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8 Hydrology & Hydrogeology

8.1 Introduction

This chapter comprises an assessment of the hydrological and hydrogeological environment (collectively known as the water environment) within the site and the surrounding environs. The potential effects posed by the construction and operational phases of the Proposed Development are investigated, and suitable mitigation measures are recommended to minimise effects on the local water receptors.

In terms of Environmental Impact Assessment (EIA):

- "Hydrology" is the study of surface water features.
- "Hydrogeology" is the study of groundwater features.

The objectives of this chapter are.

- To provide a baseline assessment of the receiving water environment in terms of surface water (hydrological) and groundwater (hydrogeological) receptors.
- To identify any potential negative effects 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 effects posed by the Proposed Development.

8.2 Consultation

ORS have been commissioned to assess the potential impacts of the Proposed Development in terms of hydrology 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:**
  Bianca Severgnini – B.Eng. (Hons) (Environmental). Current Role: Environmental Consultant. Experience *ca*. 3 years.

- **Project Scientist & Reviewer:**
  Luke Martin – B.A. (MOD) (Natural Sciences), M.Sc. (Sustainable Energy and Green Technology), CEnv, MIEnvSc. Current Role: Chartered Environmental Consultant. Experience *ca.* 12 years.

- **Project Coordinator & Reviewer:**
  Oisín Doherty – B.Sc. (Geography with Environmental Science), MSc. (Environmental Management), CEnv, MIEnvSc. Current Role: Chartered Environmental Consultant. Experience *ca.* 14 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 hydrology and hydrogeology.

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8.3 Assessment Methodology & Significance Criteria

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*.
- 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*.
- NRA, (2008). *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*.
- CIRIA, (2001). C532 - *Control of Water Pollution from Construction Sites – Guidance for consultants and contractors*.

8.3.1 Desktop Study

A desk-based assessment method was used to assess baseline water quality for the receiving environment of the Proposed Development. The baseline information that is detailed in this section of the assessment was obtained from publicly available information.

The following documents and sources were referenced:

- Aquifer classification and vulnerability identification from the Geological Survey of Ireland (GSI web page).
- Search of GSI and Wicklow County Council files to determine the location of groundwater wells within a 2km radius.
- 1:50,000 Discovery Series Maps and 6” maps (Geohive).
- Water Quality in Ireland 2010-2015 (EPA).
- Water Quality in Ireland 2013-2018 (EPA).
- Water Action Plan 2024: A River Basin Management Plan for Ireland.
- Meteorological data from Met Eireann and hydrometric data from the Office of Public Works (OPW).
- Wicklow County Development Plan 2022 – 2028.
- Reports, maps and data published by the Geological Survey of Ireland (GSI) and the National Soil Survey of Ireland.
- General Soil Map of Ireland 2nd Edition, (1980), The National Soil Survey, An Fóras Taluntais.
- An Foras Talúntais (1980). Soil associations of Ireland and their land use potential. Reports, maps and data published by the Environmental Protection Agency (EPA).
- UK CIRIA report C552 (2001). (Contaminated Land Risk Assessment: A Guide to Good Practice.
- IFI (2016), Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Watercourses.
- OPW and DoEHLG (2009), The Planning System and Flood Risk Management - Guidelines for Planning Authorities.
- EPA (2022), River Quality Surveys: Biological - Hydrometric Area 10.
- Möller, K., & Müller, T. (2012). Effects of anaerobic digestion on digestate nutrient availability and crop growth: a review. Engineering in Life Sciences, 12(3), 242-257.

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The following technical reports completed in support of the planning application for the Proposed Development were also consulted to further assess baseline water quality.

- Civil Engineering Design Report
- Site Specific Flood Risk Assessment
- Site Suitability Assessment for onsite domestic wastewater treatment system

8.3.2 Field Survey

Fieldwork commissioned October 2024 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 3rd of October 2024 to identify hydrological features on site including:

- Drainage patterns and distribution
- Exposures
- Drainage Infrastructure
- Wet ground

8.3.3 Impact Assessment Methodology

Chapter 1: Introduction of the EIAR outlines the impact assessment rationale applied to each chapter of the study. This section describes some further criteria applied to the assessment of hydrological and hydrogeological receptors.

Risk Appraisal Methodology

The Conceptual Site Model (CSM) identifies potential contaminants, receptors and exposure pathways that may be present during the construction and operational phases of the Proposed Development. The identification of potential "contaminant linkages" is a key aspect of the evaluation of potentially contaminated land. An approach based on this methodology has been adopted within this report. For each of the contaminant linkages, an estimate is made of:

- The potential severity of the risk.
- The likelihood of the risk occurring.

Hydrological and Hydrogeological Receptor Criteria

The level of sensitivity of hydrological and hydrogeological receptors are based on a number of factors which are summarised in **Table 8.1** overleaf.

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Table 8.1: Criteria for rating importance of hydrological and hydrogeological attributes (NRA, 2008)

Importance	Criteria	Receptors	
		Hydrological	Hydrogeological
Extreme	Attribute has a high quality or value on an international scale	River, wetland, or surface water body ecosystem protected by EU legislation	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation – NHA status. Regionally important potable water source supplying >2500 homes. Quality Class A (Biotic Index Q4, Q5) Flood plain protecting more than 50 residential or commercial properties from flooding. Nationally important amenity site for wide range of leisure activities.	Regionally Important Aquifer with multiple wellfields Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – NHA status Regionally important potable water source supplying >2500 homes Inner source protection area for regionally important water source
High	Attribute has a high quality or value on a local scale	Locally important potable water source supplying >1000 homes Quality Class B (Biotic Index Q3-4) Flood plain protecting between 5 and 50 residential or commercial properties from flooding Locally important amenity site for wide range of leisure activities	Regionally Important Aquifer Groundwater provides large proportion of baseflow to local rivers Locally important potable water source supplying >1000 homes. Outer source protection area for regionally important water source Inner source protection area for locally important water source
Medium	Attribute has a medium quality or value on a local scale	Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2-3) Flood plain protecting between 1 and 5 residential or commercial properties from flooding	Locally Important Aquifer Potable water source supplying >50 homes Outer source protection area for locally important water source
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities Local potable water source supplying <50 homes Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding	Poor Bedrock Aquifer Potable water source supplying <50 homes

River Water Quality Assessment Criteria

Under the Water Framework Directive and SI 722 of 2003 European Communities (Water Policy) Regulations, the EPA carries out water quality assessments of rivers, transitional and coastal water bodies as part of a nationwide monitoring programme. Data is collected from physico-chemical and biological surveys, sampling both river water and the benthic substrate (sediment). **Table 8.2** overleaf summarises the quality classes used to assess the condition of rivers throughout the country.

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Table 8.2: Biotic Indices Classification for River Water Quality

Biotic Indices	Community Diversity	Quality	Condition	Quality Status	Quality Class
Q5	High	Good	Satisfactory	Unpolluted	Class A
Q4	Reduced	Fair	Satisfactory	Slightly Polluted - Unpolluted	Class B-A
Q3	Low	Doubtful	Unsatisfactory	Moderately – Slightly Polluted	Class C-B
Q2	Very Low	Poor	Unsatisfactory	Seriously – Moderately Polluted	Class C-D
Q1	Little/None	Bad	Unsatisfactory	Seriously Polluted	Class D

'Biotic Indices' or Quality (Q) Values are indicative of specified groups of macro-invertebrates' sensitivity to pollution. Q-Values are assigned to a waterbody based on the presence or absence of particular species with the Q5 biotic index indicating the least polluted waters and the Q1 biotic index indicating the most polluted waters.

'Quality Class' relates to the potential beneficial use of a water body as summarised in **Table 8.3**.

Table 8.3: Quality Class Descriptions

Quality Class	Description	BOD (mg/l)	Orthophosphate (mg/l)	Dissolved Oxygen (% Sat)
A	Highest water quality with very high amenity value Suitable for abstraction Suitable for game fisheries	<3	~0.015	~100%
B	Variable water quality with considerable amenity value Potential abstraction issues Game fish 'At Risk'	Occasionally exceeds 3mg/l	~0.045	<80% or >120%
C	Doubtful Water Quality with reduced amenity value Advanced Treatment of abstracted water required Coarse fisheries – Fish kills likely	Regularly Exceeds 3mg/l	~0.070	v. unstable
D	Poor to bad water quality with no amenity value Low grade & limited abstraction Fish absent	Levels regularly far in exceedance of 3mg/l	>0.1	Low, approaching 0%

Groundwater Vulnerability Assessment Criteria

Groundwater Vulnerability is a term used to represent the intrinsic geological and hydro geological characteristics that determine the ease with which groundwater may be contaminated by human activities. It is usually dependent on the nature (sandy, gravely, clay, etc.,) and depth of soil/subsoil overlying an aquifer (i.e., its shallowness). The travel time, attenuation capacity of the subsoils (i.e., ability to filter contaminants) and the nature of the contaminants are also important elements in determining the vulnerability of groundwater.

In the context of groundwater protection, Groundwater Vulnerability is the most important factor in determining control measures in areas where potentially hazardous discharge to groundwater might take place. This is because the type, permeability and thickness of the soil and subsoil play a critical role in preventing groundwater contamination by acting as a protecting filtering layer over the groundwater.

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The extent of site investigation works required to accurately assess the groundwater vulnerability at a site is determined by the sensitivity of hydrogeological receptors within the site vicinity. The extent of sampling requirements as defined by the hydrogeological sensitivity of the site is defined in **Table 8.4**.

Table 8.4: Summary of Sampling Requirements

Ground Water Protection Scheme (GWPS) exists	**Vulnerability**	**Sampling Requirements**
	LOW	Simple walkover survey to confirm what has been established in the GWPS, i.e., no evidence of outcrop, depth to bedrock information from wells, etc.[1] If walkover survey indicates that the lands do not have sufficient thickness of subsoil (i.e. rock outcrops) then site specific information may be required.
	MEDIUM	
	HIGH	
	EXTREME[2]	Regionally Important Aquifers - Prove that 2m depth of soil/subsoil cover exists. Minimum of 1 data point per hectare is required.
		Locally Important and Poor Aquifers – Prove that 1m depth of soil/subsoil cover exists. Minimum of 1 data point per 5 hectares is required.
Ground Water Protection Scheme (GWPS) does not exist	**Aquifer Type**	**Sampling Requirements**
	Locally Important / Poor Aquifers	Prove that 1m depth of soil/subsoil cover exists. Minimum of 1 data point per 5 hectares is required. Site investigation points can be based on existing information. New information only required where existing information is insufficient.
	Regionally Important Aquifers	Prove that 2m depth of soil/subsoil cover exists. Minimum of 1 data point per hectare is required. Site investigation points can be based on existing information. New information only required where existing information is insufficient.
Source Protection Areas[3]	**Source Protection Zone**	**Sampling Requirements**
	Outer	A minimum thickness of 3m of subsoil should be demonstrated at a minimum depth to rock data point frequency of one point per hectare.
	Inner	It is not generally acceptable to land-spread unless there is no alternative area available, and that the area has been defined as having moderate vulnerability (i.e. > 10m of moderate permeability subsoil or > 5m of low permeability subsoil) overlying the aquifer. The depth to rock should be demonstrated at a minimum frequency of one point per hectare.

[1] The classification to Low / Medium / High class as part of GWPS indicates that minimum of 3m soil/subsoil depth can be anticipated
[2] To give a rough picture of “extreme vulnerability” areas we can use: GSI Outcrop data & Teagasc Shallow Rock data
[3] In general land-spreading of organic wastes should not be carried out within the source protection area (SPA) of a water supply. However, there are cases where if the subsoil is sufficiently thick it may be deemed acceptable subject to conditions

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8.4 Description of the Receiving Environment

8.4.1 Background

This section of the chapter provides the baseline information in relation to geology, hydrogeology and hydrology that exists in the vicinity of the Proposed Development.

The Proposed Development site is located in the townland of Moneylane, Arklow, Co. Wicklow. approximately 1.9km southwest of the town of Arklow, Co. Wicklow and approximately 23km southwest of Wicklow town Co. Wicklow. The approximate grid reference location for the centre of the site is T 22154 72252, ITM: 722094, 672281. The total site area measures *ca*. 4.02 ha. The site is currently used as agricultural pastureland and bounded to the north, south, east, and west by further agricultural pastureland. An operational farm is located on the opposite side of the road to the site to the south. The Rooaun 10 Stream runs underground in the field adjacent to the proposed site northeast boundary and emerges through a pipe into the Moneylane 10 Stream (both streams have reference EPA name: BALLYDUFF STREAM (WICKLOW)_010).

The underlying geology has a major influence on topographical, hydrogeological and hydrological features within the site vicinity, hence this chapter is closely linked to the previous chapter (**Chapter 7 – Soils & Geology**).

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

- Topography
- Drift (Quaternary) Geology
- Bedrock Geology
- Hydrology
- Hydrogeology

8.4.2 Topography

County Wicklow's topography features a contrast between its mountainous interior and its lower-lying coastal areas. The National Park and the Wicklow Mountain range dominate the County, with peaks rising to 925 meters, such as Lugnaquilla. These mountains exhibit glacial geomorphology, including U-shaped valleys, cirques, and moraines, giving way to a gently sloping coastal plain to the east. Apart from a narrow coastal strip and some low ground in the south, over two thirds of the County lie above the 200-metre contour. The county's river systems, including the Avonmore, Avoca, and Slaney, carve deep, fertile valleys through the terrain, supporting a mix of heathland, bogs, forests, and farmland.

As part of the Wicklow County Development Plan 2016–2022, a Landscape Assessment identified 15 distinctive landscape categories organised into a hierarchy, ranging from Mountain and Lakeshore AONB (1) to Urban Area (6). This assessment has not been updated in the Wicklow CDP 2022–2028, as it continues to accurately reflect the county's landscape character zones.

The site is located in a Corridor Area, more specifically the N11 Corridor as shown **Figure 8.1**. This category ranks 4th in the hierarchy, indicating medium vulnerability. Corridor Areas include lands influenced by the N11 and N81 roadways characterised by low-lying, easily developable terrain. These areas serve as vital connections between the major towns along the county's

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east coast.

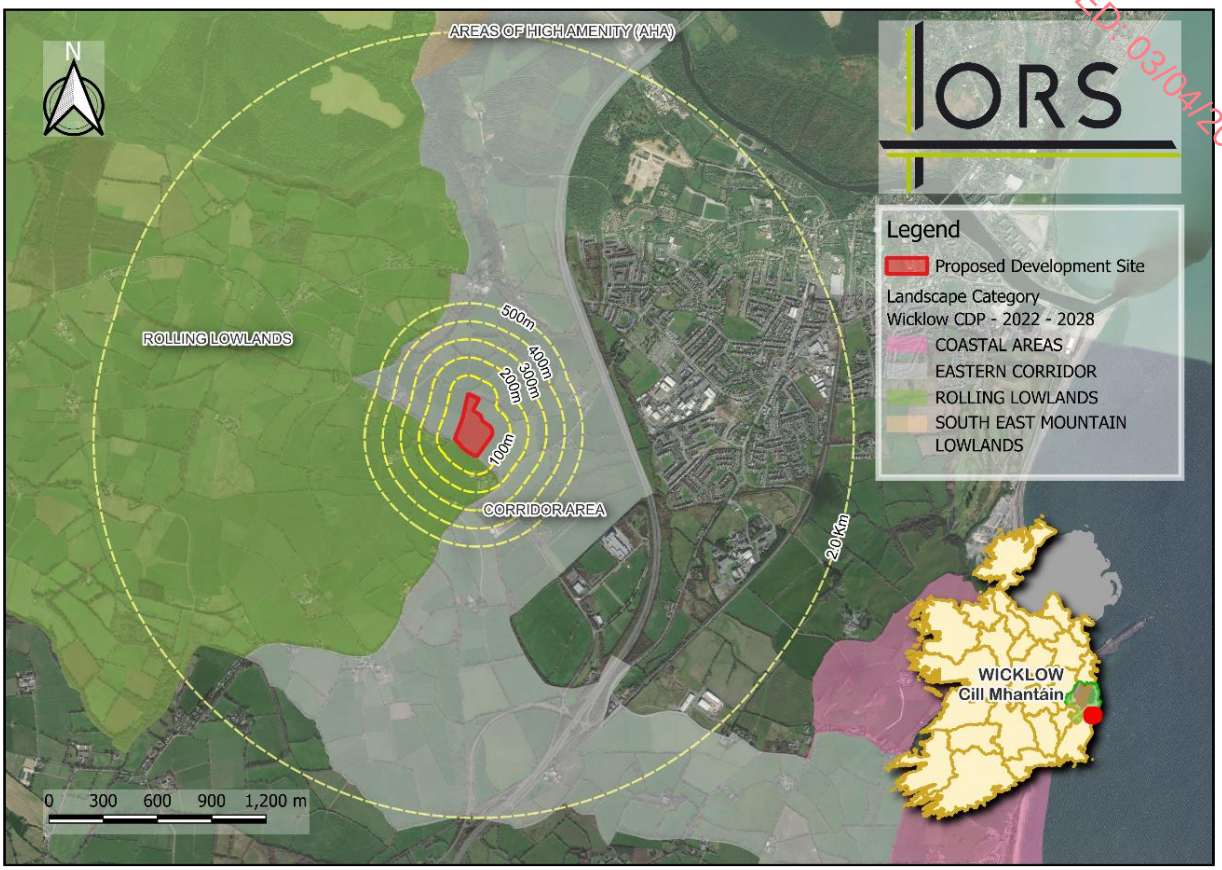

Figure 8.1: Proposed site location over County Wicklow Landscape categories.

Adjacent to the south lies the Rolling Lowlands landscape setting, a region characterised by gently rolling and undulating countryside that is relatively low-lying compared to the surrounding terrain in County Wicklow. Within a 2.0 km radius of the site, there is a small portion of the Area of High Amenity (AHA) known as the South East Mountain Lowlands, *ca.* 1.7 km to the north. Additionally, *ca.* 780 m to the east, lies the urban area of Arklow Town and its environs, which is classified as a 'settlement' in the County's settlement hierarchy.

The proposed site, as shown on the elevation map (see **Figure 8.2**), is located in a low-lying area, consistent with the County Landscape Assessment. To the west, the terrain rises steeply, transitioning into upland terrain with prominent features such as Croghan Kinsella (606 m), part of a mountainous region. Northward, the landscape is shaped by rivers and gentle slopes forming a valley system, while to the east, the land flattens considerably near the coastline. The site itself lies at an intermediate elevation, acting as a transitional zone between the hilly

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uplands to the west and the coastal plains to the east.

