Visibility
PS	Pumping Station
QI	Qualifying Interest
RAS	Return Activated Sludge
RBC	Regional Bioresource Centre
RSES	Regional Spatial and Economic Strategy
SAC	Special Area of Conservation
TDS	Total Dry Solids
THP	Thermal Hydrolysis Process
PFF	Pass Forward Flow
PFT	Picket Fence Thickener
pNHA	Proposed National Heritage Area

Acronym (where applicable)	Departments & Stakeholders
ACP	An Coimisiún Pleanála
DPER	Department of Public Expenditure and Reform
CACNaT	Department of Climate Action, Communication Networks and Transport
DCCAE	Department of Communications, Climate Action and Environment – Changed in 2020
DCHG	Department of Culture, Heritage and the Gaeltacht – Changed in 2020
DoF	Department of Finance
DHPLG	Department of Housing, Planning and Local Government – Changed in 2020
HLGaH	Department of Housing, Local Government and Heritage
EPA	Environmental Protection Agency
GSI	Geological Survey Ireland
GWS	Group Water Schemes
IFI	Inland Fisheries Ireland
IR	Irish Rail (Iarnród Éireann)
UÉ	Uisce Éireann
LCCC	Limerick City & County Council
LA	Local Authority
NMS	National Monuments Service
NPWS	National Parks & Wildlife Service
NRA	National Roads Authority
NTA	National Transport Authority
OPW	Office of Public Works
OSi	Ordnance Survey Ireland
SRA	Southern Regional Assembly

14 LAND AND SOILS

14.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) examines the potential impacts on land, soils and geology at the Limerick Wastewater Treatment Plant & Regional Bioresource Centre and Corcanree pumping station, (hereafter referred to as the 'Proposed Development').

14.1.1 Purpose of this Report

This section considers the potential impacts to land, soils and geology as a result of the Proposed Development. The objectives of the proposed scheme are outlined in Chapter 1 (Introduction).

The methodology for the assessment has been carried out according to best practice and guidelines. An overview of the baseline conditions is provided, together with the proposed methodology and an overview of the scope of work likely to be required to undertake a detailed identification/assessment of the proposed project.

The assessment includes the development of a baseline analysis which is done by reviewing all available and relevant site investigation data and determining the current soil and bedrock conditions and identifying sensitive receptors within the area of the Proposed Development.

The assessment identifies potential impacts of construction and operational activities on the land, soils, and geology in and around the Proposed Development. Any excess soil and/or contaminated soils are discussed and cross referenced with Chapter 17 (Resource and Waste Management).

Potential impacts related to the surface water environment are not considered in this assessment but are considered separately in the water chapter.

14.1.2 Outline Project Description

The Proposed Development will cater for future population growth and industrial development in the area, in line with population projections for Limerick as set out in the National Planning Framework (NPF) Implementation Roadmap and Regional Spatial and Economic Strategy (RSES) for the Southern Region. It will provide 20% Headroom allowance, in line with Uisce Éireann guidelines for large urban settlements. It will also ensure the WWTP continues to comply with requirements of the EPA Wastewater Discharge License (WWDL), Urban Wastewater Treatment Regulations (UWWTR) and other relevant Uisce Éireann Guidelines.

The initial upgrade works will cater for the +10-year growth projections, increasing from 130,000 PE to 285,000 PE including a future industrial committed load of 27,500 PE. There will be provision made in the civil infrastructural development of the plant (tank sizing and pipework) for the +25-year growth projections of 325,000 PE. However, a planning review will be required before any uplift above 285,000 PE can be installed. The proposed project will consist of the upgrade of the existing wastewater treatment plant and Regional Bioresource Centre which will be contained within the existing site boundary. The proposed development also consists of the upgrade of the Corcanree Pumpstation, located to the east of the WWTP site, consisting of stormwater storage. A detailed description of the proposed development is included in Chapter 3 (The Proposed Development) of this EIAR, and a description of the construction methods is carried out in Chapter 4 (Construction Strategy).

The proximity of the sites to the river are shown in Figure 14-1.