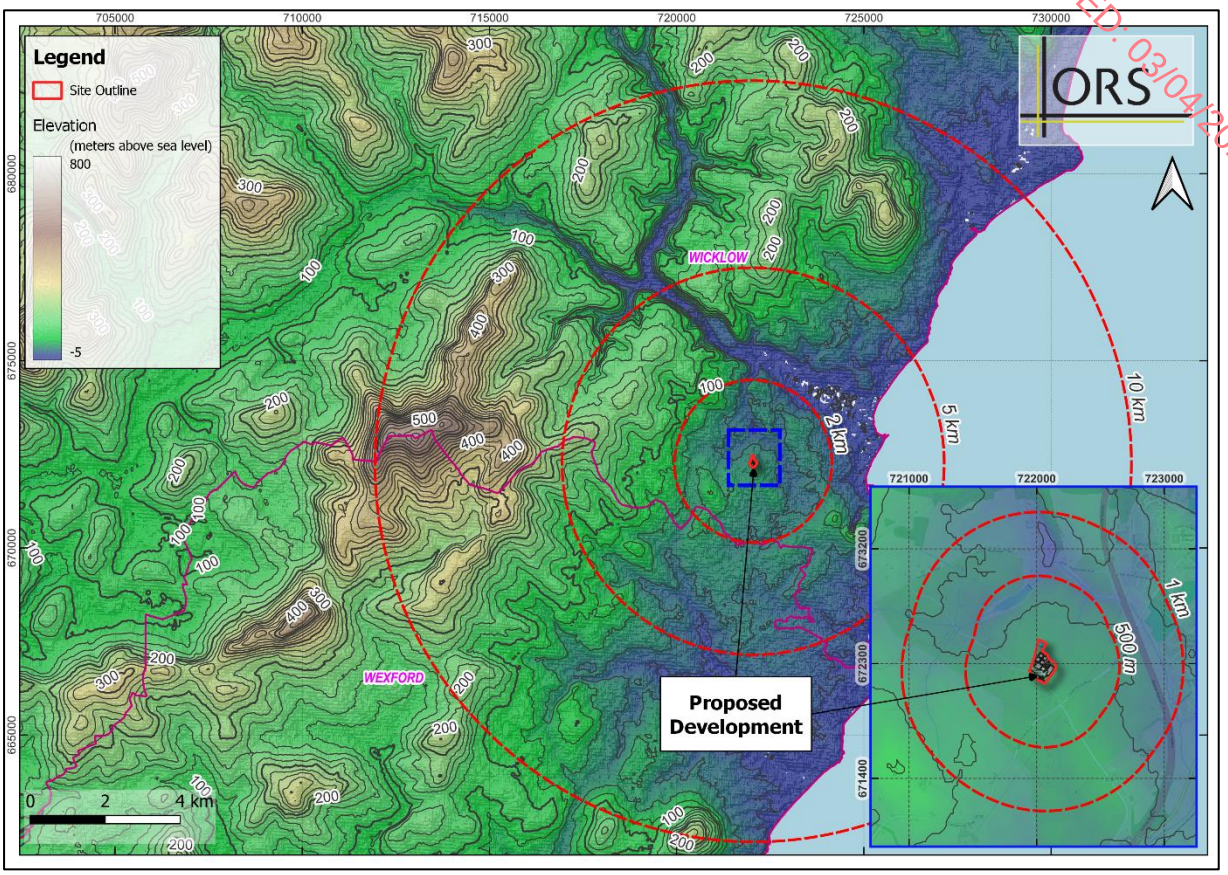

Figure 8.2: Elevation map of the proposed site surrounding area.

The topography of the site slopes smoothly from South to the North. A peak in the site topography, 51.928 m AOD, is situated in the Southernmost boundary corner of the Site with a smooth gradient northward. This gradient keeps developing smoothly across the whole site and continues to gradually descend northwards to a low of *ca.* 46.5m AOD along the northern site boundary. The overall landscape has a gradient of 5.43m, descending from 51.928 m AOD to 46.5m AOD along 333m, which results in a slope of 1.63 %, making the terrain classified as a Moderate Slope. The **Figure 8.3** overleaf shows the Site and environs landscape topography.

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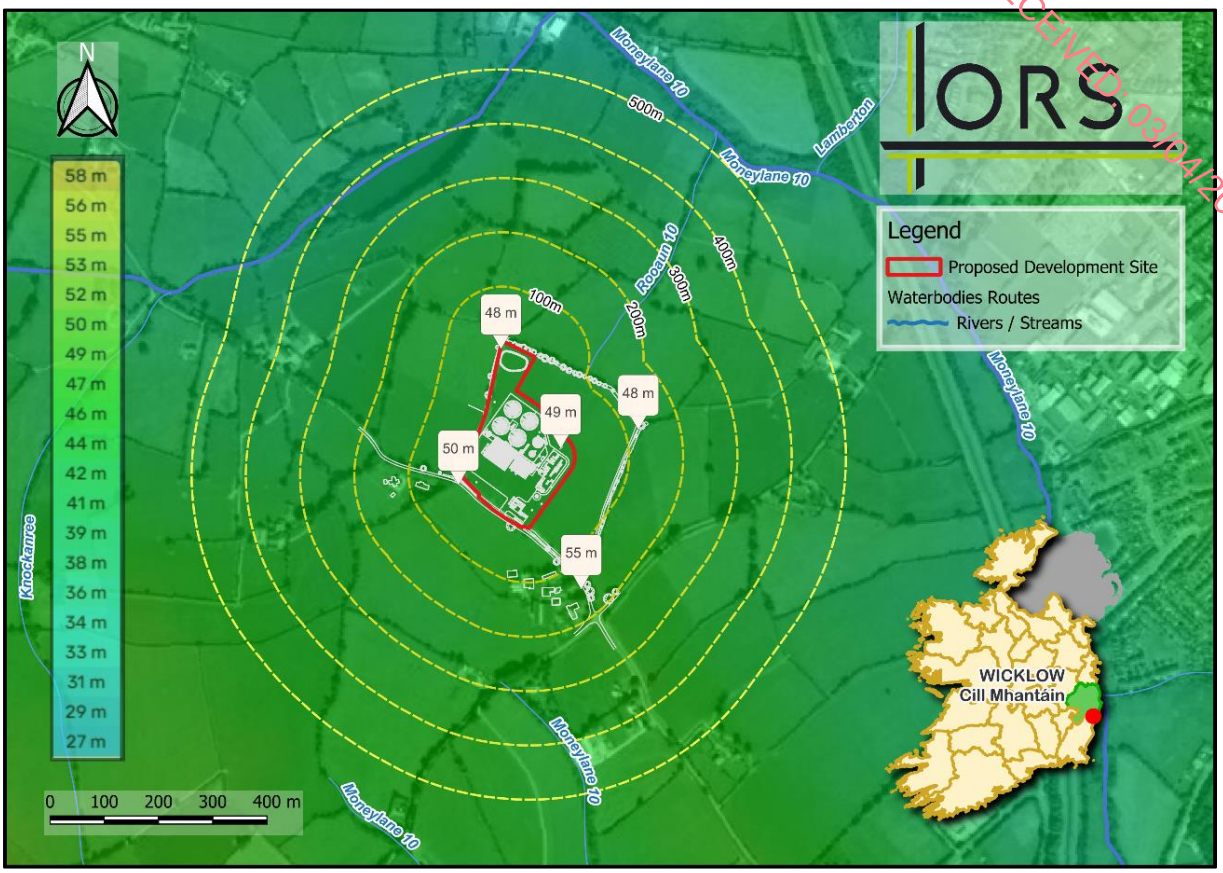

Figure 8.3: Topographical map of the landscape surrounding the site

8.4.3 Drift Geology

Drift is a general term applied to all mineral material (clay, silt, sand, gravel and boulders) transported by a glacier and deposited directly by or from the ice or as fluvioglacial deposits. It generally applies to deposits laid down during the Pleistocene (Quaternary) glaciations but can also be included under Holocene (Quaternary) deposits. The drift geology of a determined area mostly reflects the depositional process of the last glaciation.

The Quaternary Geological Map of Ireland shows the County Wicklow is primarily covered by till derived from granites, reflecting the granite-rich bedrock of the Wicklow Mountains. Lowland areas feature till derived from sandstones and shales, while glaciofluvial and glaciolacustrine sands and gravels are prominent, formed by meltwater streams and glacial lakes. Slope deposits occur on steeper terrains, and peat extensively blankets uplands, indicative of bog development after glaciation. Alluvium lines river valleys, with marine and estuarine deposits along the coast, and wind-blown sands adding to the sedimentary variety in some areas.

Geomorphologically, Wicklow features significant glacial landforms, including drumlins, moraines, and meltwater channels. Drumlins, streamlined hills of till, and moraines, marking glacier retreat, are widespread, evidencing the region’s glacial dynamics. These deposits and features together create Wicklow's distinctive mix of rugged mountains, fertile lowlands, and diverse coastal areas.

In the site and immediate surrounding areas, the primary Quaternary sedimentary deposits are classified as a heterogeneous till composed of unsorted materials, including boulders, gravel, sand, silt, and clay, originating from glacial erosion of Lower Palaeozoic bedrock. Additional

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sediment types include alluvium in surrounding areas, Irish Sea Till, gravels derived from Lower Palaeozoic sandstones and shales, and bedrock outcrops or subcrops. These features, along with the varying depositional processes, contribute to the complex drift geology, as illustrated in **Figure 8.4** below.

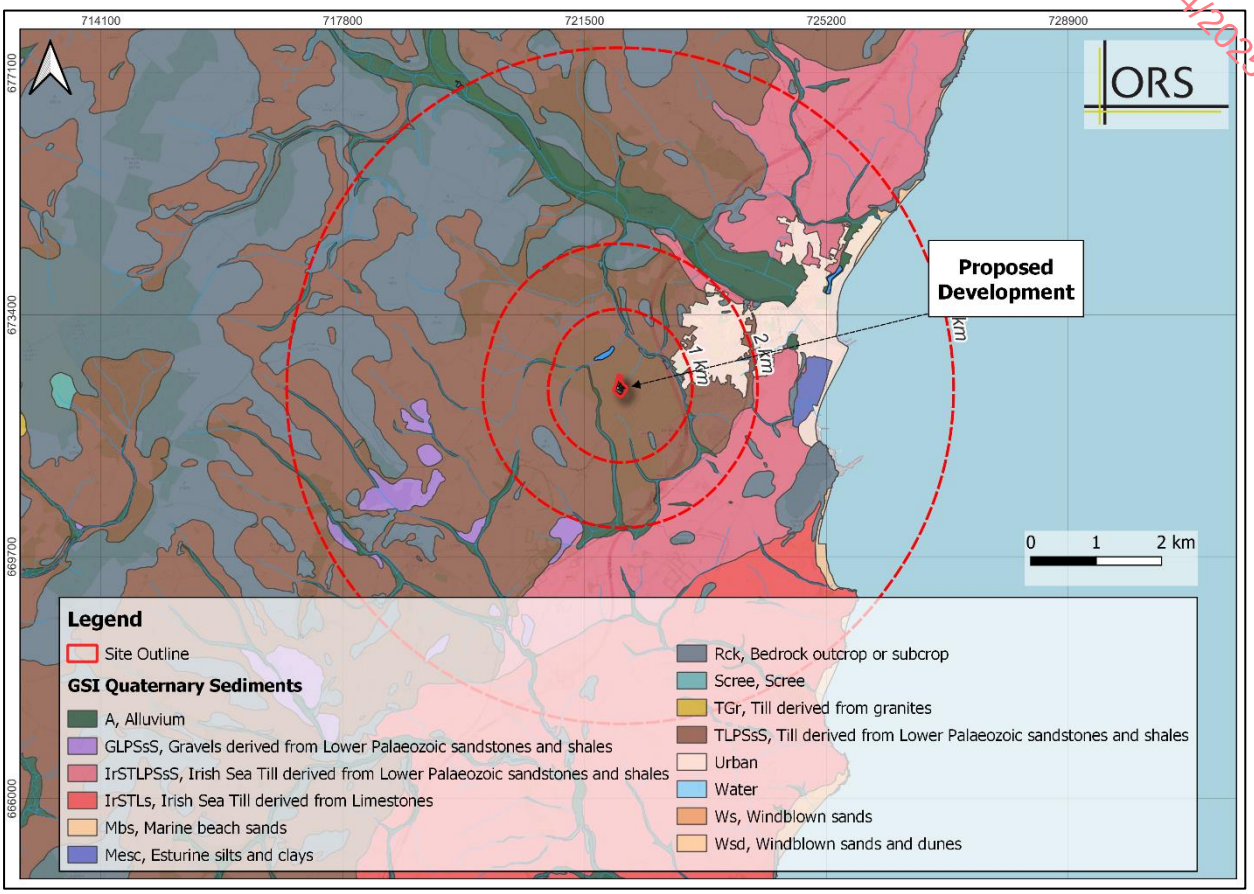

Figure 8.4: Quaternary sediments in the Site environs (Source: GSI)

The Quaternary Drift at the Proposed Development site is described as till derived from Lower Palaeozoic sandstones and shales (TLPSsS). The subsoils present a moderate permeability and are overlain by a poor-drained soil, as per GSI maps.

The Teagasc Soil Map identifies the Macamore (700a) Soil Association at the site, which is characterised by fine loamy soils overlying clayey, calcareous Irish Sea till. According to the Second Edition General Soil Map of Ireland and the EPA Irish Soil Information System (2014), this association is composed primarily (about 90%) of surface-water Gleys in clayey marine drift. Gleys are waterlogged soils with a high-water table, leading to moisture retention and poor drainage. The term "clayey marine drift" refers to fine, clay-rich sediments deposited by sea or coastal processes, creating heavy, slow-draining soils prone to waterlogging. The remaining 10% of the association consists of well-drained sandy Brown Podzolics, typically found on outwash sands and gravels formed by glacial meltwater. These soils are better-drained and more fertile, providing a contrast to the waterlogged Gleys. The parent material is primarily Glacial Mud of Irish Sea origin.

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8.4.4 Bedrock Geology

This section examines the bedrock of the area, defined as the solid rock beneath the ground surface and any overlying soil. Typically, above the bedrock lies a layer of broken, weathered rock known as basal subsoil. Sedimentary rocks are found in beds that can vary in type and orientation, meaning the rock types encountered at the surface can change over relatively short distances.

County Wicklow stands out as one of the few counties in Ireland not underlain by limestone bedrock. Instead, it features five main geological units, with the Leinster Granite being the most significant, formed around 405 million years ago. The oldest rocks are Cambrian-age Bray Group quartzites and greywackes, followed by the Ordovician Ribband Group of shales and mudstones, and the volcanic Duncannon Group. The youngest Kilcullen Group formed as the Iapetus Ocean closed. During the Caledonian orogeny, tectonic collisions caused mountain building, granite intrusion, and rock metamorphism, with the Leinster Granite as a key result. The region also includes diverse igneous intrusions like diorites and dolorites, as well as glacial features such as Glendalough and Glenmalure valleys. Post-glacial processes shaped the drainage and peat formation in the mountains.

According to the Geological Survey of Ireland and the National Draft Generalised Bedrock Map, the bedrock within the 2 km study area surrounding the Site is primarily composed of the Kilmacrea Formation (KA). This formation consists of Ordovician metasediments, predominantly fractured and weathered shales, and is characterised by a gradation in permeability. The upper layers exhibit higher permeability, which decreases with depth. The Kilmacrea Formation is part of the Duncannon Group, alongside the Avoca, Arklow Head, and Ballymoyle formations. These rock units outcrop across the region, stretching from south of Wicklow Town to Rathdrum, Avoca, and Arklow, an area known for its faulting.

The 1:100,000 Bedrock Solid Geology Map further indicates that the Kilmacrea Formation is predominantly composed of dark grey to black mudstones, slates, and shales, with occasional pale grey sandstones and tuffs. These rocks are extensively jointed, fractured, and weathered, contributing to the higher permeability observed near the surface and along fault zones. Water inflow below a depth of 100 meters is rarely reported in trial wells, as permeability decreases rapidly with depth. Typically, the bedrock remains well-fractured to a depth of about 30 meters.

Additionally, the study area includes portions of the Oaklands Formation, located *ca.* 300m to the north, 1.0km northwest, and 1.4km east of the Site. This formation is composed of green, red-purple, and buff-coloured slates and siltstones.

The bedrock geology and associated linework, as shown on the 1:100,000 scale mapping from the GSI, reveal several geological features, including unconformities and faults, within the 2 km study area. The nearest unconformity lies *ca.* 270m to the northeast, running from north to south, while a second unconformity is located *ca.* 400m to the south, extending from east to west. These faults occur both within the Kilmacrea Formation and at the contact between the Kilmacrea and Oaklands formations. The bedrock geology and linework can be viewed in **Figure 8.5** overleaf.

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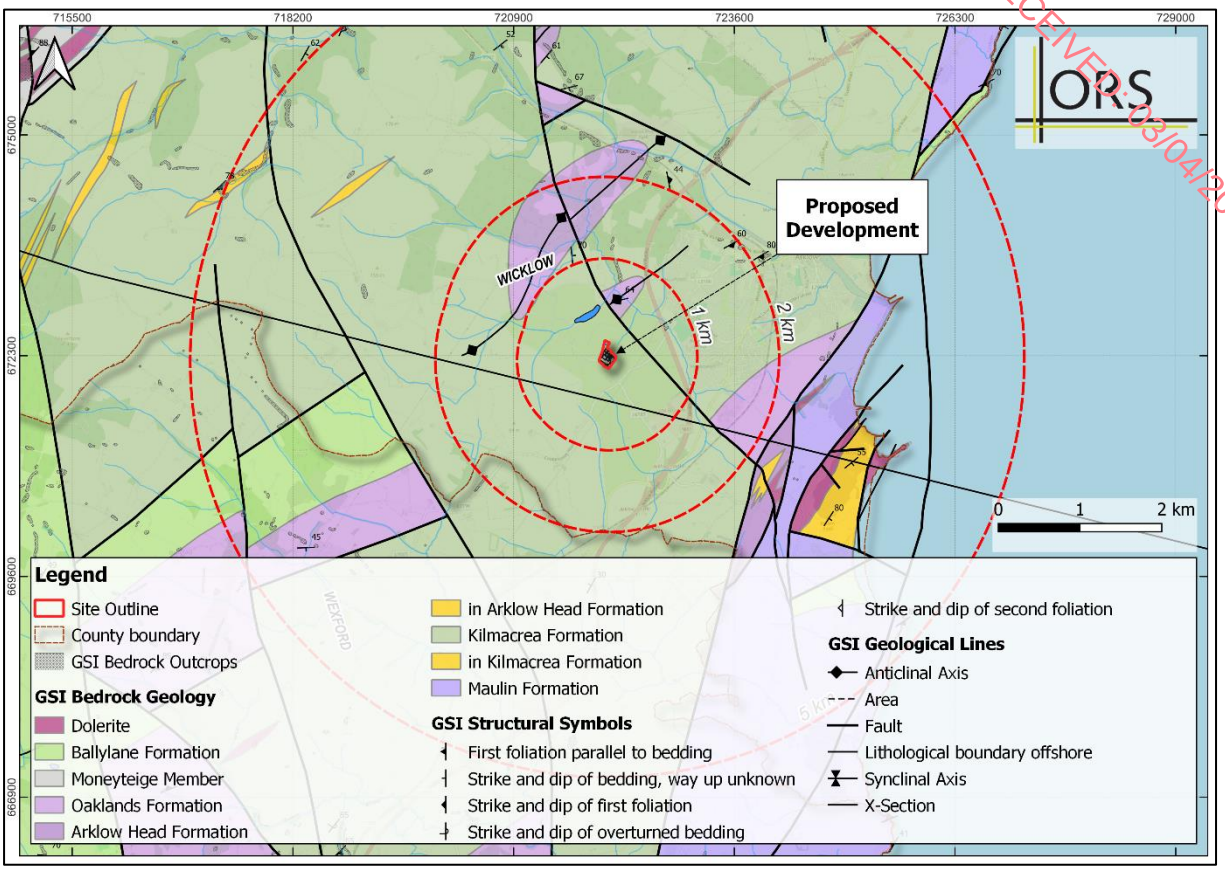

Figure 8.5: Regional Bedrock Formations based on GSI data.

8.4.5 Hydrology

Regional Hydrology

A river basin is the area of land drained by a river, its tributaries, and their associated groundwaters and coastal waters. The Water Action Plan 2024, part of Ireland's third River Basin Management Plan, builds on lessons from previous initiatives and incorporates both immediate and long-term goals to meet EU and international environmental obligations. The plan outlines a comprehensive approach to restoring and protecting the country's water bodies, such as rivers, lakes, estuaries, coastal waters, and groundwater. This initiative aligns with the EU Water Framework Directive, aiming to achieve "good" ecological status for water bodies by 2027. The newly adapted Plan covers a single national River Basin District (RBD), which also includes two international RBDs shared with Northern Ireland.

The Irish RBD spans 70,273 km² and is divided into 46 catchment management units, further broken down into subcatchments. Agriculture dominates land use within the RBD, with 55% dedicated to pastures, 7% to agricultural land, 5% to arable land, and 1% to complex cultivation. Forestry makes up 6% of the land use, while Urban fabric represents only 2% of the area. The remaining land uses are wetlands and peatlands (15%), natural landscapes (7%) and water bodies (2%).

A catchment is a land area where all surface water flows toward a single point, such as a river. The proposed site is situated within the Ovoca-Vartry Catchment (Hydrometric Area 10), which encompasses the region drained by the River Avoca and Vartry and all its tributaries that enter tidal waters between Sorrento Point, Co. Dublin and Kilmichel Point, Co. Wicklow. This catchment covers a total area of 1,274km². Bray is the largest urban centre within the

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catchment, with other significant towns including Dun Laoghaire-Rathdown, Arklow, Wicklow Town, Rathnew, Newtown Mount Kennedy, Greystones, Delgany and Kilcoole. The Ovoca-Vartry Catchment is divided into 10 sub-catchments (which are illustrated in **Figure 8.6**) and contains 71 river waterbodies, 11 lakes waterbodies, 4 transitional waterbodies, 3 coastal waterbody, and 12 groundwater bodies.

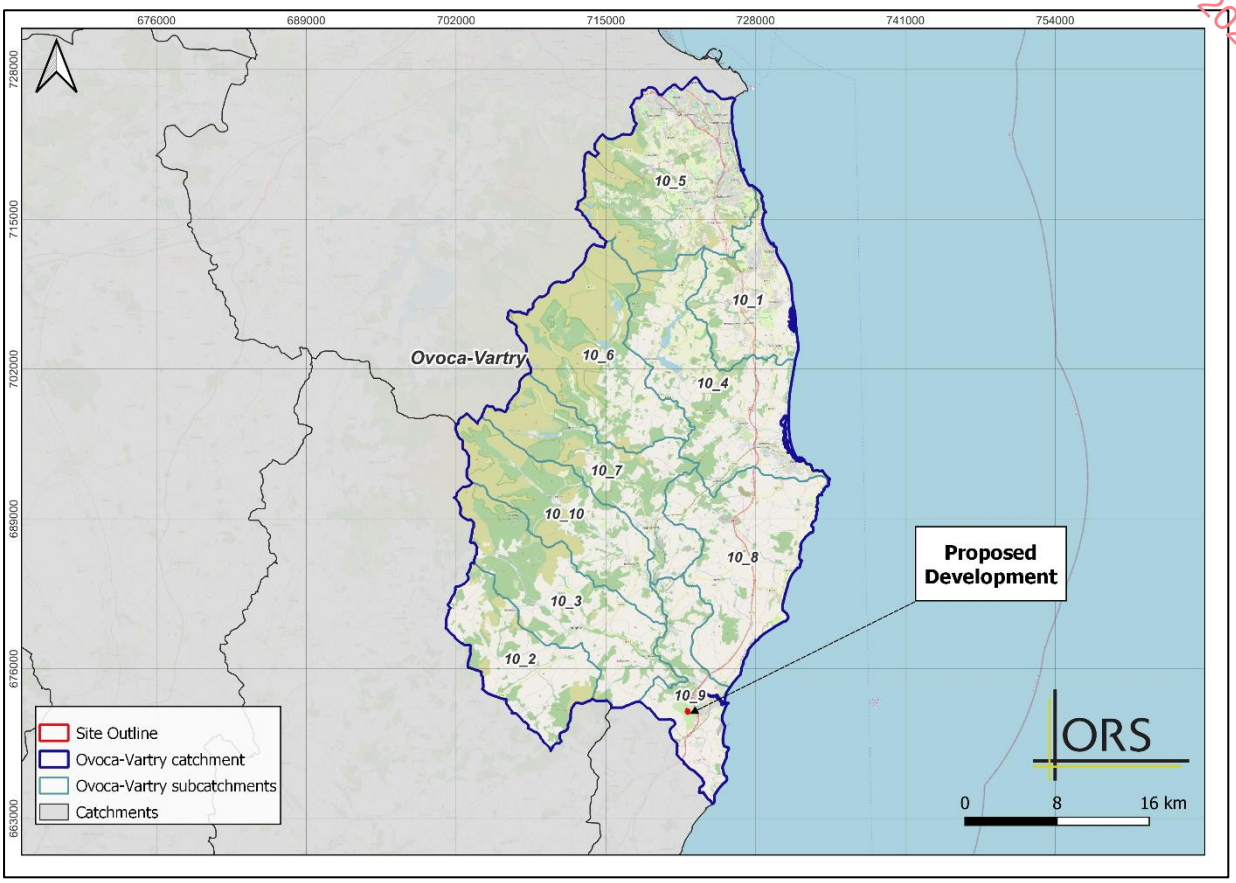

Figure 8.6: Ovoca-Vartry River Catchment and Sub-Catchments (EPA Maps)

The two main hydrological features in the catchment are the River Vartry and the River Avoca. The River Vartry drains the northern portion of the catchment, originating in the Great Sugar Loaf Mountain in north County Wicklow. It flows southeast through Ashford before entering the Irish Sea at Wicklow Harbour. The River Avoca drains the central-southern region and begins as two major tributaries, the Avonbeg and Avonmore Rivers, which flow southeast and merge at the Meeting of the Waters in County Wicklow. From there, it becomes the Avoca River and reaches the sea at Arklow. Together, the Avoca and its three main tributaries span approximately 679km in channel length.

The Vartry catchment is underlain by greywacke, shale, and schist, with land use dominated by blanket bog, agriculture, and significant forestry in the upper reaches. In contrast, the Avoca catchment features siliceous granite and Ordovician slate, with agriculture as the primary land use, complemented by substantial pockets of forestry throughout the region.

As shown in **Figure 8.6**, the Proposed Development site in Moneylane, Arklow, is located in the sub catchment 10_9 of the Ovoca-Vartry river catchment, also identified as Avoca_SC_020 sub-catchment.

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Local Hydrology

The main hydrological feature near the Proposed Development site is the Moneylane Stream (EPA designation: *Moneylane 10*), located *ca.* 490 m northeast of the site within the Ballyduff sub-basin. This sub-basin drains an area of 13.9 km² and also includes the Ballyduff Stream (EPA designation: *Ballyduff (Stream) [Wicklow]_010*), located *ca.* 415 m northwest of the site. Upstream of the site, both the Ballyduff and Moneylane Streams are fed by several smaller tributaries. Downstream, the Moneylane Stream flows into the Ballynduff Stream (EPA designation: *AVOCA_030*), *ca.* 900 m north of the site. The main channel of the Avoca River is located *ca.* 3 km downstream of the site.

Additionally, according to EPA maps, a small stream, designated as Rooaun 10, is located in the field adjacent to the northeastern boundary of the site. No surface flow was observed during the preliminary site investigations, despite the wet conditions at the time. Instead, it was confirmed that the stream flows underground, emerging through a pipe at the field's edge before discharging into the Moneylane Stream. Nevertheless, it still could serve as a pathway for pollution from the Proposed Development, in the absence of appropriate mitigation measures.

It is also worth noting the presence of the Arklow Water Treatment Plant (WTP) ca. 500m north of the proposed site, along the Ballyduff Stream. With a treatment capacity of 6.1 million litres per day (MLD) sourced from both ground and surface water, it serves an estimated population equivalent (PE) of 18,000, as outlined in the Arklow and Environs Local Area Plan 2018-2024.

Both Engineers Ireland and Uisce Éireann (Irish Water) have highlighted the redevelopment of the Arklow WTP and the broader Arklow Water Supply Scheme (AWSS) to address challenges related to water supply capacity and quality. Historically, Arklow Town's water supply relied solely on surface water sources: the Goldmines River, located in Woodenbridge approximately 7 km northwest of Arklow, and the Ballyduff Reservoir (also known as the Impoundment Reservoir), situated ca. 340m north of the Proposed Development site.

As part of the AWSS upgrade, the Arklow WTP now includes 14 no. raw water abstraction boreholes, and a single surface water abstraction point at the Goldmines River. According to a 2016 Drinking Water Audit Report (EPA File Reference: DW2008/431), at that time, only 3 boreholes in the Avoca River Basin were actively used for water abstraction. The Goldmines River was not in use, as the boreholes alone met the demand. Irish Water did not anticipate utilizing the Goldmines River in the short- to medium-term and considered its use unlikely unless demand significantly increased.

The current operational status of the Ballyduff Reservoir in the water supply system is unclear. Historically, it played an important role in storing surface water before treatment. However, with the shift toward reliance on groundwater abstraction from boreholes as part of the Arklow Water Supply Scheme, recent reporting would suggest that the Ballyduff reservoir is not in use for this purpose.

The Proposed Development site is not directly hydrologically connected to the impounding reservoir or the water treatment plant. Nonetheless, due to the reservoir's proximity to the Proposed Development, a comprehensive evaluation of potential impacts on the local water infrastructure was conducted, and appropriate mitigation measures have been integrated into the project design (see **Section 8.6** for further details). Only stormwater will be discharged from the site, and it will undergo treatment and testing before release. Consequently, the risk of surface water contamination affecting the Arklow Public Water Supply Scheme and the local hydrological system is deemed negligible.

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The local hydrology of the Proposed Development and its surrounding area are shown in **Figure 8.7**.

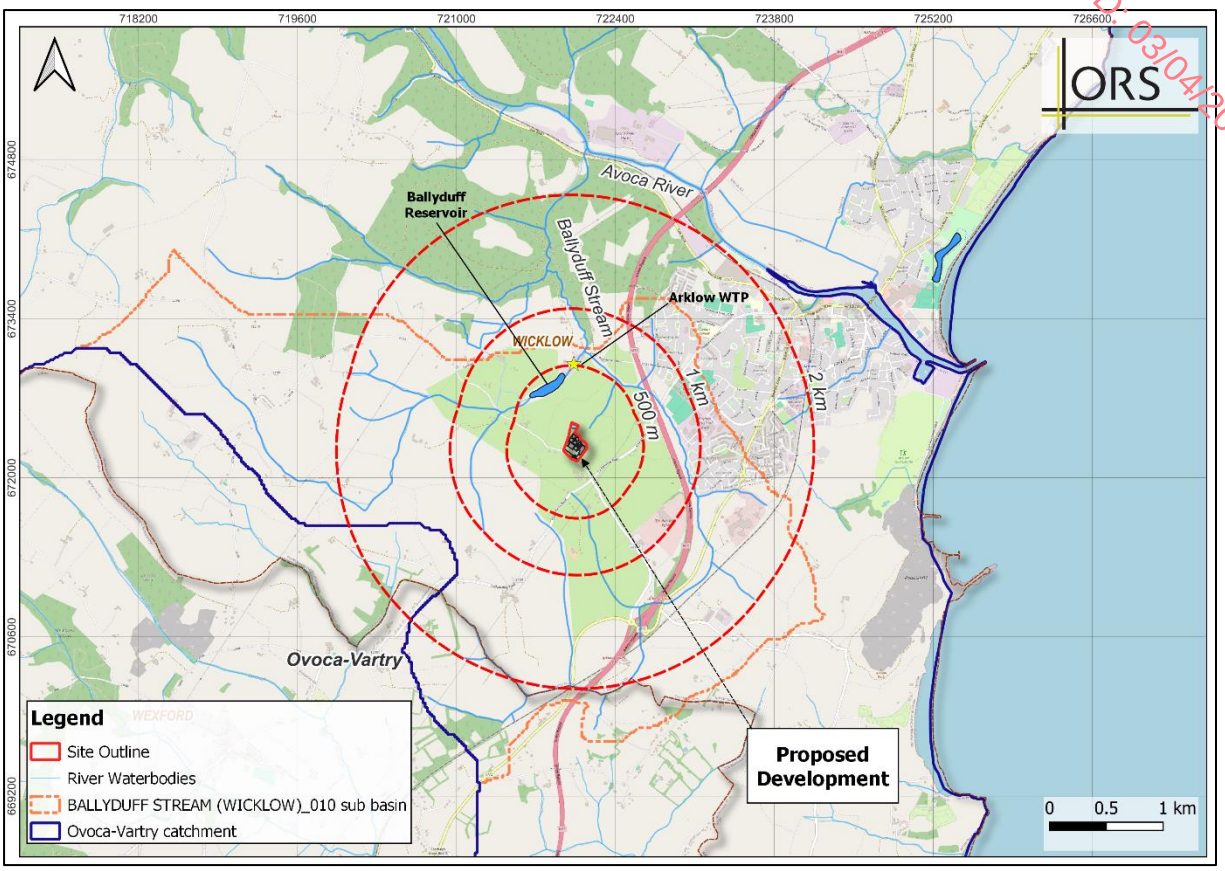

Figure 8.7: Local hydrology, based on EPA Maps.

Protected Areas

The Proposed Development is not located within or immediately adjacent to any Natura 2000 or nationally designated sites, such as Natural Heritage Areas (NHAs) or proposed NHAs. However, there are three Natura 2000 sites and eight proposed nationally important sites (also known as NHAs) within a 15 km radius of the development. The site's proximity to these designated areas is illustrated in **Figure 8.8.**

The nearest proposed NHA is the Arklow Town Marsh, located *ca.* 2.3 km northeast of the Proposed Development. Notably, the Arklow Town Marsh is the only protected area hydrologically connected to the site. This hydrological link is established via the Rooaun Stream, which runs *ca.* 20 meters north of the development. The Rooaun Stream flows into the Moneylane Stream, a tributary of the Ballyduff Stream, which subsequently joins the Avoca River. The Avoca River ultimately connects to the Arklow Town Marsh pNHA *ca.* 3.4 km downstream (by hydrological distance) of the Proposed Development.

Due to this hydrological connection, there is potential for indirect impacts on sensitive habitats and species within the marsh. Such impacts could arise from changes to water quality, including sediment runoff, nutrient enrichment, or accidental spills, which may affect the

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ecological integrity of this protected area.

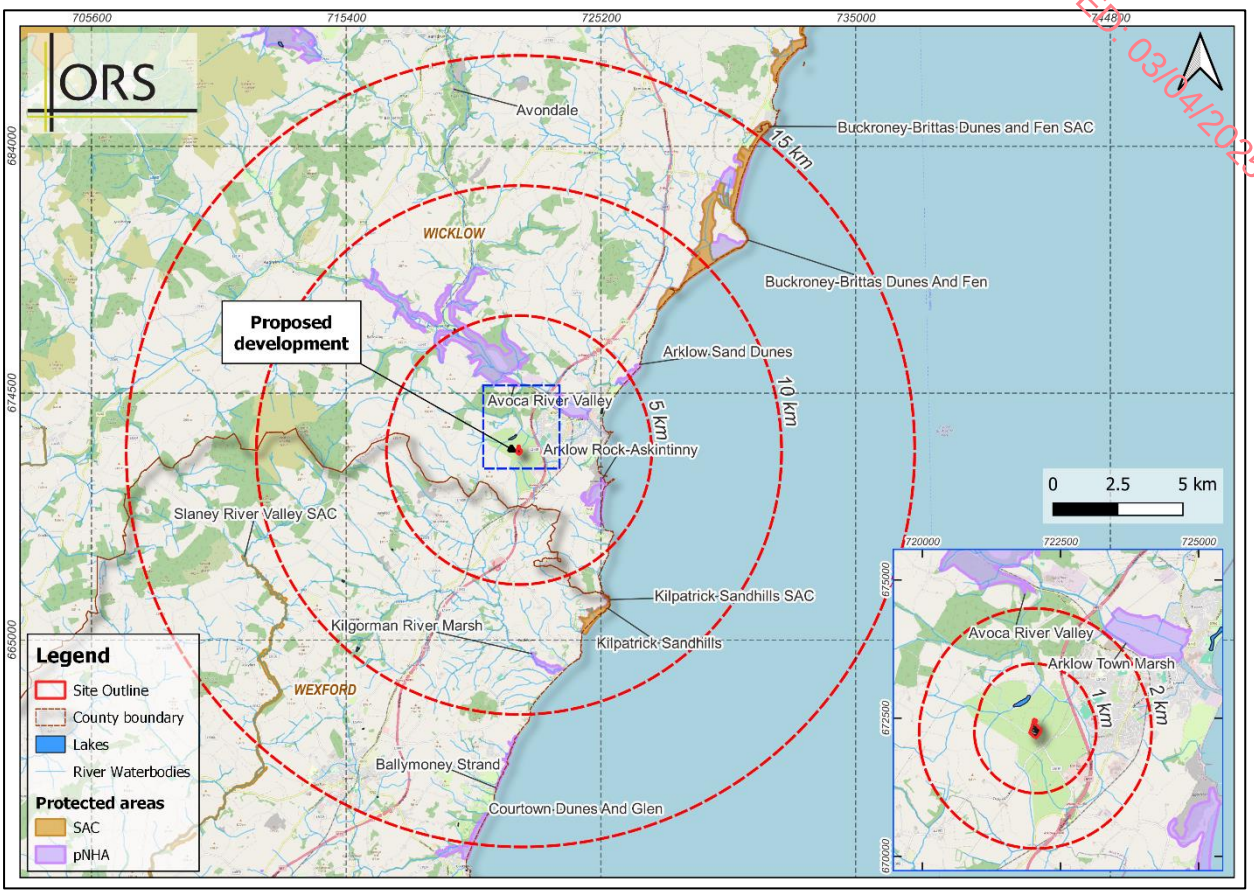

Figure 8.8: Summary of protected areas within the vicinity of the site. (EPA Maps)

A full list and appraisal of the potential effects of the Proposed Development on the constitutive characteristics of European sites identified within 15km of the Proposed Development is set out in the Appropriate Assessment Screening Report (**Document Ref: 241504-ORS-XX-XX-RP-EN-13d-004**) which accompanies the planning application for this Proposed Development.

The Appropriate Assessment Screening Report concludes that the Proposed Development at Moneylane, Arklow, does not pose a significant risk to Natura 2000 sites, as there is no direct or indirect hydrological connection to these areas. However, the development is hydrologically connected to Arklow Town Marsh pNHA, which is protected under national biodiversity policy.

Adherence to good housekeeping practices, the implementation of measures outlined in the accompanying Construction Environmental Management Plan (CEMP), and effective pollution control and surface water management will mitigate any potential significant impacts. With these precautions in place, the Proposed Development will not significantly affect the ecological integrity of the Arklow Town Marsh pNHA.

Site Drainage

Arterial Drainage Schemes are those that the Office of Public Works (OPW) is legally obligated to maintain. These schemes were established under the Arterial Drainage Act of 1945, primarily to enhance agricultural land and mitigate flooding. The works involved modifications to rivers, lakes, weirs, and bridges to improve water conveyance, the construction of

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embankments to control floodwater movement, and various other activities outlined in Part II of the Act. The main objectives of the schemes were to improve agricultural land, ensure that flood levels up to a 3-year return period were contained within banks, and reduce waterlogging in adjacent lands (known as callows) by lowering water levels during the growing season. As a result, flood protection in the affected areas was significantly enhanced.

In addition, local authorities are responsible for maintaining Drainage Districts, with provisions for their management outlined in Part III and Part VIII of the Arterial Drainage Act, 1945.

According to the Arterial Drainage Scheme (ADS) and Drainage District (DD) maps, the Proposed Development site is not located near any drainage scheme or their benefitted lands. The nearest Drainage District, Burren, is situated over 30 km to the west of the site, while the closest Arterial Drainage Scheme, Owenavorragh, is *ca.* 15 km to the south. Neither of these drainage schemes is hydrologically connected to the Proposed Development site. The locations of these schemes in relation to the site are illustrated in **Figure 8.9** below.