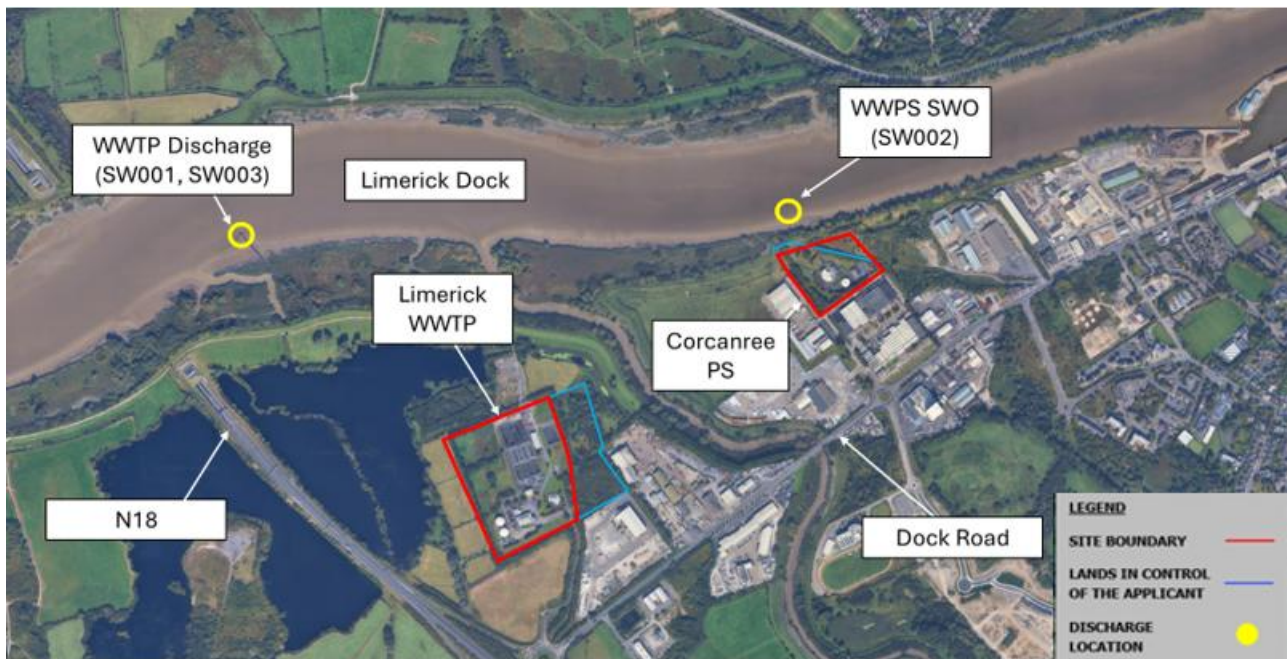


FIGURE 14-1 SITE LOCATION MAP

Decommissioning of the Proposed Development is not envisaged at this time. Given the scale of the existing infrastructure, it is anticipated that Uisce Éireann will continue phased development to salvage and re-use as much of the installed infrastructure as possible as the demand in Limerick grows. Consolidating additional infrastructure at this location is considered beneficial and will help minimise future capital investment. The proposed layouts are designed to optimise land take and preserve capacity for future expansion. On this basis, decommissioning has been screened out.

14.2 Methodology

The following section outlines the legislation and guidelines considered, and the adopted methodology for defining the baseline environments and undertaking the assessment in terms of land, soils and geology.

The potential impacts of the proposed scheme on land, soils and geology have been assessed by classifying the importance of the relevant existing attributes and quantifying the likely magnitude of any impact on these attributes.

14.2.1 Study Area

The primary assessment focuses on a study area of 250m beyond all the site boundaries for the Proposed Development, defined based on the potential zone of influence of works and the characteristics of the receiving environment. In addition, consideration was also given to factors such as general trafficability/access around the site.

14.2.2 Relevant Legislation, Policy and Guidelines

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

- Institute of Geologists of Ireland Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statement (IGI) 2013;
- Environmental Protection agency (EPA) Guidelines on Information to be contained in Environmental Impact Assessment Reports (hereafter referred to as the EPA Guidelines), EPA 2022; and
- Environmental Protection agency (EPA) Guidance on the Management of contaminated Land and Groundwater at EPA Licensed Sites, EPA 2013.

14.2.3 Appraisal Method for the Assessment of Impacts

The Impact assessment for this chapter has been carried out in accordance with the IGI guidelines (IGI 2013) and EPA EIAR guidelines (EPA 2022).

14.2.3.1 Baseline-Initial assessment

The existing land, soils, and geology conditions in the Study Area have been interpreted from review of existing data, consultation, and walkover survey.

This assessment includes the development of a preliminary Conceptual Site Model (CSM), which describes the ground conditions expected throughout the Study Area of the Proposed scheme based on existing literature. Also, as part of this initial assessment, the preliminary generic type of geological / hydrogeological environment is determined. The IGI Guidelines (IGI, 2013) provide five types of environments as examples (Types A to E, as described in Step 3 of the IGI Guidance).

14.2.3.2 Baseline-direct and indirect site investigations

Information gathered on the baseline environment during specific ground investigations for the Proposed Scheme corresponds to the second element of the methodology, 'Direct and Indirect Site Investigation and Studies'

As part of the second element, relevant site investigations and studies close to the Proposed Scheme are gathered and assessed. Then, the preliminary CSM is refined accordingly.

14.2.3.3 Gradation of impacts

The EPA, EIAR Guidelines (EPA 2022) and IGI guidelines (IGI 2013) provide criteria and examples for determining likely significant impacts/effects as outlined in Table 14-1 the guidance applied in this assessment is as follows:

- Baseline Characterisation (sensitivity/Importance)
- Criteria for Assessment of Effects: The magnitude of impacts is defined in accordance with Annex III of the EIA Directive
- Description of Effects and Determination of Significance
- Duration of Effects

The assessment adopts the significance terminology set out in the EPA EIAR Guidelines (EPA, 2022) and applies a structured, criteria-based approach to justify the assignment of impact significance. This approach does not rely on prescriptive intermediate steps, but instead integrates the following key components:

- Step 1: Identify and characterise the environment, including the importance of geological and soil features
- Step 2: Assess the magnitude of impact arising from the proposed development
- Step 3: Determine the significance of the impact by combining the importance and magnitude of impact
- Step 4: Estimate the duration of the impact

TABLE 14-1 RATING OF SIGNIFICANCE OF EFFECTS (EPA, 2022)