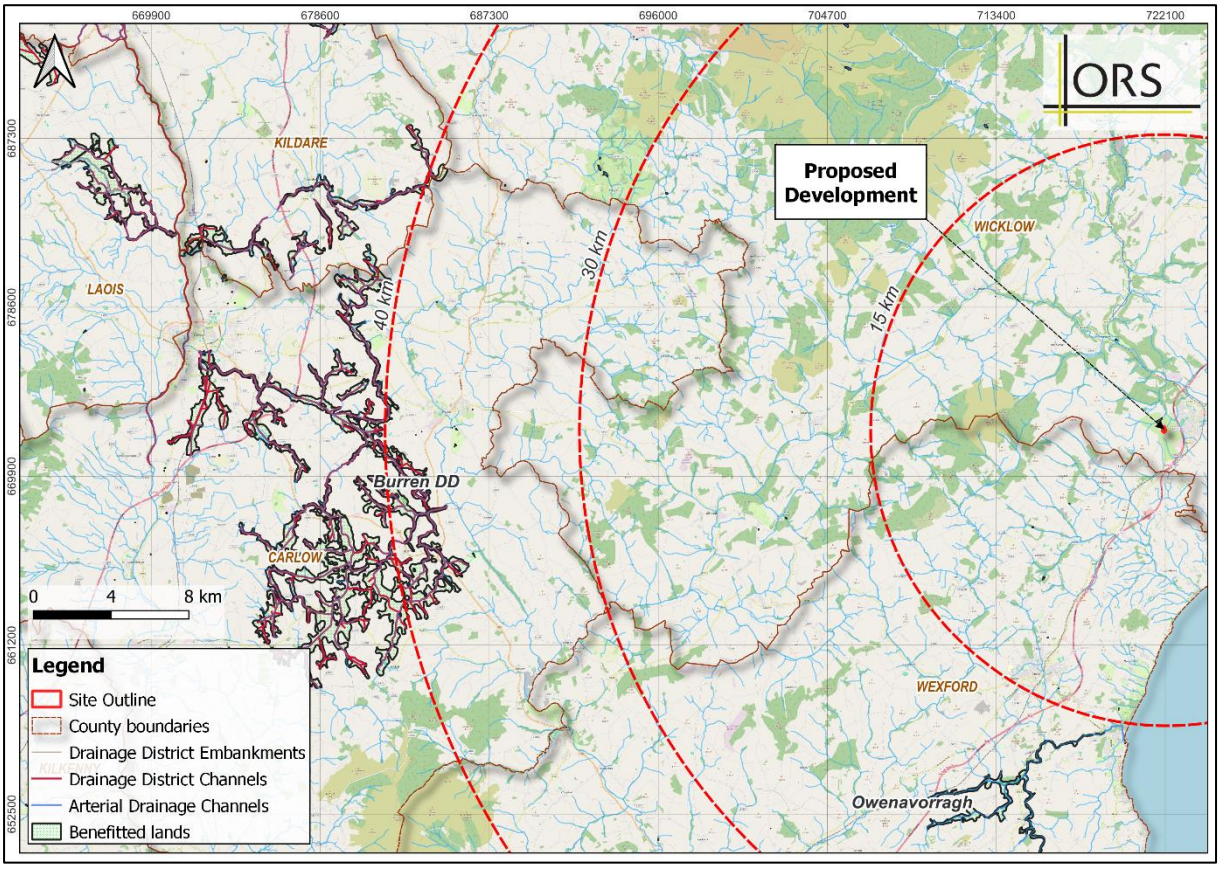

Figure 8.9: Site drainage catchments (OPW)

The drainage at the site corresponds to its topographical gradient, with the primary flow direction occurring northward. During the site investigation, a ditch has been identified along its northern boundary, which functions as a drainage channel during periods of rainfall. This ditch does not exhibit any regular flow and, therefore, does not meet the criteria to be classified as a watercourse. Instead, it operates solely as a drainage feature to manage surface runoff from the site and its surrounding area.

Surface Water Rate of Discharge

The permissible rate of surface water discharge from the site is determined based on criteria

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outlined in the Greater Dublin Strategic Drainage Study and the CIRIA SuDS Manual. To ensure that the Proposed Development does not adversely affect the flood regime of the receiving watercourse, the discharge rate should not exceed either the calculated Qbar value or 2.0 litres per second per hectare (l/s/ha), whichever is greater.

- Qbar, calculated using the IH124 method, is 10.7 l/s.
- The main site area is 4.02 hectares, which corresponds to a discharge rate of 7.72 l/s (3.86 ha × 2.0 l/s/ha).

Therefore, the maximum permissible discharge rate for surface water from the Proposed Development is 10.7 l/s. For further information on the surface drainage system for the Proposed Development see **Appendix 8.2**.

Wicklow County Development Plan 2022 – 2028 – Flood Risk Management

A review of the Wicklow County Development Plan was carried out to determine the policies and objectives relevant to the management of flood risk throughout the region. In **Chapter 14 – Flood Risk Management**, the plan outlines key goals for managing flood risks, focusing on the impacts of climate change and the importance of integrating flood mitigation into broader development plans. These goals align with the county's main priorities: fostering sustainable healthy communities, promoting climate action, and creating economic opportunities. The County objectives related to Flood Risk Management are the following:

- **CPO 14.01:** *To support the implementation of recommendations in the OPW Flood Risk Management Plans (FRMPs), including planned investment measures for managing and reducing flood risk.*
- **CPO 14.02:** *To support and facilitate flood management activities, projects or programmes as may arise, including but not limited to those relating to the management of upstream catchments and the use of 'natural water retention' measures, and ensure each flood risk management activity is examined to determine actions required to embed and provide for effective climate change adaptation as set out in the Climate Change Sectoral Adaptation Plan for Flood Risk Management applicable at the time.*
- **CPO 14.03:** *To recognise the concept of coastal evolution and fluvial flooding as part of our dynamic physical environment and adopt an adaptive approach to working with these natural processes. The focus of a flood management strategy should not solely be driven by conservation of existing lands; it should recognise that marshes, mud flats and other associated ecosystems evolve and degenerate, and appropriate consideration should be given to the realignment of defences and use of managed retreat and sacrificial flood protection lands to maintain such habitats as part of an overall strategy.*
- **CPO 14.04:** *To ensure the County's natural coastal defences (beaches, sand dunes, salt marshes and estuary lands) are protected and to ensure that their flood defence/management function is not put at risk by inappropriate works or development.*
- **CPO 14.05:** *To continue to work with the OPW and other agencies to deliver Flood Defence Schemes in the County as identified in current and future FRMPs, and in particular:*
  a) Avoca River (Arklow) Flood Defence Scheme;
  b) Avoca River (Avoca) Flood Defence Scheme;
  c) Low cost works in accordance with the OPW's Minor Works Scheme;
  d) Coastal Protection Projects, where funding allows;
  and ensure that development proposals support, and do not impede or prevent,

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progression of such schemes.

- **CPO 14.06:** *To implement the 'Guidelines on the Planning System and Flood Risk Management' (DoEHLG/OPW, 2009).*
- **CPO 14.07:** *To prepare new or update existing flood risk assessments and flood zone maps for all zoned lands within the County as part of the review process for Local Area Plans, zoning variations and Small Town Plans, where considered necessary.*
- **CPO 14.08:** *The zoning of land that has been identified as being at a high or moderate probability of flooding (flood zones A or B) shall be in accordance with the requirements of the Flood Risk Management Guidelines and in particular the 'Justification Test for Development Plans' (as set out in Section 4.23 and Box 4.1 of the Guidelines).*
- **CPO 14.09:** *Applications for new developments or significant alterations/extension to existing developments in an area at risk of flooding shall comply with the following:*
  a) Follow the 'sequential approach' as set out in the Flood Risk Management Guidelines;
  b) An appropriately detailed flood risk / drainage impact assessment will be required with all planning applications, to ensure that the development itself is not at risk of flooding and the development does not increase the flood risk in the relevant catchment (both up and down stream of the application site), taking into account all sources of flooding;
  c) Restrict the types of development permitted in Flood Zone A and Flood Zone B to that which are 'appropriate' to each flood zone, as set out in Tables 3.1 and 3.2 of the Flood Risk Management Guidelines unless the 'plan making justification test' has been applied and passed;
  d) Where a site has been subject to and satisfied the 'Plan Making Justification Test' development will only be permitted where a proposal complies with the 'Justification Test for Development Management', as set out in Box 5.1 of the Guidelines. Flood Risk Assessments shall be in accordance with the requirements set out in the Guidelines and the SFRA.

  Where flood zone mapping does not indicate a risk of flooding but the Planning Authority is of the opinion that flood risk may arise or new information has come to light that may alter the flood designation of the land, an appropriate flood risk assessment will be required to be submitted by an applicant for planning permission and the sequential approach shall be applied as the 'Plan Making Justification Test' will not be satisfied.
- **CPO 14.10:** *To prohibit development in river flood plains or other areas known to provide natural attenuation for floodwaters except where the development can clearly be justified with the Flood Risk Management Guidelines 'Justification Test'.*
- **CPO 14.11:** *To limit or break up large areas of hard surfacing in new developments and to require all surface car parks to integrate permeability measures such as permeable paving.*
- **CPO 14.12:** *Excessive hard surfacing shall not be permitted for new, or extensions to, residential or commercial developments and all applications will be required to show that sustainable drainage techniques have been employed in the design of the development.*
- **CPO 14.13:** *Ensure the implementation of Sustainable Urban Drainage Systems (SUDS) in accordance with the Wicklow County Council SuDS Policy to ensure surface water runoff is managed for maximum benefit. In particular to require proposed developments to meet the design criteria of each of the four pillars of SuDS design; Water Quality, Water Quantity, Amenity and Biodiversity.*
- **CPO 14.14:** *Underground tanks and storage systems shall be permitted as a last resort only where it can be demonstrated the other more sustainable SuDS infrastructure measures are not feasible. In any case underground tanks and storage systems shall not*

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be permitted under public open space, unless there is no other feasible alternative.

- **CPO 14.15:** *To promote the use of green infrastructure, such as swales and wetlands, where feasible as landscape features in new development to provide storm / surface runoff storage and reduce pollutants, as well as habitat, recreation and aesthetic functions.*
- **CPO 14.16:** *For developments adjacent to all watercourses or where it is necessary to maintain the ecological or environmental quality of the watercourse, any structures (including hard landscaping) must be set back from the edge of the watercourse in accordance with the guidelines in 'Planning for Watercourses in the Urban Environment' by Inland Fisheries Ireland.*

Arklow and Environs Local Area Plan 2018 – 2024 – Flood Risk Management

The purpose of the Arklow Local Area Plan (LAP) is to guide the sustainable development of the town and its surroundings in alignment with the County Development Plan. The LAP outlines 11 key visions for the town, including adapting to climate change by addressing flooding and promoting renewable energy, while integrating sustainability into its objectives. The plan is designed to avoid flood risk wherever possible. When avoidance isn't feasible, it prioritises replacing vulnerable uses with less vulnerable ones and implements risk mitigation and management measures as necessary.

As part of the LAP, a Strategic Flood Risk Assessment (SFRA) was conducted to comply with the guidelines for Planning Authorities '*The Planning System and Flood Risk Management'*. The assessment reviewed the zoning of lands in Arklow, aligning their objectives and approved uses with identified flood risks. However, the proposed site and its surroundings, situated in a rural area without specific zoning, were not directly addressed in the SFRA. As a result, no specific flood management objectives have been established for the site.

Flood Risk

According to the Office of Public Works (OPW), the main sources of flooding are rainfall (Inland flooding) or higher sea levels (Coastal Flooding). The principal pathways include rivers, drains, sewers, overland flow and river and coastal floodplains. The receptors may include people, their property, and the environment. To accurately determine the potential consequences of flooding, it is essential to assess these three elements – sources, pathways, and receptors - alongside the vulnerability and exposure of receptors.

The OPW and Department of Environment, Heritage and Local Government (DoEHLG) published 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' in 2009 (The Guidelines). The Guidelines define the likelihood of flooding is the probability or frequency of a flood of a specific magnitude or severity occurring or being exceeded in any given year. It is generally expressed as the chance of a particular flood level being exceeded in one year. This return period is described as the Annual Exceedance Probability (AEP). For example, a 1 in 100 or 1% flood is that which would, on average, be expected to occur once in 100 years, though it could happen at any time.

Flood zones are geographical areas within which the likelihood of flooding is in a particular range. There are three types or levels of flood zones defined for the purposes of the Guidelines:

- **Flood Zone A** – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);

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- **Flood Zone B** – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and
- **Flood Zone C** – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

In 2018, the Office of Public Works (OPW) launched a new online flood map viewer to provide information on the likelihood of flood risk and the extent of flooding across Ireland. This viewer includes flood risk data derived from several sources including:

1. ***Catchment Flood Risk Assessment and Management (CFRAM) Programme:*** 300 communities at potentially significant flood risk, referred to as Areas for Further Assessment (AFA's).
2. ***National Indicative Fluvial Mapping (NIFM):*** Predictive flood maps showing indicative areas predicted to be inundated during a theoretical fluvial flood event with an estimated probability of occurrence. Indicative flood maps have been produced for all watercourses that are on the EPA watercourse layers, have a catchment area greater than 5km^2 and for which flood maps were not produced under the National CFRAM Programme.
3. ***Geological Survey Ireland Groundwater Flooding:*** Probabilistic flood extent of groundwater flooding in limestone regions. These maps are focused primarily (but not entirely) on flooding at seasonally flooded wetlands known as turloughs.
4. ***Past Flood Events:*** A Past Flood Event is defined as the occurrence of recorded flooding at a given location on a given date or on a recurring basis. The event is derived from available flood information documentation including flood event reports, news articles, archive information and photos.

A summary of the above-noted flood risk data as derived from the OPW map viewer within the vicinity of the site is presented in **Figure 8.10**.

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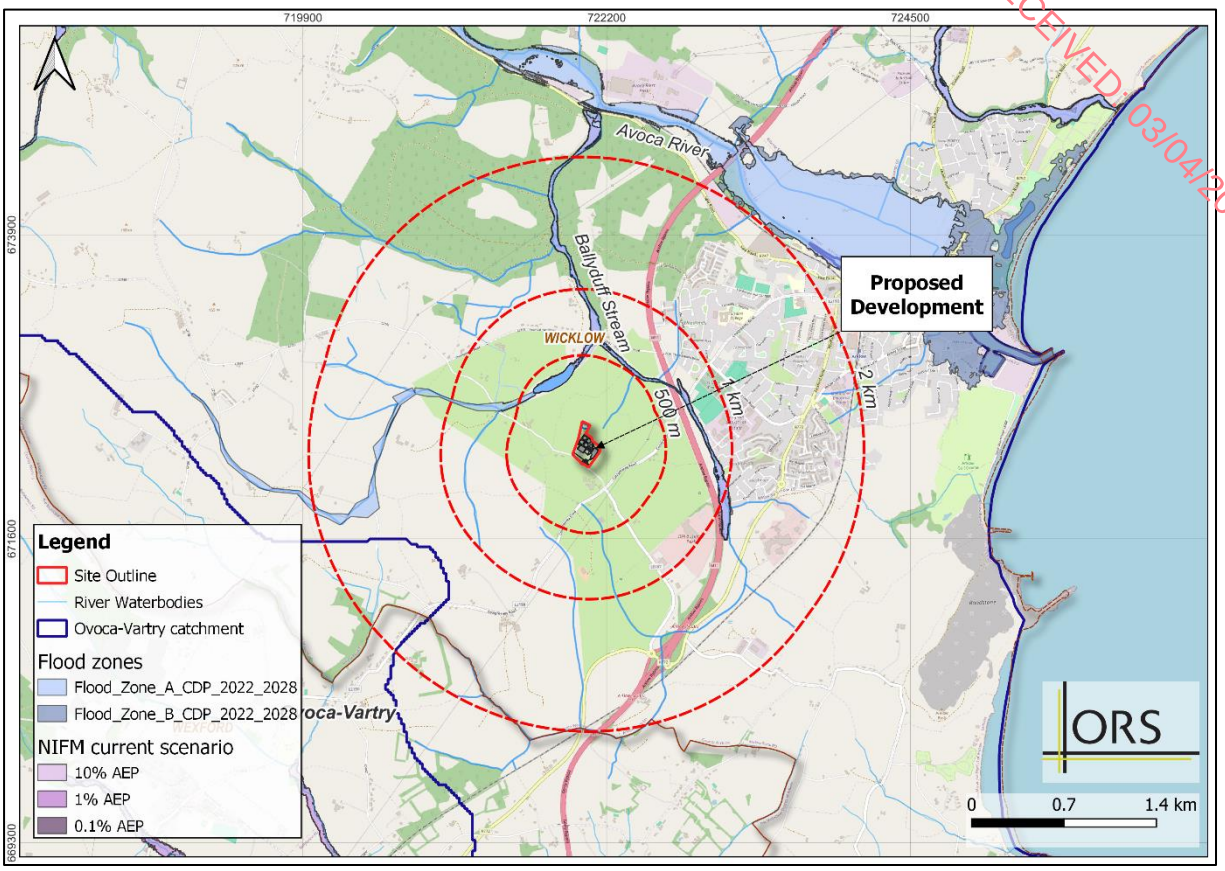

Figure 8.10: Flood Risk Summary (OPW)

The Preliminary Flood Risk Assessment (PFRA) did not identify any significant risk of groundwater or pluvial flooding near the proposed site. For fluvial and coastal flooding, Arklow recorded a Flood Risk Index of 3454—well above the cutoff value of 150 for significant flooding—highlighting a high flood risk in the town. Additionally, Arklow Town was assigned the maximum Historic Hazard Category (4), reflecting a high number of recorded historic flood events.

According to the PFRA, Arklow was identified as a probable Area for Further Assessment (AFA), which led to the town being subject to additional analysis through the CFRAM Studies. These studies included the creation of various maps to identify the extent, depth, and risk of flooding. For Arklow AFA (ID No. 100109), the studies focused on fluvial and coastal flooding modelled to occur along the mouth of the Avoca River. As a result, the proposed site location was not included in the flood risk mapping for this area.

The NIFM fluvial flood extents for the Present-Day scenario show potential flooding approximately 340m northwest and 500m north of the site, with no significant extension of these floods towards the site in the mid-range and high-end future scenarios. Additionally, there are no groundwater flood extents, from low to high probabilities, predicted to occur within the site and in the surrounding areas.

Based on this assessment, the site is classified as Flood Zone C. Construction is not expected to increase flood risk in the area. This aligns with the findings in the Strategic Flood Risk Assessment part of the Wicklow County Development Plan (2022-2028), indicating that no specific flood risk mitigation measures are required for the Proposed Development site.

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Wicklow County Development Plan 2022 – 2028 – Water Quality

A review of the Wicklow County Development Plan was carried out to determine the policies and objectives relevant to the preservation and protection of water quality throughout the region.

Settlement Strategy Policy Objectives:

- ***CPO 4.14:*** *To ensure that key assets in rural areas such as water quality and natural and cultural heritage are protected to support quality of life and economic vitality.*

Economic Development Policy Objectives – Green Industry:

- ***CPO 9.21:*** *To encourage and facilitate the 'circular economy' and the development of 'green' industries, including industries relating to renewable energy and energy-efficient technologies, material / waste recycling and conservation.*
- ***CPO 9.38:*** *To encourage and facilitate agricultural diversification into suitable agri-businesses. Subject to all other objectives being complied with, the Council will support the alternative use of agricultural land for the following alternative farm enterprises:*
  a) Specialist farming practices, e.g. organic farming, horticulture, specialised animal breeding, deer and goat farming, poultry, flower growing, forestry, equine facilities, allotments, bioenergy production of crops and forestry, organic and speciality foods; and
  b) suitable rural enterprises.