EFFECTS	DEFINITION
Quality of Effects	
Positive Effects	A change which improves the quality of the environment (e.g. increasing species diversity, improving ecosystem function, removing nuisances, improving amenities).
Neutral Effects	No effects or effects that are imperceptible, within normal bounds of variation or forecasting error
Negative/Adverse Effects	A change which reduces the quality of the environment (e.g. reduced biodiversity, damage to health/property, nuisance).
Significance of Effects	
Imperceptible	An effect capable of measurement without significant consequences
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends
Significant Effects	An effect which, by its character, magnitude, duration or intensity, alters a sensitive aspect of the environment
Very Significant	An effect which, by its character, magnitude, duration or intensity, significantly alters most of a sensitive aspect of the environment
Profound Effects	An effect which obliterates sensitive characteristics
Extent and Context of Effects	
Extent	The size of the area, the number of sites, or the proportion of a population affected by an effect.
Context	Whether the effect conforms to or contrasts with established baseline conditions (e.g. whether it is the largest, longest, or most intense effect).
Probability of Effects	
Likely Effects	Effects that can reasonably be expected to occur if mitigation measures are properly implemented.
Unlikely Effects	Effects that can reasonably be expected not to occur if mitigation measures are properly implemented.
Duration and Frequency of Effects	
Momentary Effects	Effects lasting from seconds to minutes.
Brief Effects	Effects lasting less than a day.
Temporary Effects	Effects lasting less than one year.
Short-term Effects	Effects lasting one to seven years.
Medium-term Effects	Effects lasting seven to fifteen years.
Long-term Effects	Effects lasting fifteen to sixty years.
Permanent Effects	Effects lasting over sixty years.
Reversible Effects	Effects that can be undone, for example through remediation or restoration.
Frequency of Effects	Describes how often the effect will occur (e.g. once, rarely, occasionally, frequently, constantly, or hourly, daily, weekly, monthly, annually).

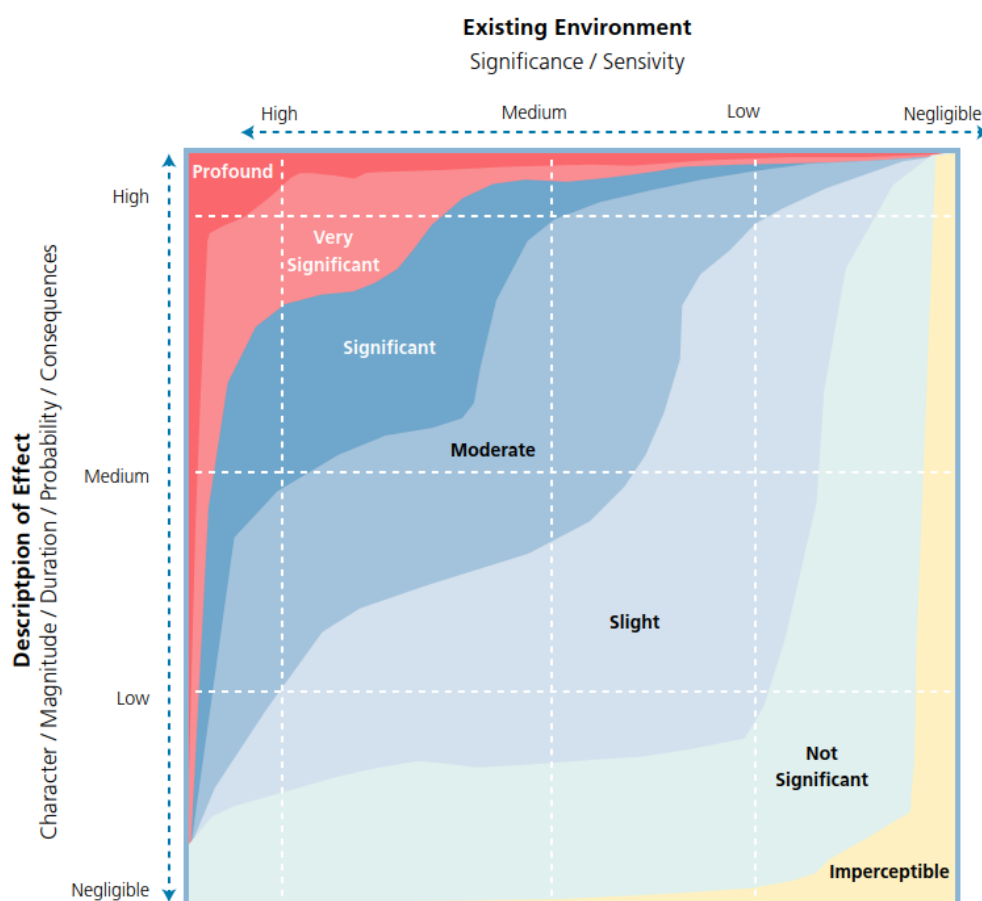


FIGURE 14-2 RATING OF SIGNIFICANCE (EPA, 2022)

14.2.4 Data Collection and Collation

Data was collated from publicly available datasets, the findings of ground investigations, design information, a scheme walkover survey, and other sources, as outlined below:

14.2.4.1 Publicly available datasets

The publicly available datasets listed in Table 14-2 have been acquired and consulted in the assessment of the baseline conditions. All datasets were accessed throughout 2025.

TABLE 14-2 PUBLICLY AVAILABLE DATASETS

Organisation	Database	Description	Link
GSI	Bedrock	Bedrock 100k: Bedrock geology map of Ireland at 1:100,000 scale.	https://www.gsi.ie/en-ie/data-and-maps/Pages/Bedrock.aspx#
	Quaternary	Quaternary Geomorphology: Mapping of Irish glacial geomorphological features at 1:50,000 scale; Quaternary Sediments: Mapping of all sediments within 1m of the surface, including those which were laid down during the Quaternary, bedrock at or close to the surface, and Made Ground.	https://www.gsi.ie/en-ie/data-and-maps/Pages/Quaternary.aspx