Economic Development Policy Objectives – Agriculture:

- ***CPO 9.38:*** *To facilitate the development of environmentally sustainable agricultural activities, whereby watercourses, wildlife habitats, areas of ecological importance and other environmental assets are protected from the threat of pollution, and where development does not impinge on the visual amenity of the countryside. […]*
- ***CPO 9.40:*** *To ensure that agricultural developments do not cause increased pollution to watercourses. Developments will be required to adhere to the Nitrates Directive (91/676/EC), the Nitrates National Action Programme and the EC (Good Agricultural Practice for Protection of Waters) Regulations 2009 (as amended), with regard to storage facilities, concerning the protection of waters against pollution caused or induced by nitrates from agricultural sources. Developments will be required to comply with relevant measures, which operate to protect water quality from pollution by agricultural sources. The disposal and storage of agricultural waste shall comply with the standards required by Council.*

Water Services Policy Objectives – Water Quality:

- ***CPO 13.1:*** *To ensure and support the implementation of the EU Groundwater Directive and the EU Water Framework Directive and associated River Basin and Sub-Basin Management Plans and Blue Dot Catchment Programme, to ensure the protection, improvement and sustainable use of all waters in the County, including rivers, lakes, ground water, coastal and estuarine waters, and to restrict development likely to lead to a deterioration in water quality. The Council will also have cognisance of, where relevant, the EU's Common Implementation Strategy Guidance Document No. 20 and 36 which provide guidance on exemptions to the environmental objectives of the Water Framework Directive.*
- ***CPO 13.2:*** *To prevent development that would pollute water bodies and in particular, to regulate the installation of effluent storage and disposal systems in the vicinity of natural water bodies or development that would exacerbate existing underlying water contamination.*
- ***CPO 13.3:*** *To minimise alterations or interference with river / stream beds, banks and*

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channels, except for reasons of overriding public health and safety (e.g. to reduce risk of flooding); a buffer of generally 25m along watercourses should be provided (or other width, as determined by the Planning Authority having particular regard to 'Planning for Watercourses in the Urban Environment' by Inland Fisheries Ireland for urban locations) free from inappropriate development, with undeveloped riparian vegetation strips, wetlands and floodplains generally being retained in as natural a state as possible.

- ***CPO 13.5:*** *To ensure compliance with and to implement the provisions of the Nitrates Directive in so far as it falls within the remit of the Council to do so.*
- ***CPO 13.6:*** *To encourage and promote the use of catchment-sensitive farming practices, in order to meet Water Framework Directive targets and comply with the River Basin Management Plan.*
- ***CPO 13.7:*** *To support and facilitate projects and programmes that aim to improve scientific knowledge and public awareness of the importance of natural water quality, and in particular to support the LAWPRO programme in County Wicklow and adjoining counties as appropriate.*

Water Services Policy Objectives – Water Supply:

- ***CPO 13.9:*** *To protect existing and potential water resources of the County, in accordance with the EU Water Framework Directive, the River Basin Management Plans, the Groundwater Protection Scheme and source protection plans for public water supplies.*
- ***CPO 13.10:*** *To require new developments to connect to public water supplies where services are adequate or where they will be provided in the near future, or where extension of an adjacent water supply system is technically and environmentally feasible.*
- ***CPO 13.11:*** *Where connection to an existing public water supply is not possible, or the existing supply system does not have sufficient capacity, the provision of a private water supply will be only permitted where it can be demonstrated that the proposed water supply meets the standards set out in EU and national legislation and guidance, would not be prejudicial to public health, would not impact on the source or yield of an existing supply, particularly a public supply or would not adversely affect the ability of water bodies to meet the objectives of the Water Framework Directive. Private water supplies for multi-house developments will not be permitted.*

Water Services Policy Objectives – Water Demand:

- ***CPO 13.14:*** *To require all new developments to integrate water demand reduction designs and technologies in all aspects of the development including but not limited to:*

  a) Installation of water efficient equipment;
  b) Provision of dual flush toilets, cistern bags or other similar technologies;
  c) Construction of grey water systems to allow for the re-use of wastewater from sinks, shower drains or washing machines;
  d) Provision of rainwater harvesting equipment;
  e) The use of low maintenance plants in the design of landscaping; […]

Water Services Policy Objectives – Waste Water:

- ***CPO 13.19:*** *Where any application for a private treatment plant would require a discharge licence under the Water Pollution Acts, a simultaneous application for same shall be required to be made when submitting the planning application.*

Water Services Policy Objectives – Storm & Surface Water Infrastructure:

- ***CPO 13.20:*** *Ensure the separation of foul and surface water discharges in new*

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developments through the provision of separate networks.

- ***CPO 13.21:*** *Ensure the implementation of Sustainable Urban Drainage Systems (SUDS) in accordance with the Wicklow County Council SuDS Policy to ensure surface water runoff is managed for maximum benefit. In particular to require proposed developments to meet the design criteria of each of the four pillars of SuDS design; Water Quality, Water Quantity, Amenity and Biodiversity.*
- ***CPO 13.22:*** *To promote the use of green infrastructure, such as swales and wetlands, where feasible as landscape features in new development to provide storm / surface runoff storage and reduce pollutants, as well as habitat, recreation and aesthetic functions.*

Energy Infrastructure & Communications Policy Objectives – General:

- ***CPO 16.01:*** *To support and facilitate to the highest degree possible the development of alternative and renewable sources of energy, particularly in the generation of electricity / heating and for use as transport fuel.*
- ***CPO 16.02:*** *To support and facilitate the co-location of renewable energy developments and technologies to ensure the most efficient use of land identified as suitable for renewable energy generation.*
- ***CPO 16.03:*** *To support and promote the development of 'Sustainable Energy Communities' and in particular to encourage and facilitate developments that are energy neutral / low emission, integrate renewable energy technology or involve local renewable energy production.*

Energy Infrastructure & Communications Policy Objectives – Bio-Energy:

- ***CPO 16.13*** *To facilitate the development of projects that convert biomass to gas or electricity, subject to demonstration that such projects are resource efficient having regard to carbon emissions resulting from the growth, harvesting and transport of inputs, and do not result in unsustainable climate damaging agricultural intensification.*
- ***CPO 16.14:*** *Other than biomass installations that are location specific to the rural area, biomass conversion installations / facilities shall be located on suitable zoned industrial land in settlements.*

Energy Infrastructure & Communications Policy Objectives – Transmission & Distribution:

- ***CPO 16.19:*** *To facilitate planned growth and transmission / distribution of a renewable energy focused electricity generation across the main demand centres.*

Natural Heritage & Biodiversity Policy Objectives – Water Systems:

- ***CPO 17.24:*** *To ensure and support the implementation of the EU Groundwater Directive and the EU Water Framework Directive and associated River Basin and Sub-Basin Management Plans and Blue Dot Catchment Programme, to ensure the protection, improvement and sustainable use of all waters in the County, including rivers, lakes, ground water, coastal and estuarine waters, and to restrict development likely to lead to a deterioration in water quality. The Council will also have cognisance of, where relevant, the EU's Common Implementation Strategy Guidance Documents No. 20 and 36 which provide guidance on exemptions to the environmental objectives of the Water Framework Directive.*
- ***CPO 17.26:*** *Protect rivers, streams and other water courses by avoiding interference with river / stream beds, banks and channels and maintaining a core riparian buffer zone of generally 25m along watercourses (or other width, as determined by the Planning Authority having particular regard to 'Planning for Watercourses in the Urban Environment' by Inland*

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Fisheries Ireland for urban locations) free from inappropriate development, with undeveloped riparian vegetation strips, wetlands and floodplains generally being retained in as natural a state as possible. Structures such as bridges should be clear span and designed and built in accordance with Inland Fisheries Ireland guidance.

8.4.6 Biological Water Quality

National surveys of Irish rivers have taken place on a continuous basis since 1971. The National Rivers Monitoring Programme was replaced by the Water Framework Monitoring Programme from 22 December 2006. As part of the Water Framework Directive (WFD) Monitoring Programme approximately one third of our major rivers and their more important tributaries are surveyed and assessed each year by EPA ecologists. A complete survey cycle is completed every three years. The sites are scored on a five-point system developed by the EPA called the Biological Q-Rating system. Macroinvertebrate data is utilised to ascertain the biological quality of a given river or stream as detailed in **Table 8.2** at the beginning of this chapter.

Several EPA monitoring stations are located along the Avoca River and its tributaries in the vicinity of Arklow Town that are relevant to the proposed site. However, complete physico-chemical and biological water quality datasets are available only for monitoring stations situated on the Ballyduff Stream, the Gold Mine River, and the Aughrim River, tributaries of the Avoca River. For the Avoca River itself, updated data is limited to a station *ca.* 4 km upstream of its confluence with the Gold Mine River. No recent data is available for downstream sections of the Avoca River, including those downstream of its confluence with the Ballyduff Stream. Also, there is no data availability for the Ballyduff Stream upstream of the Proposed Development.

Table 8.5 overleaf provides details of the monitoring stations near the Proposed Development, including their associated Q-Ratings, while their locations relative to the site are shown in **Figure 8.11** overleaf.

Table 8.5: Biological Q-Ratings for waterbodies hydraulically connected to the River Avoca (EPA)

Station ID (EPA)	Station Name	Year								
		1971-2000	2003	2006	2009	2012	2015	2018	2020	2024
RS10G040290	GOLD MINE - u/s Clonwilliam Branch	4-5	-	-	-	-	-	-	-	-
RS10G040500	Br u/s Aughrim R confl	3	3-4	5	4	4	4	4-5	4-5	4-5
RS10A020400	Wooden Br	4	4	4	4	3-4	3-4	3-4	4	4
RS10A030700	Avoca Br	1/0	-	4	-	3/0	3/0	2/0	3/0	3/0
RS10A030800	AVOCA - At Woodenbridge Golf Club	1/0	-	-	-	-	-	-	-	-
RS10A030900	AVOCA - Footbr 0.5km d/s Aughrim R	1/0	-	-	-	-	-	-	-	-
RS10A031000	AVOCA - At Shelton Abbey (u/s I.F.I.)	2/0	-	-	-	-	-	-	-	-
RS10A031200	AVOCA - Arklow Br	1/0	-	-	-	-	-	-	-	-
RS10B010200	Ballyduff Br	3/0	3-4*	3-4	3-4*	3	3*	3*	3-4*	3

* Values are based primarily on the relative proportions of pollution sensitive to tolerant macroinvertebrates (the young stages of insects primarily but also snails, worms, shrimps etc.) resident at a river site.

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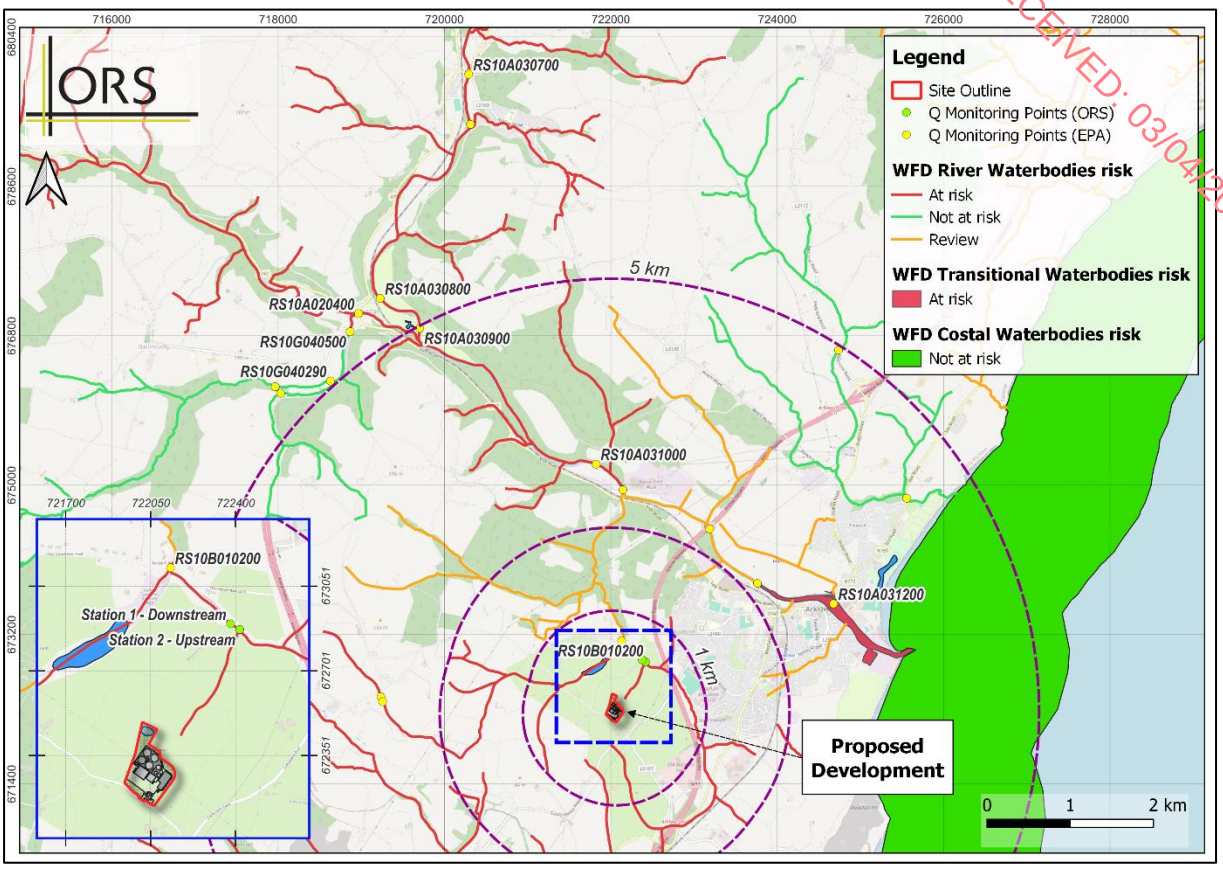

Figure 8.11: Water Framework Directive Risk and locations of water quality monitoring stations (EPA maps)

The **RS10G040290** and **RS10G040500** water monitoring stations are located on the Gold Mine River upstream of the point of hydrological connectivity between the Ballyduff Stream and the River Avoca, at hydrological distances of *ca.* 8 km and 7.4 km, respectively. The **RS10G040290** station has no recent Q-Rating, with the last recorded value of 4-5 dating back to 2000. In contrast, the **RS10G040500** station has a more extensive dataset, having been monitored consistently during every monitoring cycle since 1990. The most recent Q-Rating for this station, recorded in June 2024, was 4-5, indicating a 'High' status under the Water Framework Directive (WFD) and classifying the water as 'Unpolluted' according to EPA standards, reflecting a satisfactory condition.

Similarly, the **RS10A020400** monitoring station, situated on the River Aughrim (a tributary of the River Avoca) *ca.* 7 km upstream of the point of hydrological connectivity between the Ballyduff Stream and the River Avoca, has been consistently monitored in every cycle since 1977. In 2024, it recorded a Q-Rating of 4, indicating a 'Good' status under the Water Framework Directive (WFD) and an 'Unpolluted' classification by the EPA, reflecting that the water is in a satisfactory condition.

As previously noted, the monitoring stations on the River Avoca near the proposed site have not been included in the most recent monitoring cycles. The stations **RS10A030800**, **RS10A030900**, **RS10A031000**, and **RS10A031200**, located approximately 7 km, 6.4 km, 3.4 km upstream and 6 km downstream from the site, were last monitored in 1990, 1994, 1986, and 1990, respectively. The recorded Q-Ratings highlighted the degraded state of the River Avoca, ranging from 1/0 to 2/0, indicating a 'Bad' WFD Status and a seriously polluted ecosystem. The suffix 0 further reflects the apparent or suspected presence of toxic effects in the water.

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In contrast, the **RS10A030700** station, located *ca.* 9.3 km upstream, has extensive data records, with Q-Ratings measured during every monitoring cycle since 1974, except for 1997 and 2003. The **RS18F050100** station has demonstrated a notable improvement in biological water quality in the River Avoca upstream of its confluence with the River Aughrim over the years. Q-Ratings ranged from 1/0 before 2000 to 4 in 2006 and 2010. The most recent rating, however, was 3/0, corresponding to a 'Moderate' WFD status and a 'Slightly Polluted' classification, which remains unsatisfactory by EPA standards. While toxic effects appear to persist in the River Avoca, the improvement observed at this station may have a positive influence on downstream stations, especially considering the 'Good' WFD status of the River Aughrim as recorded by the **RS10A020400** station.

Finally, the closest monitoring station to the site, the **RS10B010200** station (*ca.* 740 m downstream), shows a consistency in water quality at the Ballyduff Stream. Q-Ratings have varied slightly from 3 to 3-4 across different monitoring cycles. The latest available data, a '3' rating in 2024, indicates a 'Poor' WFD status and a classification of 'Moderately polluted', standing as unsatisfactory condition as per EPA standards.

The River Avoca, both upstream and downstream from the site (EPA designations: Avoca_020 and Avoca_030), is classified as 'Moderate' under the Water Framework Directive (WFD) and is not considered at risk. The 3rd Cycle Draft Ovoca-Vartry Catchment Report (HA 10), published in 2024, identifies a polluted site (historic mines) as the primary pressure on the River Avoca. Additionally, the Ovoca Vartry Catchment Assessment 2010-2015 (HA 10) highlights other significant pressures, including industrial discharge and urban wastewater.

The Ballyduff Stream (EPA designation: BALLYDUFF STREAM (WICKLOW)_010) is also classified as 'Moderate' under the WFD Status 2016-2021, but it is considered to be "At Risk," reflecting concerns about its ecological and chemical health. According to the 3rd Cycle Draft Ovoca-Vartry Catchment Report (HA 10), the primary pressure affecting the stream is attributed to agricultural activities. Other relevant source of pollution, as identified in the Ovoca Vartry Catchment Assessment 2010-2015 (HA 10), is Urban Waste Water.

Based on the available data, waterbodies near the site have exhibited slight fluctuations in quality over multiple monitoring cycles, ranging between Poor and Moderate status. Notably, the Ballyduff Stream showed a slight improvement in water quality during the previous monitoring cycle. However, the most recent data collected in 2024—excluded from the EPA assessment published in May 2024—indicates a return to Poor status, suggesting a potential decline from the earlier improvement.

8.4.6.1 On-Site Q-Value Assessment

An evaluation of water monitoring stations hydrologically of relevance to the proposed site revealed a lack of biological Q-value data and physico-chemical data for the receiving waterbodies, the Rooaun 10 and Moneylane 10 streams. To address these data deficiencies, ORS conducted a site assessment on November 1st, 2024. A Q-value assessment was performed on the Moneylane 10 Stream; it was not possible to conduct a similar assessment on the Rooaun 10 Stream due to its dry conditions during the site visit.

Sampling was conducted at 2 sites along the Moneylane Stream, at Arklow, County Wicklow, both upstream & downstream of the hydrological point of connectivity with the Proposed Development. The samples were collected using kick sampling with a sweep net and of standard 1mm fine mesh to catch invertebrates. At each station, three samples were taken to provide a representative profile of each river section. Vegetative characteristics, including macrophytes, were compiled during sampling to provide additional ecological context. Substrate composition and water body characteristics including flow type, and water depth and

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width were also measured. Collected specimens were identified to the lowest taxonomic level possible using a taxonomic key and stereoscopic microscope, following standard procedures. Q-values were assigned to identified taxa based on their sensitivity to pollution.

The location of the sampling points can be seen on **Figure 8.11**, while the results of the Q-value assessment are presented in **Table 8.6**. The full Q-value Assessment report is presented in **Appendix 8.1**.