Organisation	Database	Description	Link
	Geohazards	Landslides Susceptibility Mapping: Systematic mapping of Ireland identifying areas predisposed to landslides and classifying susceptibility from low to high. Karst Features: Database of all known karst features in Ireland, including boreholes, caves, dry valleys, enclosed depressions, estavelles, springs, superficial solution features, swallow holes, and turloughs.	https://www.gsi.ie/en-ie/data-and-maps/Pages/Geohazards.aspx#
	Geological Heritage	Geological Heritage Sites Audited: Database of all audited geological heritage sites. Geological Heritage Sites Unaudited: Database of all unaudited geological heritage sites, including buffer zones around features.	https://www.gsi.ie/en-ie/data-and-maps/Pages/Geoheritage.aspx
	Geotechnical	External Geotechnical Boreholes and Site Investigations: Borehole logs and site investigation data submitted to the National Geotechnical Borehole Database.	https://www.gsi.ie/en-ie/data-and-maps/Pages/Geotechnical.aspx
	Topography	Open Topographic Viewer: Collection of published LiDAR Survey Data. Contains Irish Public Sector Data (Geological Survey Ireland & the Office of Public Works) licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=b0e763964070ad69bf8c1572c9f5
	Minerals	Mineral Localities: Database of mineral localities compiled from 6" geological maps, field investigations, exploration reports, and other sources. Quarry Directory: Comprehensive database of active quarries containing information such as quarry products, location, and contact details. Aggregate Potential Mapping: Mapping showing the potential for crushed rock, and sand and gravel aggregates, including an inventory of active and historical pits and quarries.	https://www.gsi.ie/en-ie/data-and-maps/Pages/Minerals.aspx

Organisation	Database	Description	Link
EPA	Industrial Emissions (IE) Facilities	Point dataset of IE-licensed facilities in Ireland, including those licensed, applied, surrendered, and others. The EPA is the competent authority for granting and enforcing these licenses for specified industrial and agricultural activities, as listed in the First Schedule of the Environmental Protection Agency Act 1992 as amended.	https://gis.epa.ie/geonetwork/srv/eng/catalog.search#/metadata/7905844c-a43d-4dd4-b262-c95c7aa0e9c7
	Integrated Pollution Control (IPC) facilities	Point dataset of IPC licensed facilities in Ireland, including those licensed, applied, surrendered, and others. The EPA is the competent authority for granting and enforcing these licenses for specified industrial and agricultural activities, as listed in the First Schedule of the Environmental Protection Agency Act 1992 as amended.	https://gis.epa.ie/geonetwork/srv/eng/catalog.search#/metadata/70e60147-0f3f-4ce5-9831-6787d016f439
	Integrated Pollution Prevention Control (IPPC) Facilities	Point dataset of IPPC licensed facilities in Ireland, including those licensed, applied, surrendered, and others. The EPA is the competent authority for granting and enforcing these licenses for specified industrial and agricultural activities, as listed in the First Schedule of the Environmental Protection Agency Act 1992 as amended.	https://gis.epa.ie/geonetwork/srv/eng/catalog.search#/metadata/7459f32a-afa0-470f-aae9-7eae49419740
	Licensed Waste Facilities	Point dataset of waste-licensed facilities in Ireland, including licensed, applied, surrendered, and others. The EPA is the competent authority for granting and enforcing these licenses. Facilities include landfills, transfer stations, hazardous waste disposal, and other significant waste disposal and recovery activities	https://gis.epa.ie/geonetwork/srv/eng/catalog.search#/metadata/00750a6a-e2f4-451d-b41c-0f067a40c94c
NPWS	Protected Sites	Mapping of protected sites, including Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Natural Heritage Areas (NHAs), and proposed National Heritage Areas (pNHAs).	https://experience.arcgis.com/experience/edf34d92e28040fd87d3d14f55d8d95f

14.2.4.2 Ground investigation

An intrusive ground investigation (GI) was employed as part of this project to examine the subsurface conditions and inform the Proposed Development design. The investigation comprised a combination of trial pits, cable percussion and rotary cored boreholes with in-situ tests (standard penetration test and hand shear vane) completed at specific depths. Groundwater levels were also monitored within boreholes where

encountered. The ground investigation was conducted in 2021, details of the ground investigation is included in Appendix 14.1 and 14.2 in Volume 4 of this EIAR and has been used to assess the site-specific conditions.

TABLE 14-3 PROJECT GROUND INVESTIGATION

Title	Contractor	Year	Scope
Limerick WWTP & RBC	Whiteford Geoservices Ltd	2021	Ground investigation information at the Limerick WWTP & RBC site.
Corcanree Pumping station		2021	Ground investigation information at the Corcanree site.

14.3 Consultation

Consultation undertaken in relation to the Proposed Development is outlined in Section 1.8 of Chapter 1 of this EIAR.

14.4 Baseline Environment

This section describes the existing conditions and important features in terms of the land, soils and geology within the study area of the Proposed Development. A description of site-specific baseline conditions of identified features and their importance ranked in accordance with the IGI guidelines (IGI, 2013).

14.4.1 Current Baseline Environment

This section describes the desk study on the current baseline environment and complies to characterise the receiving environment:

14.4.1.1 Regional Bedrock

The bedrock geology of the Proposed Development as classified by GSI 100k bedrock geology map. The Proposed Development is underlain by Visean Limestone. According to GSI bedrock geology, there are no structural features reported withing the study area. Summary of bedrock geology in Table 14-4 below.

TABLE 14-4 SUMMARY OF BEDROCK GEOLOGY AND IMPORTANCE

Formation	Description	Location	Importance	Justification for Importance rating
Visean Limestone	Pale grey to greyish-blue colour and is primarily composed of compressed marine sediments.	Widespread	Low	Widespread bedrock with no designated geological importance within the study area.

14.4.1.2 Regional Subsoils (GSI Quaternary Classification)

Quaternary sediments are the most recent deposited geological strata. According to the GSI quaternary map, the overburden consists of Estuarine silts and clay and Embankment (Made ground).

TABLE 14-5 SUMMARY OF QUATERNARY GEOLOGY AND IMPORTANCE

Soil type	Description	Location	Importance	Justification for importance rating
Estuarine silts and clays	Marine/Estuarine silts and clays	Widespread across the site	Low	Widespread and not designated; limited environmental and resource value within the study area.