Table 8.6: Biological Q-Ratings for the Moneylane Stream both upstream and downstream from the hydrological connection with the Proposed Development

ORS monitoring points	Q-Value	Ecological Status
Station 1 – Downstream	Q3	Poor
Station 2 – Upstream	Q4	Good

A Q-value of ***Q4*** has been assigned to the upstream sample, the rationale being that taxonomic indicator group **B** were *dominant* in the sample, showing as 69% of the total sample. The second highest proportion of taxa were represented by indicator groups **C** and **D**, with a status of *common* respectively. Indicator group **C** accounted for 12% of the sample (Common) and indicator group **D** represented 17% of the sample. The Upstream sample therefore has a WFD status of “Good”, a Pollution Status of “Unpolluted”, and a Condition rating of “Satisfactory”. A Q-Value of Q3 has been assigned to the Downstream site 1 sampling location, the rational being that taxonomic indicator group D (very tolerant) were present and “dominant” where they represented 73% of the overall sample. The taxonomic group C (tolerant) were present and numerous making up 27% of the kick sample. Downstream site 1 has a WFD status of “Poor”, a pollution status of “Moderately Polluted”, and a condition of Unsatisfactory.

8.4.7 Hydrochemistry Data

ORS attended site on the January 13th, 2025, and obtained baseline samples along the Moneylane Stream upstream (U/S) and downstream (D/S) of the Proposed Development (locations of the sample points are shown in **Figure 8.12** overleaf). Samples were sent to an accredited laboratory (Fitz Scientific), and results are presented in **Table 8.8** overleaf.

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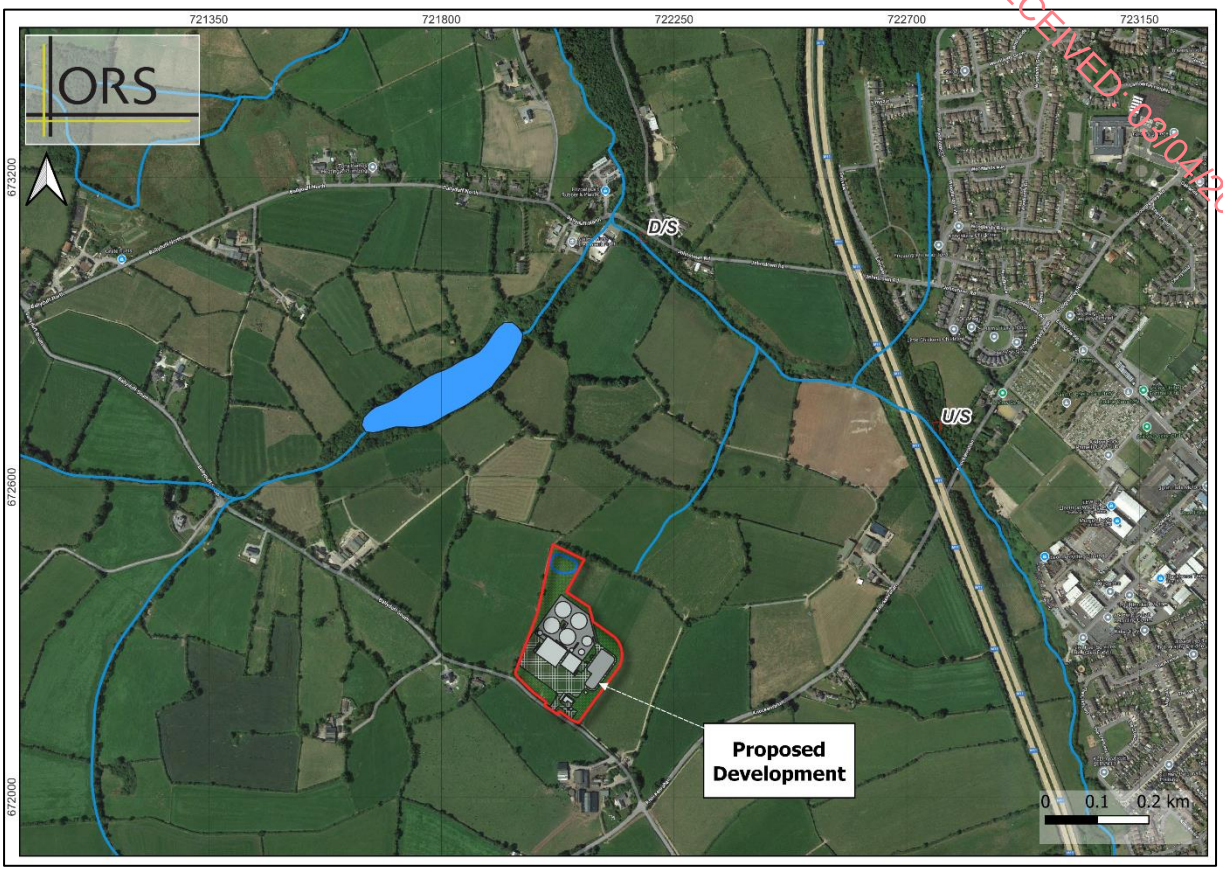

Figure 8.12: Water sample locations.

Table 8.7: Hydrochemistry results

Sampling Location	Parameter	Unit	Result
Moneylane, Arklow (U/S)	Ammonia	mg/l as N	0.06
	BOD	mg/l	1.0
	COD	mg/l	<5
	Nitrogen (Total Oxidised)	mg/l as N	2.86
	Nitrate (Surface Water)	mg/l as N	2.83
	Nitrite (Surface Water)	Mg/l as N	0.028
	pH	pH units	7.69
	Phosphate (Ortho) Surface Water	mg/l as P	0.08
	Total Suspended Solids	mg/l	<5
Moneylane, Arklow (D/S)	Ammonia	mg/l as N	0.09
	BOD	mg/l	1.1
	COD	mg/l	<5
	Nitrogen (Total Oxidised)	mg/l as N	2.93
	Nitrate (Surface Water)	mg/l as N	2.9
	Nitrite (Surface Water)	Mg/l as N	0.027
	pH	pH units	7.68
	Phosphate (Ortho) Surface Water	mg/l as P	0.08
	Total Suspended Solids	mg/l	<5

These results indicate that the Moneylane Stream exceeds the threshold for achieving a "Good" status under the Water Framework Directive (WFD). This finding aligns with the most recent WFD assessment, which classified the stream as having a "Moderate" status and designated it as "At Risk." To ensure a comprehensive evaluation of local water quality and to assess the potential impacts of the Proposed Development on the receiving hydrological

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environment, hydrochemical data from the Ballyduff Stream downstream of its confluence with the Moneylane Stream (Monitoring Station: **RS10B010200**) was considered in the analysis along with the results from the site-specific samples collected by ORS.

This combined dataset, incorporating select EPA parameters and ORS-collected samples, offers a comprehensive basis for evaluating water quality. An overview of the Ballyduff Stream is presented in **Table 8.9**.

Table 8.8: Description of Receiving Waters – BALLYDUFF STREAM (WICKLOW)_010 (Catchments.ie)

Characteristic	Classification	Status	Interpretation
Receiving Waterbody Name	BALLYDUFF STREAM (WICKLOW)_010	At risk	Receiving Waters include AVOCA_030, which have a Moderate WFD Status, and it is not considered to be at risk. The waterbody does not contain any data for 'Inputting Waterbody'.
Waterbody Type	River	-	-
WFD Status	SW 2016-2021	Moderate	The waterbody demonstrates an improvement in water quality compared to the previous monitoring cycle (2013–2018), during which it was classified as 'Poor.' However, its historical data indicates persistent pollution issues since the initiation of monitoring. As per past Catchment Reports, the Ballyduff Stream (Wicklow)_010 is highly impacted by both the Arklow Wastewater Treatment Plant (WWTP) and the associated agglomeration network along with the agricultural activities in the surrounding area.
Resource	Not Classified		No drinking water abstractions and no abstractions pressures registered for Ballyduff Stream, despite the presence of the Arklow WTP along its course.
Hydromorphological Conditions	Not classified	N/A	Hydromorphological Conditions is not included in the Planned Monitoring for this station.
Chemical SW Status	Not classified	N/A	Chemical Surface Water Status is not included in the Planned Monitoring for this station.
Biological Status	Macrophyte Status or Potential	N/A	The Ballyduff Stream has been tested for Invertebrate Status or Potential once every three years. The waterbody has presented an improvement in relation to last monitoring cycles, where the Invertebrate Status or Potential has been classified as Poor in three consecutive analyses. Macrophyte, Phytobenthos, and Fish Status are not included in the Planned Monitoring for this station.
	Invertebrate Status or Potential	Moderate	
	Phytobenthos Status or Potential	N/A	
	Fish Status or Potential	N/A	
Supporting Chemistry Conditions	Oxygenation Conditions	High	DO status: High Ammonia-Total (as N) has a 'Moderate' indicative quality. While this parameter has experienced fluctuations over the years, it

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Characteristic	Classification	Status	Interpretation
	Nitrogen	Moderate	has shown a downward trend since 2015, even recording levels below the threshold for good quality status at times. However, the most recent sample, collected in 2021, still classified the quality as moderate, with ammonia levels reaching 0.110 mg N/l—nearly double the threshold for good quality (0.065 mg N/l). Total Oxidised Nitrogen (as N) reflects a 'Moderate' indicative quality. After a decline in concentration from 2007 to 2015, an upward trend has since been observed. However, the most recent sample showed a slight decrease in 2021, dropping from 4.880 mg N/l in 2020 to 4.120 mg N/l. Despite this decrease, the levels remain well above the threshold for good quality (1.800 mg N/l). Orthophosphate (as P) reflects a 'Bad' indicative quality. This parameter has consistently exhibited unsatisfactory quality over the years. After a decline from 2010 to 2013, it peaked in 2015 with levels reaching 0.174 mg P/l, well above the threshold for good quality (0.025 mg P/l). Since then, the parameter has shown significant fluctuations, with the most recent measurement in 2021 recording 0.149 mg P/l. The levels remain far above the acceptable limit for good quality and are trending upwards. Specific Pollutant Conditions is not included in the Planned Monitoring for this station.
	Phosphorus	Moderate	
	Other Nutrients	Moderate	
	Specific Pollutant Conditions	N/A	

8.4.8 Hydrogeology

Regional & Local Hydrogeology

Hydrogeology is the study of groundwater, including its origin, occurrence, movement and quality. Rocks which store and transmit groundwater are known as bedrock aquifers. Different bedrock types have differing abilities to store and transmit water, depending on their permeability and fracture intensity. The Geological Survey of Ireland has classified all aquifers in Ireland in three main categories based on potential yield and extent:

- Regionally Important
- Locally Important
- Poor

County Wicklow has limited groundwater resources, with no regionally significant aquifers. Despite this, groundwater plays a crucial role in the county's water supply, supporting various small to medium-sized public schemes, which account for 15% of the county's total public

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water consumption, along with numerous private rural systems. The most productive aquifers are found in sand and gravel deposits in the northeast and northwest. Over half of the county's rock formations are classified as "Poor Aquifers," where the bedrock is generally unproductive except in localised areas, while approximately 40% are categorised as "Locally Important Aquifers," which are moderately productive in specific zones.

The remaining aquifer types include "Poor Aquifer – Bedrock generally unproductive" (Pu), covering 3.3%, and "Locally Important Aquifer – Sand/Gravel" (Lg), comprising 2.2% of the area. In the southern region, Ll aquifers dominate, with only one local gravel aquifer, while the northern region is primarily characterised by Pl aquifers and several local gravel aquifers. Over 90% of the county experiences high or extreme groundwater vulnerability due to the shallow nature of subsoils, with moderate and low vulnerability areas being rare.

Despite its vulnerability, County Wicklow's groundwater is generally of good quality, though localised pollution occurs, primarily from point sources like farmyards, septic tanks, and poorly protected wells. Contaminants include faecal bacteria and nitrates. The groundwater's hydrochemistry is shaped by the non-limestone bedrock geology, resulting in water that is soft to moderately hard and calcium bicarbonate in type. Softer water is typically found in the upland areas of central Wicklow.

The subject site is located above the Wicklow Groundwater Body, which spans 1,396 km² in both County Dublin and County Wicklow and is classified into three primary aquifer categories as per the Wicklow GWB: Summary of Initial Characterisation (GSI). These categories are:

- ***Ll:*** *Locally important aquifer, moderately productive only in local zones*
- ***Pl:*** *Poor aquifer, generally unproductive except for local zones*
- ***Pu:*** *Poor aquifer, generally unproductive*

The proposed site is located entirely within a ***Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones (Ll)*** area, as shown in **Figure 8.13** overleaf.

The Wicklow GWB is predominantly underlain by low-permeability bedrock, with localised zones of enhanced permeability associated with fractures, joints, and major fault systems. Permeability is generally highest near the surface and decreases with depth. As a result, the majority of groundwater flow is confined to a shallow, weathered upper zone, with deeper flow restricted to areas exhibiting significant structural deformation. Groundwater movement at depths exceeding 30 meters is limited and occurs only along isolated fractures.

Groundwater flow is predominantly local in scale, as indicated by drainage density patterns that suggest shorter flow paths in granitic areas compared to the flatter Lower Paleozoic formations. Regional flow paths are unlikely to develop due to the limited transmissivity of the underlying rocks, with typical flow paths extending only a few hundred meters before discharging to the nearest surface water feature.

Recharge occurs diffusely through subsoils and exposed rock outcrops. The aquifers are generally unconfined but may become locally confined where subsoils are thicker or of lower permeability. Groundwater discharges to numerous small streams that intersect the aquifer, as well as to springs, seeps, and directly into the Irish Sea. The boundaries of this GWB align with

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those of Hydrometric Area 10.

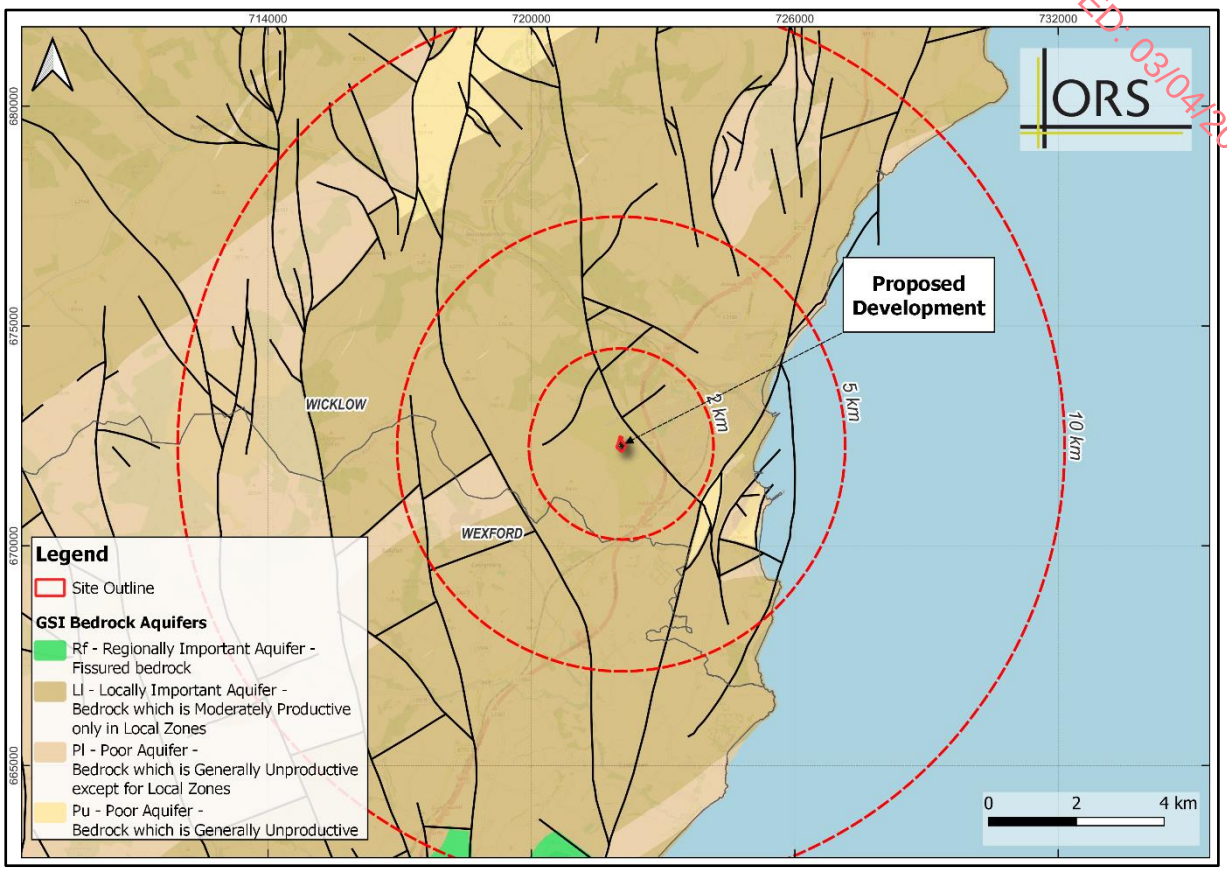

Figure 8.13: Groundwater Bodies & Aquifer Types in site locality. (GSI Maps)

The proposed site predominantly features moderately permeable subsoil overlain by poorly drained soil, corresponding to Hydrogeological Setting 3.iii. In contrast, a smaller area along the southern boundary is characterised by wet soils overlying moderately permeable subsoil, classified as Hydrogeological Setting 2.vi. The average annual recharge varies across the site, with the southern portion receiving 142 mm, while the rest of the site has a more restricted recharge rate of 95 mm.

Groundwater vulnerability is influenced by factors such as subsoil, recharge type (point or diffuse) and thickness of the unsaturated zone, through which potential contaminants can move. The Geological Survey of Ireland (GSI) uses a matrix comprising four categories - extreme, high, moderate and low - for mapping purposes and in the assessment of risk to groundwater. These categories are determined by the thickness of the overburden, as shown in **Table 8.10**, which acts as a barrier to contaminants moving toward the groundwater table. For instance, when the overburden is less than 3 m thick, the vulnerability is classified as extreme, indicating a very high risk of contamination reaching the aquifer. Conversely, with an overburden greater than 10 m thick and low permeability, vulnerability is considered low.

In County Wicklow, groundwater vulnerability is predominantly classified as Extreme or High, with smaller areas of Moderate to Low vulnerability. The highest vulnerability is typically associated with areas where bedrock is exposed or near the surface, primarily in the upland regions, while Moderate to Low vulnerability is more common in lowland areas along the coastline. Based on the proposed site's topography, groundwater vulnerability is classified as

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Moderate across the majority of the area, with a small section along the southern boundary exhibiting High vulnerability. For further detail, refer to **Figure 8.14**.

Table 8.9: Vulnerability Mapping Criteria

Subsoil Thickness	Hydrogeological Requirements				
	Diffuse Recharge (Subsoil Permeability & Type)			Point Recharge	Unsaturated Zone
	High (Sand & Gravel)	*Moderate (Sandy Subsoil)*	*Low (Clay & Peat)*	*Swallow Holes*	*Sand & Gravel Aquifers*
0-3m	Extreme	Extreme	Extreme	Extreme (30m radius)	Extreme
3-5m	High	High	High	N/A	High
5-10m	High	High	Moderate	N/A	High
>10m	High	Moderate	Low	N/A	High

There are no groundwater wells located within the boundaries of the proposed site or within a 500-meter radius. However, the GSI database identifies 27 no. groundwater wells within a 2 km radius of the site, the majority of which are boreholes. These wells exhibit a diverse range of yield classifications: 13 are classified as *poor yielding*, 6 as *good yielding*, 3 as *excellent yielding*, 3 as *moderately yielding*, and 2 are not classified. Where specified, the primary use of these wells is for domestic purposes. The depth to bedrock for these wells ranges from 0.9 to 15.5 mbgl, while their overall depths vary between 1.5 and 120 mbgl. A detailed summary of this data is provided in **Table 8.10**, and the locations of these wells in relation to the proposed site are illustrated in **Figure 8.14**.