Soil type	Description	Location	Importance	Justification for importance rating
Embankment (Made ground)	Embankment	Localised within the south eastern extent of Limerick WWTP & RBC study area.	Low	Previously disturbed material with no intrinsic geological or environmental value

14.4.1.3 Regional Karst

Karst is a type of geological features characterised by caves, caverns and other types of underground drainage resulting from dissolution of the underlying bedrock. A review GSI karst mapping does not identify any karst features within 2km of the Proposed Development alignment, and the underlying bedrock is susceptible to karstification. The closest Karst features identify are turlough which are seasonal lake approximately 2.6km south of the Proposed Development. The impact associated with karstification are not considered further in the assessment.

14.4.1.4 Regional Mineral/Aggregate Resources

The location of the Proposed Development is within the coastline of River Shannon. The GSI aggregate potential mapping has not identified any Mineral/aggregate resources within the Proposed Development. There are 2 No. quarries within a 15km radius and 9 quarries within a 30km radius.

The mining history of the Proposed Development accessed from the GSI interactive data portal, identified historic brick fields and pit within the study area.

14.4.1.5 Regional Geological Heritage

A review of GSI's geo-heritage mapping identifies two County geological sites (CGS) which are Mungret Quarry and the N18 Road cut at Ballykeefe which is outside the study area. They are approx. 500m and 300m from the study area respectively, the impact associated with geological heritage are not considered further in the assessment.

14.4.1.6 Regional environmentally sensitive sites

The National Parks and Wildlife Services (NPWS) is responsible for the designation of environmentally protected sites in Ireland and maintains a publicly available database of these sites. These sites include Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSACs), Special Protection Areas (SPAs), candidate Special Protection Areas (cSPAs) and Natural Heritage Areas (NHAs). In addition to these sites, the NPWS also maintains a database of proposed Natural Heritage Areas (pNHAs). There are two designated sites, the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA existing within the study area.

TABLE 14-6 SUMMARY OF SAC AND SPA PRESENT

Features	Description	Location	Importance	Justification for importance rating
SAC: Lower River Shannon	Major estuarine waterbody	Northern extent of the study area.	High	Critical ecological functions and key component for regional hydrology
SPA: River Shannon and River Fergus Estuaries	Major estuarine waterbody	Northern extent of the study area.	High	Critical ecological functions and key component for regional hydrology

14.4.1.7 Current and historic land use

The current and historic land use is discussed in order to give context to any potential changes to land, soils, and geology that have the potential to influence the importance of a feature and the magnitude of any impacts. The current land use is based on current aerial imagery and mapping available from Tailte Éireann, formerly Ordnance Survey Ireland (OSI), (Tailte Éireann, 2025), Google (Google, 2025), Bing (Bing, 2025) and the Corine Land Cover maps (EPA 2025). The historic land use is based on the following OSI (Tailte Éireann, 2025) historic aerial imagery and historic maps:

- Cassini 6 inch raster mapping (1830s – 1930s)
- Historic Map 6 inch Colour (1837 – 1842)
- Historic Map 6 inch Black and White (1837 – 1842)
- Historic Map 25 inch (1888 – 1913)
- Aerial Imagery (1995 – 2017)
- Corine land cover map

Historic mapping (OSI 6 Inch 1st Edition Maps, 1837-1842) indicates that the study area was pasture for agricultural use and brick pits/fields. CORINE 2018 land mapping data indicates the study area is underlain by artificial surfaces and coastal wetlands.

14.4.1.8 Ground conditions

Ground investigation has been completed at the study area for the Proposed Development by Whiteford Geoservices LTD. in May 2021 which consist of 5 No. trial pits, 6 No. cable percussion and 5 No. follow up rotary core boreholes and in September 2021 completed 2 No. Trial pits, 6 No. percussive boreholes and 4 No. rotary cored boreholes, presented in Figure 14.3 and Figure 14.4 in Volume 3 of this EIAR. An interpreted generalised stratigraphy based on the ground investigation is presented in the table below. The location of the exploratory holes is shown in the exploratory location plan and copies of exploratory logs attached to Appendix 14.1 and 14.2 in Volume 4 of this EIAR.

TABLE 14-7 GENERAL STRATIGRAPHY OF THE PROPOSED DEVELOPMENT

Stratum	Description	Depth to top of stratum (m bgl)	Thickness of stratum (m)
Topsoil (TS)	Topsoil	0.0	0.2
Made ground (MG)*	Made Ground	0.2	4.2
Glacial Deposit (SSC)	Soft Silt	0.2 – 1.7	8.2
Glacial Deposit (CGT)	Medium dense Gravel	6.8 – 8.4	1.7
Bedrock (RCK)	Limestone	9.5	-

* Concanree Pumping station

14.4.2 Evolution of the Environment in the Absence of the Proposed Development

In the Do-Nothing scenario, the Proposed Development would not be implemented, and the existing environmental conditions related to land, soils, and geology would remain unchanged. The existing site conditions would remain unchanged in the short term. However, continued operation may result in indirect negative long-term impacts on the surrounding land and soil environment such as increased risk of leakages, overflow or system failure due to ageing infrastructure leading to localised soil contamination and gradual deterioration of soil quality.

14.4.3 Summary of Features of Importance

The importance ranking of the features for the baseline conditions is summarised below in Table 14-8 below.

Features with an importance ranking of low are not considered any further as they will not result in a significant impact.

TABLE 14-8 SUMMARY OF LANDS, SOIL, AND GEOLOGY FEATURES

Feature	Description	Category	Location	Importance	Justification
Visean Limestone	Pale grey to greyish-blue colour and is primarily composed of compressed marine sediments.	Regional Bedrock	Widespread	Low	Widespread bedrock with no designated geological importance within the study area
Topsoil	Topsoil	Regional Subsoil (GSI Quaternary Classification)	Widespread across the site	Low	Topsoil is a non-renewable resource that supports vegetation and soil functions
Estuarine silts and clays	Marine/Estuarine silts and clays		Widespread across the site	Low	Widespread and not designated; limited environmental and resource value within the study area
Embankment (Made ground)	Embankment		Localised within the southeastern extent of Limerick WWTP & RBC study area.	Low	Previously disturbed material with no intrinsic geological or environmental value
Lower River Shannon and River Fergus Estuaries	Major estuarine waterbody	Regional Environmental Sensitive site	Northern extent of the study area.	High	Critical ecological functions and key component for regional hydrology
Quarries	Aggregate quarries	Economic Geology	9 Quarries within a 30km radius of the site	Low	Quarries are a use of natural resources

14.4.4 Conceptual Site Model

A conceptual Site Model (CSM) has been developed for the proposed project based on ground investigation data and all publicly available data. It is a representation of the characteristics of the site, it shows the possible relationship between sources, pathways and receptors. The proposed scheme is predominantly underlain by very soft – soft cohesive glacial deposit over granular glacial till over limestone bedrock. The relevant sub-section of the proposed scheme is presented in Table 14-9.

TABLE 14-9 CONCEPTUAL SITE MODEL

Subsection	Size (m)	Dominant Earthwork Type	Foundation type	Expected ground conditions	Range of Depth (m bgl)	Additional notes
Limerick WWTP & RBC	335 X 260	Deep	Piles	Topsoil overlying Made ground overlying Soft Glacial Till and Medium dense Granular Glacial Till overlying Medium strong to strong fine grained Limestone Bedrock (Visean Limestone formation) Groundwater strikes recorded from 1.00 to 10.0 m bgl	Topsoil: 0.0 – 0.2 Made ground*: 0.2 – 4.5 SSC: 0.2 – 9.8 GGT: 6 – 9.8 RCK: >9.5	Existing structures within site boundary
Corcanree Pumping Station	122 X 167	Deep	Piles	Topsoil overlying Made ground overlying Soft Glacial Till and Medium dense Granular Glacial Till (Gravel) overlying Medium strong to strong fine grained Limestone Bedrock (Visean Limestone formation) Groundwater strikes recorded from 3.50 to 6.5 m bgl	Topsoil: 0.0 – 0.2 Made ground: 0.2 – 4.9 SSC**: 4.9 – 5.9 GGT: 5.9 – 7.4 RCK: >7.4	Existing structures within site boundary

*Localised and close to existing structures

**top of strata varies across the site

14.4.5 Environment Type

The environment across the study area has been categorised in accordance with the IGI Guideline (IGI, 2013).

The study area has been classified as a Type A environment which corresponds to a passive geological environment, examples include areas of thick low permeability subsoils and historically stable geological environments.

14.5 Potential Impacts

This section identifies and assesses the likely significant effects that may occur due to the Proposed Scheme on land, soils and geology, in the absence of mitigation. This informs the need for mitigation or monitoring to be proposed.

14.5.1 Construction Phase

The potential land, soils, and geological impact during the Construction Phase for the relevant construction activities described are presented in this Section, along with their impact significance. These potential impacts also relate and interact with other environmental factors which are described within the EIAR. The Proposed Development could have the following impacts on land, soils and geology:

- Loss of or damage to Topsoil
- Construction of structures
- Pollution from construction activities,
- Piling activities
- Impact of Dewatering
- Groundwater contamination

Though the magnitude of the impact may vary depending on the scale of activities and location of the Proposed Development relative to the impacted important feature, in order to ensure a robust assessment, only the maximum magnitude or worst case of the impact of the Proposed Development is considered.

14.5.1.1 Loss of and damage to Topsoil

Topsoil is a non-renewable resource which if removed or damaged can result in a permanent negative impact. The potential impact arises from stripping, trafficking of plant, erosion, laying of hardstanding surfaces and storage of materials in areas not intended to be paved as part of the Proposed Development.

The scale of this impact is reflected in the estimated volume of topsoil to be stripped, approximately 17,490m³, derived from preliminary earthworks quantities (Chapter 17 – Resource and Waste Management).

The quality of effects is negative/adverse effect, significance of effect is not significant, the extent is contained within the site, the duration is permanent and the probability is likely. Therefore, the impact on topsoil is considered slight negative localised and long-term.

14.5.1.2 Construction of structures

The Proposed Development will include the construction of new stormwater storage and upgrade to the existing WWTP. Construction of these structures will require excavation of topsoil and subsoil down to the proposed foundation level. Construction of these structures will also require the importation of a small volume of engineering fill and concrete. The impact on economic geology is considered to be negative, imperceptible, of permanent duration and likely to occur, resulting in a negligible impact.

Where excavation to suitable formation levels is not feasible, piled foundations will be adopted.

The potential impact is the excavation and permanent removal of the soil and alteration of the ground profile within the development footprint. The works will involve the excavation of approximately 31,480m³ of subsoils and 17,490m³ of topsoil, creating significant volumes of material requiring management.

Due to the presence of widespread soft estuarine deposits, a significant proportion of excavated material is anticipated to be unsuitable for reuse without treatment, requiring off-site removal to appropriately licensed facilities and replacement with engineered fill. The excavation and handling of materials will be managed in accordance with the waste hierarchy, as detailed in Chapter 17 (Resource and Waste Management).

The excavation and handling of materials may also result in localised disturbance of soils and potential mobilisation of fine sediments via surface runoff where soils are exposed.