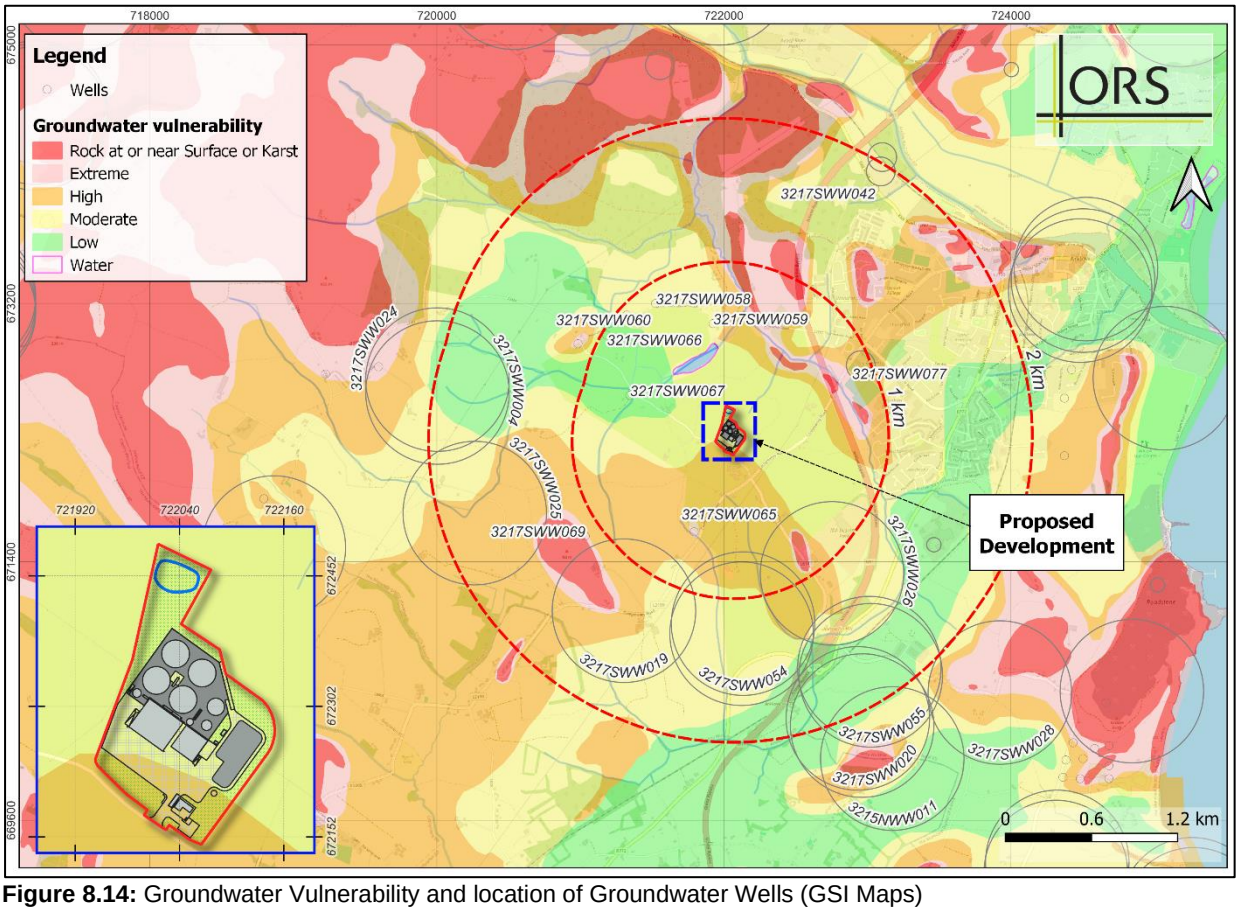

Figure 8.14: Groundwater Vulnerability and location of Groundwater Wells (GSI Maps)

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Table 8.10: Groundwater Wells with 2km of the site (GSI Well Database)

GSI Reference	Easting, Northing	Well Type	Depth (mbgl)	DTB* (mbgl)	Well use	Yield (m3/d)	Proximity to the site
3217SWW065	323180, 174180	Borehole	91.4	7.5	n/a	287	530m SE
3217SWW059	323130, 173960	Borehole	91.4	7.5	n/a	151	570m N
3217SWW026	321400, 173080	Borehole	35.7	9.2	Domestic use only	38	580m SE
3217SWW102	323540, 171480	Borehole	61	3	Agri & domestic use	21.8	590m S
3217SWW067	321060, 172880	Borehole	91.4	15.5	n/a	314.2	670m W
3217SWW054	321600, 173160	Dug well	1.5	n/a	n/a	n/a	680m S
3217SWW021	322000, 173020	Borehole	21.6	2.4	Domestic use only	22	735m S
3217SWW019	322440, 171660	Dug well	4.2	n/a	n/a	n/a	820m SW
3217SWW077	321260, 172940	Borehole	48.7	n/a	Domestic use only	80	830m NE
3217SWW058	321420, 172520	Borehole	91.4	7.5	n/a	347.3	890m NW
3217SWW060	323170, 174080	Borehole	73.2	9	n/a	440	930m NW
3217SWW066	321110, 171540	Borehole	91.4	12.5	n/a	400	950m NW
3217SWW068	322210, 170930	Borehole	91.4	3	n/a	628.4	1.1km NW
3217SWW069	321380, 171020	Borehole	n/a	n/a	Domestic use only	275	1.1km SW
3217SWW018	323090, 170620	Borehole	13.7	1.2	Domestic use only	38	1.3km SE
3217SWW055	323040, 170220	Borehole	34.4	15.2	n/a	55	1.3km SE
3217SWW025	323010, 170270	Borehole	31.1	12.2	n/a	49	1.3km W
3217SWW020	322200, 170860	Borehole	21.3	6.7	Domestic use only	27	1.5km SE
3217SWW076	324000, 170450	Borehole	76.2	n/a	Industrial use	20	1.5km SE
3217SWW004	320080, 172630	Borehole	33.5	6.1	Domestic use only	38	1.5km W
3217SWW024	323250, 169990	Borehole	26.8	0.9	Domestic use only	22	1.5km W
3217SWW017	320340, 171700	Borehole	21.3	6.7	Domestic use only	27	1.6km SE
3217SWW042	320080, 172540	Borehole	61	n/a	Domestic use only	35	1.8km NE
3217SWW040	323100, 170570	Borehole	120	4.5	Other	3	1.8km NE
3217SWW041	322830, 171280	Borehole	61	12	Industrial use	120	1.9km NE
3215NWW011	323030, 172730	Borehole	27.4	n/a	Domestic use only	20	1.9km SE
3217SWW028	321870, 171570	Borehole	22.5	3	n/a	38	2km SE

**DTB – Depth to bedrock*

Karst areas, characterised by unique dissolution landforms, often contain aquifers that are highly susceptible to pollution and can contribute to flooding risks. There are no karstic features located within the site or within its immediate vicinity. Due to the lack of karstified aquifers in County Wicklow, karstic features are not abundant within its area. Only one example of karst landform within the County had been mapped, indicated as a Cave, and it is located in the area of the Deerpark, Ballybawn, *ca.* 39.6km north of the site, as illustrated in **Figure 8.15** overleaf.

Groundwater sources are critical, particularly for public water supply and industrial use. To protect these sources, Source Protection Areas (SPAs) have been established, imposing stricter controls within the Zone of Contribution (ZOC). SPAs are divided into two zones: the Inner Protection Area (SI), which safeguards against immediate human impacts and microbial pollution, and the Outer Protection Area (SO), covering the remainder of the ZOC. According to the GSI Source Protection Area map, no SPAs are located near the proposed site. The closest SPA is the Coolgreany Public Water Supply Scheme (PWS), *ca.* 3.4 km southwest of the site. The location of the nearby SPAs in relation to the Proposed Development can be seen in **Figure 8.15**.

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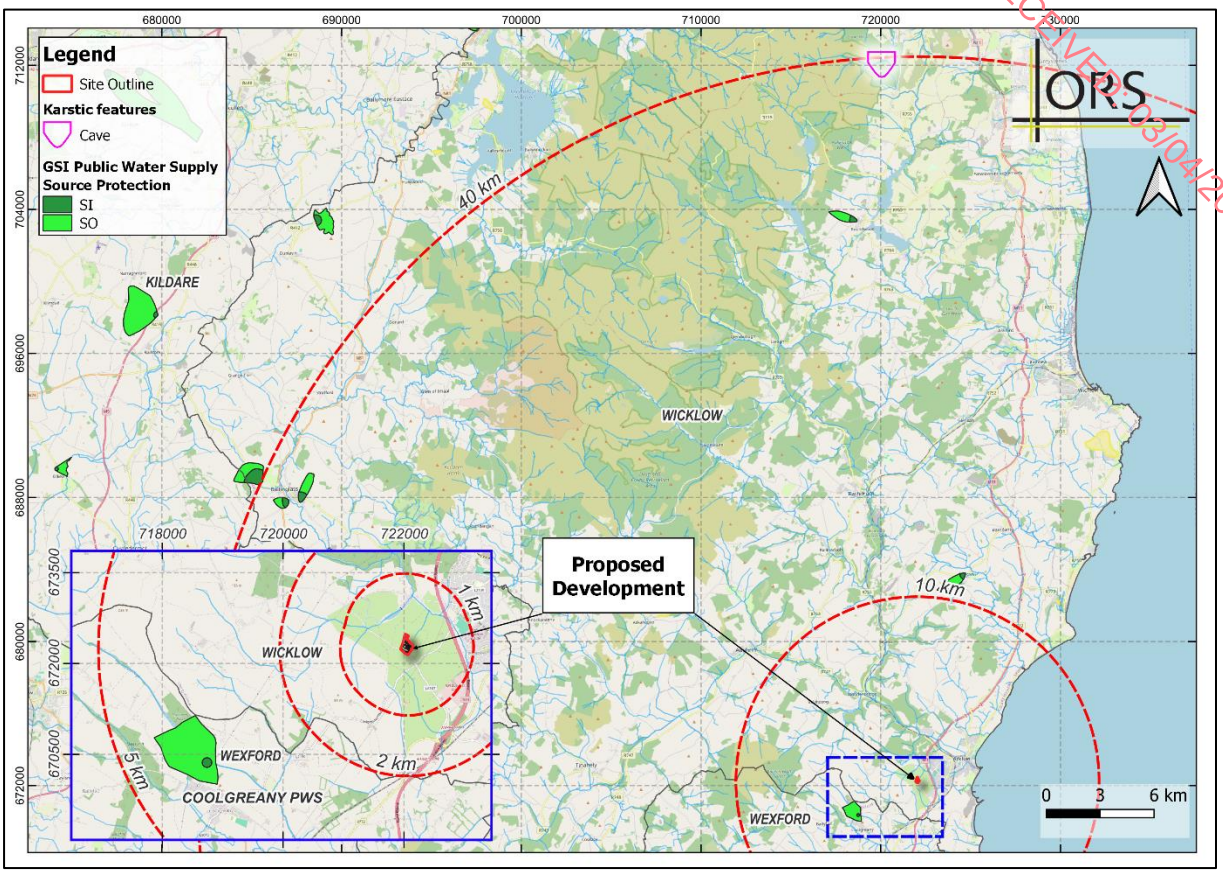

Figure 8.15: Karstic Features and Source Protection Areas (SPAs) location (GSI Maps)

According to the 2016 Drinking Water Audit Report (EPA File Reference: DW2008/431), 3 out of the 14 no. boreholes existent in the Arklow Water Supply Scheme were operational for water abstraction at the time of the audit. The water abstracted from these boreholes is conveyed to the Arklow Water Treatment Plant for treatment and subsequent distribution to the local population. However, there is no indication of the location of these boreholes on the GSI maps, nor is there any documented information regarding potential Source Protection Zones or other safeguarding measures associated with their operation. The only available information concerning the location of these boreholes was provided by Engineers Ireland, which included a sketch of the AWSS upgrade. This can be viewed in **Figure 8.16**.

None of these boreholes are situated within 500 meters of the Proposed Development site. Additionally, they are located on the opposite side of the Ballyduff Stream, which acts as a natural barrier, making it highly unlikely that they would be affected by any potential groundwater contamination. Moreover, the risk of groundwater contamination itself is considered low due to the site's design and mitigation measures (further information available in **Section 8.8**).

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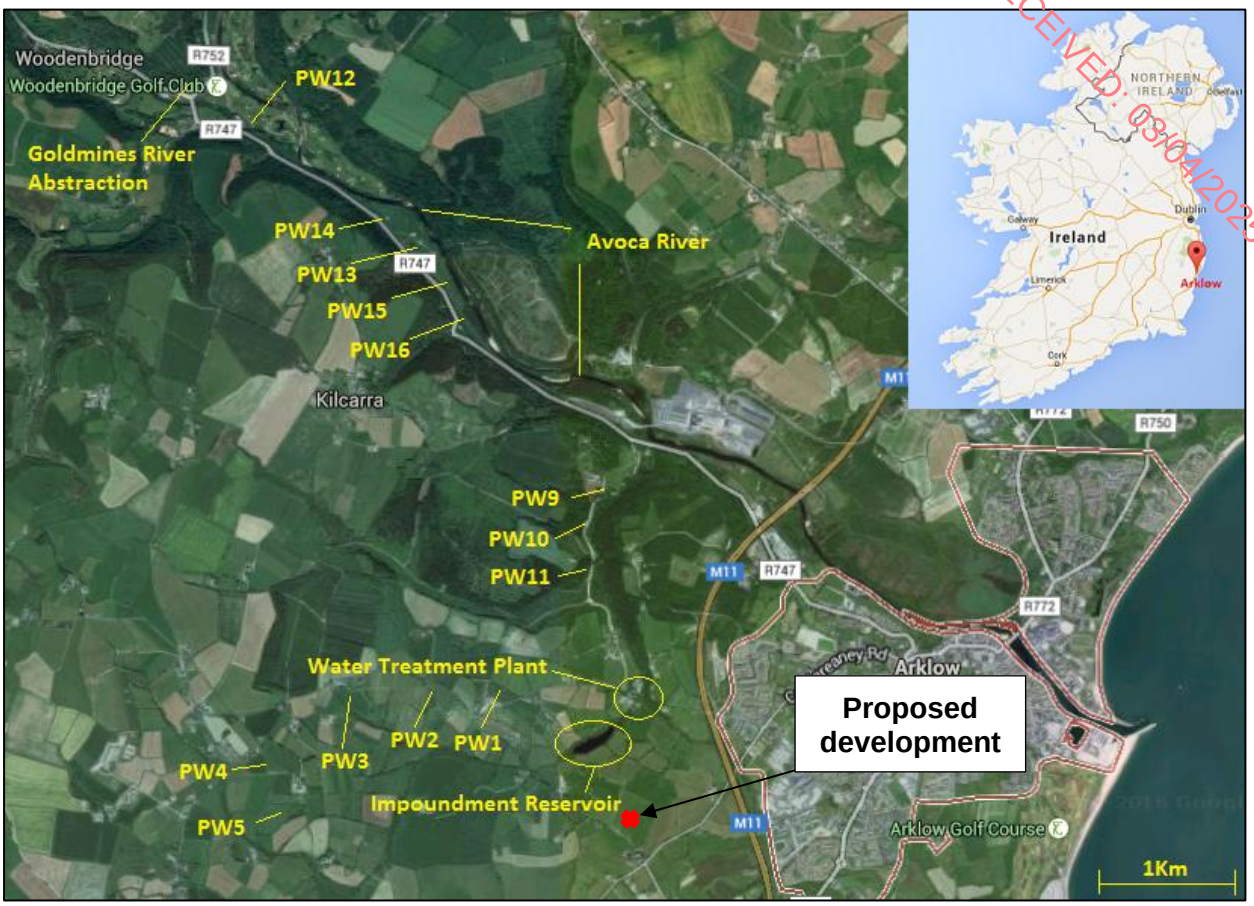

Figure 8.16: Location of the Arklow Water Supply Scheme and associated structures in relation to the Proposed Site (Adapted from Engineers Ireland)

Ground Investigations

Ground investigation works were conducted at the site in Moneylane on October 3rd, 2024, by ORS chartered environmental scientists. These investigations revealed a slight deviation from the general geology and subsoil conditions depicted in geological maps. The topsoil was classified as brown earths with gravelly silty loam characteristics, aligning it with the Clonroche Soil Association. This variance may be due to the generalised nature of the EPA/GIS/Teagasc mapping, as the county has not been fully surveyed, and the results rely on extrapolated soilscapes (Terra Incognita). Other contributing factors could include the resolution limitations of the geological maps and the site's proximity to a transition zone between two soil association areas.

The depths of the trial pits ranged from 2.8mbgl to 3.0mbgl. Bedrock was not encountered in any of the trial pits and is estimated to lie below 4m depth in this area. Groundwater was observed only in TP02, at a depth of 3.0m. TP01 was excavated at the lowest point of the site (46.657m AOD), where the attenuation tank is proposed to be installed to a depth of 2.8mbgl. TP02 and TP03 are situated in the processing area, with elevations of approximately 49.5m AOD and 48.7m AOD, respectively. TP04 is located in the area designated for the reception building, at approximately 49.8m AOD.

The location and depth of the trial pits is shown on **Figure 8.17**, and details of each investigation location is presented in **Table 8.11**.

The trial pits showed slight variations in soil profiles, with topsoil across all pits classified as brown earth, consisting of gravelly silty loam. Subsoil characteristics varied, with TP01 having a

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sand/clay layer, TP02 exhibiting podzolic soils with distinct horizons, and TP03 and TP04 containing gravelly clay or sandy loam with occasional cobbles. TP02 displayed the greatest diversity among subsoil horizons. The underlying soils are mineral-based, derived from non-calcareous materials, overlying Silurian bedrock composed of dark grey slates, shales, and occasional sandstones. Groundwater infiltration was observed in TP04 at 1.8mbgl. Soil depths across the site range from 1.9m to 2.3m, with well-drained, highly permeable soils predominating.

Geoenvironmental Environmental Consultants conducted a site characterisation (percolation) assessment from 16th to 19th November 2024 near the proposed office building location, around **TP-04**, situated on moderately sloped ground. A trial pit was excavated to a depth of 2.1 mbgl, where no bedrock was encountered. The water table was recorded at 1.85 mbgl, with water seepage observed at 1.3 mbgl.

It is important to note that the assessment followed a period of heavy rainfall, which may have influenced groundwater levels. For additional details, please refer to **Appendix 8.2**.

Table 8.11: Ground profile for each Trial Pit

Location	Depth (m)	Ground Profile	Comments
TP 01	0.0-0.7m 0.7-2.0m 2.0-2.8m 2.8m	Brown Earths, - gravelly silty LOAM Lighter SAND/CLAY, occasional subangular gravel and cobbles. Hardpan (iron) layer present and obvious mottling. In summary: Podzolic soils with leached light-coloured sandy layer (A horizon). Accumulation (B horizon) – darker layer throughout due to accumulation of Organic matter & Hardpan Iron oxidised layer. Brown LOAMY/ CLAY soil, granular cobbles (shale) abundant. END OF TP	Trial Pit located at proposed Attenuation Pond area. No GW or Bedrock encountered. Well drained land with obvious leaching and a low water table. Bedrock adjudged to be >4m depth.
TP-02	0.0-0.8m 0.8-1.5m 1.5–2.0m 2.0-2.8m 2.8-3.1m	Brown Earths - gravelly silty LOAM Podzolic soils: A horizon: light coloured orange SAND/ Grey leached light coloured SILT containing gravels. B horizon: Dark OM heavy layer. Podzolic soils – gravelly silt, more subangular cobbles present.	Trial Pit located at proposed Tank Farm Area. No Bedrock encountered. GW Encountered at 3.0mbgl. Well drained land with obvious leaching and perched water table. Bedrock adjudged to be >5m depth.
TP-03	0-0.4 0.4-0.9m 0.9-3.0m 3.0m	Brown Earths - gravelly silty LOAM Lighter gravelly CLAY/SAND - occasional cobble. Ribbon test 12mm – high permeability soils. Hardpan layer present. Dark Brown SILT, subangular Shale. Small boulders present. End of TP	Trial Pit located at centre of site No Bedrock encountered. No GW encountered Well drained land with high permeability soils underlying. Bedrock adjudged to be >3m depth.
TP-04	0.0-0.5m 0.5-1.7m 1.7 -3.0m 3.0m	Brown Earths - gravelly silty LOAM Lighter gravelly SANDY/LOAM - occasional cobble. Ribbon test 18mm – high permeability soils. Dark organic heavy Hardpan layer present. Dark Brown SILT/LOAM – HighD Cobble/small boulder content. End of TP.	Trial Pit located at the proposed office building. No Bedrock encountered. No GW encountered Well drained land with high permeability soils underlying. Bedrock adjudged to be >3m depth.