The quality of effect is negative/adverse, significance of effect is not significant, the extent is contained within the footprint, the duration is permanent. Therefore, the impact during construction of structures is considered slight negative localised and short term.

14.5.1.3 Pollution from construction activities

The potential impact is the localised contamination of soils and subsoils arising from construction activities, including the accidental release of fuels, oils or concrete washout. This exposure may result in localised contamination of material through infiltration or surface run-off into site drainage pathways, resulting localised contamination.

The quality of effect is negative/adverse, significance of effect is moderate, the extent is localised, the duration is temporary and the probability is unlikely to occur. The impact is considered slight negative localised and short-term.

14.5.1.4 Piling activities

Piling will be undertaken in areas where excavation to suitable bearing strata is not feasible and will primarily support structures such as the tanks and process infrastructure.

Piling activities will result in localised disturbance and displacement of soils within the pile footprint and may generate ground vibrations, particularly in soft cohesive soils. Where not properly controlled, piling may also create preferential pathways for groundwater movement.

The quality of effect is negative/adverse, significance of effect is not significant, the extent is localised, the duration is temporary within the pile footprint and the probability is unlikely, resulting in a slight negative short-term effect.

14.5.1.5 Impact of Dewatering

The potential impact is the localised alteration of groundwater levels due to dewatering activities, associated with excavation works. This may result in temporary changes to soil moisture conditions, leading to minor consolidation or settlement within the immediate vicinity of excavations.

The quality of effect is negative/adverse, significance of effect is not significant, the extent is localised, the duration is temporary and the probability is likely, resulting in a slight negative short-term effect.

14.5.1.6 Groundwater contamination

The potential impact is the localised contamination of groundwater arising from construction activities, including the accidental release of fuels, oils, or concrete washout, which may infiltrate to underlying groundwater or transported via surface runoff to drainage pathways, potentially affecting groundwater quality.

The quality of effect is negative/adverse, significance of effect is not significant, the extent is localised, the duration is temporary and the probability is unlikely, resulting in a slight negative short-term effect.

TABLE 14-10 SUMMARY OF PREDICTED CONSTRUCTION PHASE IMPACTS (EPA 2022 ALIGNED)

Potential Impact	Location/Extent	Duration	Quality of Effect	Likelihood	Effect
Loss or damage of Topsoil	Contained within the site	Permanent	Negative (Adverse)	Likely	Slight Negative
Construction of structures	Localised	Permanent	Negative (Adverse)	Likely	Slight Negative
	At the 9 quarries local to the site	Permanent	Negative (Adverse)	Likely	Imperceptible
Pollution from construction activities,	Localised	Temporary	Negative (Adverse)	Unlikely	Slight Negative
Piling activities	Localised	Permanent	Negative (Adverse)	Likely	Slight Negative
Impact of Dewatering	Localised	Temporary	Negative (Adverse)	Likely	Slight Negative
Groundwater contamination	Localised	Temporary	Negative (Adverse)	Unlikely	Slight Negative

14.5.2 Operational Phase

The operational phase has the potential to result in occasional accidental leakage of chemicals used in the treatment process, which could lead to localised contamination of soils and subsoils. While the likelihood of such spillages may increase compared to the "Do Nothing" scenario due to ongoing handling and storage activities, the magnitude of any potential impact is considered negligible, given the proposed containment, bunding, and drainage control measures ingrained in the project design. Consequently, the significance of the impact on land, soils, and geology is assessed as imperceptible.

14.6 Mitigation Measures

Undertaking appropriate mitigation and monitoring measures will minimise the potential impacts discussed in section 14.5. The recommended mitigation measures are based on the currently available information. The results of the ground investigation are sufficient to assess the nature of in-situ.

14.6.1 Construction Phase

The mitigation measures for the construction phase are outlined in this section. The proposed construction shall comply with the requirements of statutory bodies (Building Control Amendment Regulations, Health Service Executive inspections, Uisce Éireann and Health Safety Authority (HSA) inspections.

14.6.1.1 Loss or damage of topsoil

Topsoil will be stripped and stored separately from subsoil by the appointed contractor using appropriate methods. Stockpiles will be kept at $\leq 3\text{m}$, located away from drainage pathways, and managed to minimise the effects of degradation and erosion.

Stripped topsoil will be reused on site for reinstatement and landscaping purposes, thereby reducing the need for off-site disposal. All topsoil will be appropriately handled, stored and reinstated to maintain its structure and quality. Where practical, the removal of topsoil from the Proposed Development will be avoided.

14.6.1.2 Construction of Structures

During construction of structures, including foundation excavation works, the extent of excavation will be the limited to the structure footprints to minimise disturbance to surrounding soils and subsoils.

Excavation works will be controlled and sequenced to prevent over excavation and unnecessary exposure of founding strata. Where deep excavation is required, temporary or permanent lateral support (sheet piles or cofferdams) will be implemented to maintain ground stability and prevent collapse or lateral movement of soils as outlined in Chapter 4 (Construction Strategy). Soft ground removal will be limited to the minimum depth required to achieve suitable formation levels.

Construction plant and equipment will operate within designated working areas only, with clearly defined haul routes to avoid compaction of adjacent soils outside the construction footprint.

Where dewatering is required, physical cut-off barriers and controlled pumping stations will be used to limit groundwater ingress, avoiding softening of founding strata and all pumped water will be treated prior to discharge.

Excavated materials will be stockpiled in a designated temporary stable area, a substantial proportion of excavated materials is anticipated to be unsuitable for reuse, requiring off-site disposal as outline in Chapter 17 (Resources and Waste Management), while suitable materials for reuse will be reinstated after the appropriate test are carried. Erosion and sediment control measures will be implemented to prevent mobilisation of fine materials from exposed or stockpiled soils. An Environmental Clerk of Works will oversee implementation of these measures, supported by regular site inspections.

14.6.1.3 Pollution from construction activities

All fuels, oils and chemicals will be stored in designated bunded areas, located away from drainage pathways and watercourses. Refuelling and maintenance activities will be undertaken in designated areas equipped with spill kits, and plant will be regularly inspected to prevent leaks. Concrete and cement washout will be contained and managed to prevent discharge to soils or groundwater. An Environmental Clerk of Works (ECoW) will oversee implementation of all prevention measures, and works will be carried out in accordance with the Construction Environmental Management Plan (CEMP), including emergency spill response procedures.

14.6.1.4 Piling activities

Piling works will be undertaken in accordance with the best practice geotechnical and environmental guidance to minimise disturbance to soils, subsoils and groundwater. Piling works will be undertaken using Continuous Flight Auger (CFA) piling, as outlined in Chapter 4 (Construction Strategy), which is a low-vibration and low-displacement technique suitable for the prevailing soft ground conditions.

To prevent the formation of preferential pathways for groundwater movement; piling will be undertaken using the continuous flight auger method, whereby the auger is continuously drilled to the required depth and concrete is pumped through the hollow of the auger as it is being withdrawn, thereby maintaining support to the surrounding soils and ensuring that the bored holes are not left open. All piling activities will be supervised by suitably qualified personnel to ensure compliance with specifications and protocols.

14.6.1.5 Dewatering

Dewatering works will be controlled and limited in extent and duration to minimise localised groundwater drawdown and associated effects on surrounding soils. Physical cut-off barriers (sheet piles or cofferdams) and controlled pumping system will be implemented to minimise groundwater ingress and softening of founding strata.

All abstracted water will be treated through lined sumps and settlement ponds, along with any other treatment required by the governing bodies before discharge to the Lower River Shannon. Monitoring of water discharge will be completed to ensure compliance.

14.6.1.6 Groundwater contamination

Control measures to prevent groundwater contamination will include the implementation of standard construction management and pollution control measures. All fuels, oils and chemicals will be stored in bunded areas, the use of designated refuelling areas with spill kits, and the implementation of spill response

procedures. All surface water and dewatering activities will be contained and treated as necessary prior to discharge, and no direct discharge of untreated water to ground will be permitted.

These measures will prevent the infiltration of contaminants into soils and groundwater, thereby minimising the potential for groundwater contamination.

14.6.2 Operational Phase

The Proposed Development has been designed to a high engineering and environmental standard, embedding mitigation measures that minimise the potential for impacts on land, soils and geology.

The development includes a high standard surface water management system designed to ensure that surface water is collected, controlled and managed, preventing uncontrolled infiltration and mobilisation of contaminants to soils and subsoils.

With the implementation of the proposed structures design measures, no additional measures for land, soils and geology are considered necessary during the operation of the Proposed Development.

In the operational phase, the infrastructure will be maintained by Uisce Éireann and will be subject to their management procedures as well as compliance with EPA standards, to ensure that the correct measures are taken in the event of any accidental spillages. This will reduce the potential for any impacts.

14.7 Residual Impacts

The residual effects are the final predicted or intended effects that occur after the proposed mitigation measures have been implemented to avoid or reduce adverse impacts.

14.7.1 Construction Phase

Effective implementation of the outlined mitigation measures, including proper handling of excavated materials, piling, pollution prevention protocols, erosion and sediment control and appropriate dewatering management, will reduce potential impacts on the land, soil and geology in the construction phase of the Proposed Development.

Residual impacts will be localised and generally slight in nature, with no significant long-term alteration of soils or geological conditions are anticipated. Localised and temporary disturbance of soils will occur within the construction footprint; however, these effects will be managed and minimised through the implementation of the proposed mitigation measures.

Ground settlement, horizontal movement and vibration monitoring will be implemented during the works to ensure that construction activities do not exceed the design limitation of nearby existing wastewater treatment infrastructure.

14.7.2 Operational Phase

During operation, with chemical storage, spill prevention procedures, monitoring and drainage containment systems in place, the potential for accidental chemical leakage to cause contamination of soils or geology will be negligible. As a result, the residual operational impact on land, soils and geology is assessed as imperceptible.

TABLE 14-11 SUMMARY OF RESIDUAL IMPACTS

Impact	Residual Effect (Significance)
Loss of and damage to topsoil	Slight (Not Significant)
Construction of structures	Slight (Not Significant)
Pollution from construction activities	Imperceptible (Not Significant)
Piling activities	Slight (Not Significant)

Impact	Residual Effect (Significance)
Dewatering activities	Imperceptible (Not Significant)
Groundwater contamination	Imperceptible (Not Significant)
Operation of WWTP and associated infrastructure	Imperceptible (Not Significant)

14.8 Cumulative Impacts and Interactions

Given the localised nature of the works and the proposed mitigation measures, no significant cumulative impacts on land, soils, or geology are anticipated. While other construction projects may occur in the wider Limerick area during the same timeframe, the scale and confined footprint of the Proposed Development, together with pollution prevention and soil management measures, will ensure that any cumulative effects on soil quality or geological integrity remain negligible. Potential interactions exist between land, soils, and geology impacts and other environmental receptors, particularly surface water, groundwater, and ecology. Contaminant mobilisation, sediment-laden runoff, or accidental spillages have the potential to affect water quality, which in turn could impact aquatic habitats. However, with effective erosion control, dewatering management, and containment measures in place, these interactions are expected to result in no significant residual effects and further discussed in Chapter 21 (Cumulative Impacts and Interactions).

14.9 Difficulties encountered in Compiling Information

There were no difficulties encountered in compiling the information for this chapter.

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