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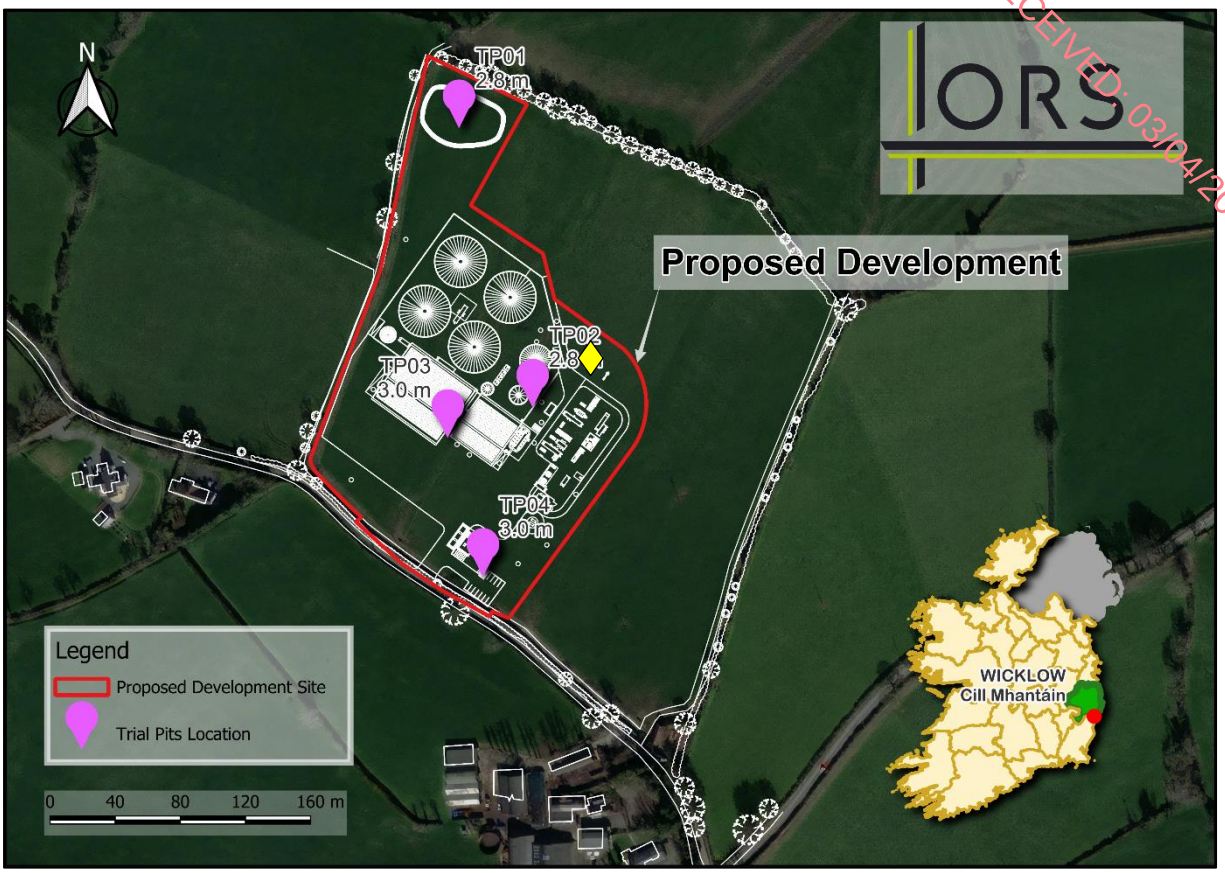

Figure 8.17: Location of Trial Pits (TP) and Site Characterisation Assessment

Wicklow County Development Plan 2022 – 2028 – Groundwater Protection

A review of the Wicklow County Development Plan was carried out to determine the policies and objectives relevant to the preservation and protection of groundwater quality throughout the region. The main policies and objectives of importance to groundwater protection are as follows:

Water Services Objectives – Water Quality:

- ***CPO 13.1:*** *To ensure and support the implementation of the EU Groundwater Directive and the EU Water Framework Directive and associated River Basin and Sub-Basin Management Plans and Blue Dot Catchment Programme, to ensure the protection, improvement and sustainable use of all waters in the County, including rivers, lakes, ground water, coastal and estuarine waters, and to restrict development likely to lead to a deterioration in water quality. The Council will also have cognisance of, where relevant, the EU's Common Implementation Strategy Guidance Document No. 20 and 36 which provide guidance on exemptions to the environmental objectives of the Water Framework Directive.*
- ***CPO 13.4:*** *To ensure that any development or activity with the potential to impact on ground water has regard to the GSI Groundwater Protection Scheme.*

Water Services Objectives – Water Supply:

- ***CPO 13.9:*** *To protect existing and potential water resources of the County, in accordance with the EU Water Framework Directive, the River Basin Management Plans, the Groundwater Protection Scheme and source protection plans for public water supplies.*

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Energy & Infrastructure Objectives – Geothermal:

- ***CPO 16.17:*** *To ensure that any proposal for geothermal technologies or any other subsurface exploration does not impact on groundwater quality.*

Natural Heritage & Biodiversity Objectives – Water Systems:

- ***CPO 17.24:*** *To ensure and support the implementation of the EU Groundwater Directive and the EU Water Framework Directive and associated River Basin and Sub-Basin Management Plans and Blue Dot Catchment Programme, to ensure the protection, improvement and sustainable use of all waters in the County, including rivers, lakes, ground water, coastal and estuarine waters, and to restrict development likely to lead to a deterioration in water quality. The Council will also have cognisance of, where relevant, the EU's Common Implementation Strategy Guidance Documents No. 20 and 36 which provide guidance on exemptions to the environmental objectives of the Water Framework Directive.*

The Wicklow CDP also highlights the Wicklow Groundwater Protect Scheme purpose of preserve the quality of groundwater, particularly for drinking water purposes, for the benefit of present and future generations. The scheme identifies the vulnerability of areas within the County and groundwater protection responses for existing and new potentially polluting activities.

Wicklow County Council Groundwater Protection Scheme (GWPS)

Groundwater protection schemes play a vital role in enabling planning and regulatory authorities to consider both geological and hydrogeological factors when determining the location of developments. As a result, they are a crucial tool in preventing groundwater pollution.

The Geological Survey of Ireland (GSI), the Department of Environment and Local Government (DELG) and the Environmental Protection Agency (EPA) have jointly developed a methodology for the preparation of groundwater protection schemes (DELG/EPA/GSI, 1999). The publication ***Groundwater Protection Schemes*** was launched in May 1999. A groundwater protection scheme has two main components, as illustrated in **Figure 8.18**.

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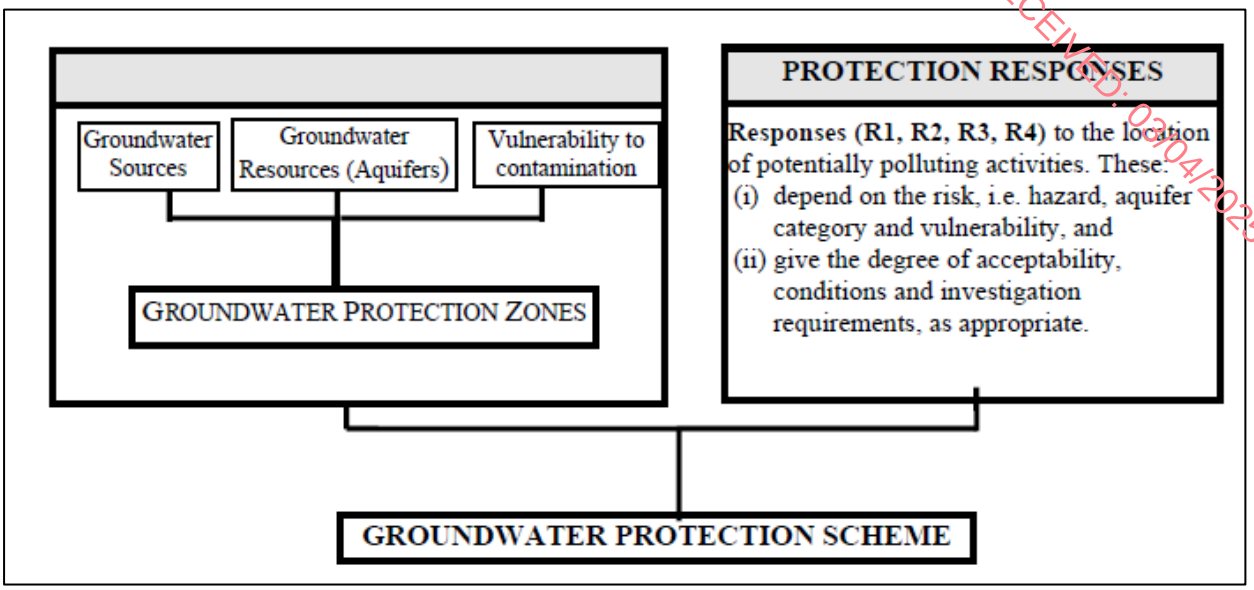

Figure 8.18: Summary of Components of a Groundwater Protection Scheme (WICKLOW COUNTY COUNCIL GROUNDWATER PROTECTION SCHEME, Main Report, 2003).

Land surface zoning provides the general framework for a groundwater protection scheme. The outcome is a map that divides any chosen area into several groundwater protection zones based on the degree of protection required. There are three main hydrogeological elements to land surface zoning:

- Division of the entire land surface according to the vulnerability of the underlying groundwater to contamination.
- Delineation of areas contributing to groundwater sources (usually public supply sources), referred to as source protection areas.
- Delineation of areas based on the value of the groundwater resources or aquifer category, referred to as resource protection areas.

In 2003, Wicklow County Council, together with the Geological Survey of Ireland (GSI), published the County Groundwater Protection Scheme Main Report. The report underscores the critical importance of groundwater protection, highlighting its role in supplying drinking water, sustaining surface water sources, and addressing the challenges posed by its complex interconnections. While the primary focus of the report was groundwater protection, its overarching objective was to collect, compile, and assess all readily available data on geology, hydrogeology, and groundwater quality to facilitate both groundwater resource management and public planning.

Detailed regional hydrogeological investigations in the county were limited to areas around four public supply sources – Blessington, Baltinglass, Roundwood, and Redcross – as well as a study of Brittas Bay. Consequently, the available data are somewhat limited and do not allow for a fully comprehensive assessment of County Wicklow's hydrogeology. However, the report provides a solid basis for strategic decision-making and site-specific investigations.

It is also important to note that, given the report's publication date (2003), some of the information may be outdated. This could explain the absence of data regarding the boreholes used in the Arklow Water Supply Scheme on the GSI maps, which might indicate a potential Source Protection Zone in the area.

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The assessment produced groundwater protection maps by combining vulnerability maps with aquifer maps. Each protection zone on the map was assigned a code representing both the vulnerability of the groundwater to contamination and the groundwater resource (aquifer category). Not all hydrogeological settings are present in County Wicklow, as there are no Regionally Important Aquifers in the county. Additionally, it is estimated that 0.2% of the county is included within Groundwater Source Protection Zones, while approximately 1.2% of the county is occupied by lakes and reservoirs. The groundwater protection codes present in the county, along with the percentage of area occupied by each, are presented in **Table 8.12**.

Table 8.12: Matrix of Groundwater Resource Protection Zones for County Wicklow (based on Wicklow County Council Groundwater Protection Scheme, Main Report, 2003).

Vulnerability Rating	Resource Protection Zones			
	Locally Important Aquifers (L)		Poor Aquifers (P)	
	Lm/Lg	Ll	Pl	PU
Extreme (E)	Lm/E (0.01%)	Ll/E (25.4%)	Pl/E (34.4%)	Pu/E (1.9%)
High (H)	Lm/H (2.1%)	Ll/H (11.1%)	Pl/H (14.2%)	Pu/H (0.7%)
Moderate (M)		Ll/M (2.3%)	Pl/M (2.8%)	Pu/M (0.3%)
Low (L)		Ll/L (2.0%)	Pl/L (1.0%)	Pu/L (0.3%)

Following the classification of the county into the matrix of Groundwater Resource Protection Zones, the assessment determined the Groundwater Protection Responses based on potentially polluting activities and developments, including landfills, landspreading of organic waste, and on-site wastewater treatment systems. For the purposes of the present study, the landspreading of licensable organic wastes is considered the most relevant activity, given the nature of the Proposed Development.

The report highlights that just over one-third of the county is generally suitable for this type of development, primarily due to the typically low subsoil thicknesses. However, an additional portion—approximately 30%—may also be suitable, pending detailed ground investigations and site-specific assessments.

Groundwater Vulnerability Assessment

The site is not located within a Source Protection Area. Given that a Groundwater Protection Scheme is in place for all of County Wicklow, this vulnerability assessment will be carried as per excerpt of **Table 8.4**, as follows:

Excerpt of **Table 8.4:** Summary of Sampling requirements for groundwater vulnerability assessments

	Vulnerability	Sampling Requirements
Ground Water Protection Scheme (GWPS) exists	LOW	Simple walkover survey to confirm what has been established in the GWPS, i.e., no evidence of outcrop, depth to bedrock information from wells, etc.[4] If walkover survey indicates that the lands do not have sufficient thickness of subsoil (i.e. rock outcrops) then site specific information may be required.
	MEDIUM	
	HIGH	
	EXTREME[5]	Regionally Important Aquifers - Prove that 2m depth of soil/subsoil cover exists. Minimum of 1 data point per hectare is required.
		Locally Important and Poor Aquifers – Prove that 1m depth of soil/subsoil cover exists. Minimum of 1 data point per 5 hectares is required.

[4] The classification to Low / Medium / High class as part of GWPS indicates that minimum of 3m soil/subsoil depth can be anticipated
[5] To give a rough picture of "extreme vulnerability" areas we can use: GSI Outcrop data & Teagasc Shallow Rock data

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Groundwater resources protection zones are determined by combining the aquifer and vulnerability maps. The aquifer map boundaries, in turn, are based on the bedrock map boundaries and the aquifer categories are obtained from an assessment of the available hydrogeological data. The vulnerability map is based on the subsoils map, together with an assessment of relevant hydrogeological data, in particular indications of permeability and karstification.

The location and management of potentially polluting activities in each groundwater protection zone is calculated by means of a groundwater protection response matrix. The level of response depends on the different elements of risk: the vulnerability, the value of the groundwater (with sources being more valuable than resources and regionally important aquifers more valuable than locally important and so on) and the contaminant loading. By consulting the Response Matrix, it can be determined:

- Development's suitability of purpose
- What kind of further investigations may be necessary to reach a final decision; and
- What planning or licensing conditions may be necessary for that development.

The groundwater protection responses are a means of ensuring that good environmental practices are followed.

The matrix in **Table 8.13** gives the result of integrating the two regional elements of land surface zoning (vulnerability categories and resource protection areas) – a possible total of 24 resource protection zones. In practice this is achieved by superimposing the vulnerability map on the aquifer map. Each zone is represented by a code e.g. Rf/M, which represents areas of regionally important fissured aquifers where the groundwater is moderately vulnerable to contamination. In land surface zoning for groundwater protection purposes, regionally important sand/gravel (Rg) and fissured aquifers (Rf) are zoned together, as are locally important sand/gravel (Lg) and bedrock which is moderately productive (Lm).

Table 8.13: Matrix of Resource Protection Zones from EPA Guidance Notes on Groundwater Protection

Vulnerability Rating	Resource Protection Zones					
	Regionally Important Aquifers (R)		Locally Important Aquifers (L)		Poor Aquifers (P)	
	Rk	Rf/Rg	Lm/Lg	LI	PI	PU
Extreme (E)	Rk/E	Rf/E	Lm/E	LI/E	PI/E	Pu/E
High (H)	Rk/H	Rf/H	Lm/H	LI/H	PI/H	Pu/H
Moderate (M)	Rk/M	Rf/M	Lm/M	LI/M	PI/M	Pu/M
Low (L)	Rk/L	Rf/L	Lm/L	LI/L	PI/L	Pu/L

Combining the proposed site vulnerability rating of Moderate and High, and the underlying aquifer classification of 'Locally Important Aquifer', the site is classified, from southwest to the northeast, as LI/M & LI/H.

Groundwater Protection Responses

The Groundwater Protection Responses for the land spreading of organic wastes (DoE/GSI/EPA publication, 1999) are relevant to this study given the proposed nature and operational phase of the development. According to the DoE/GSI/EPA guidelines, a Locally

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Important Aquifer with a moderate to high vulnerability rating is deemed acceptable for land spreading, provided standard best practices are followed.

The Groundwater Protection Scheme for County Wicklow incorporates these responses in its assessment and confirms their appropriateness when cross-referenced with the information available on the GSI maps for the county.

Table 8.14: Vulnerability Rating Summary

Vulnerability Rating	SOURCE PROTECTION AREA		Resource Protection (Aquifer Category)					
			Regionally Important Aquifers (R)		Locally Important (L)		Poor Aquifers(P)	
	Inner	Outer	Rk	Rf/Rg	Lm/Lg	Ll	Pl	Pu
Extreme (E)	R4	R4	R3[2]	R3[2]	R3[1]	R3[1]	R3[1]	R3[1]
High (H)	R4	R2[1]	R1	R1	R1	R1	R1	R1
Moderate (M)	R3[3]	R2[1]	R1	R1	R1	R1	R1	R1
Low (L)	R3[3]	R2[1]	R1	R1	R1	R1	R1	R1

R1 Acceptable, subject to normal good practice.
R2[1] Acceptable subject to a maximum organic nitrogen load (including that deposited by grazing animals) not exceeding 170 kg/hectare/yr.
R3[1] Not generally acceptable, unless a consistent minimum thickness of 1 m of soil and subsoil can be demonstrated.
R3[2] Not generally acceptable, unless a consistent minimum thickness of 2 m of soil and subsoil can be demonstrated.
R3[3] Not generally acceptable, unless no alternative areas are available, and detailed evidence is provided to show that contamination will not take place.
R4 Not acceptable

Site Vulnerability

Desktop investigation indicates that the development site is located on a locally important aquifer with moderate to high vulnerability, therefore classified as **Ll/M** & **Ll/H**. Based on the groundwater protection response matrix, the site is assigned a vulnerability rating of "**R1**," indicating that the development is acceptable from a groundwater protection perspective.

Given the existence of a Groundwater Protection Scheme for the County, a site walkover would be enough to confirm the information provided by GSI maps. Nevertheless, an intrusive site investigation was conducted by ORS in October 2024. This involved excavating four trial pits across the site of a minimum depth of 2.8mbgl. Bedrock was not encountered in any of them, while water was found only in trial pit TP-02, located in the central-eastern part of the site, at a depth of 3mbgl.

These results indicate a relatively uniform hydrogeological profile across the site and confirmed the presence of a soil/subsoil layer of at least 1 meter overlying the aquifer, which would be ideal for areas above locally important aquifers. Therefore, it is not anticipated that the proposed facility's operation will have any adverse effects on the underlying aquifer or nearby wells and no additional trial pits are deemed necessary before work commences on site.

8.5 Likely Significant Effects

Using data from the desk study, intrusive site investigation, and anecdotal evidence, a risk assessment was conducted to evaluate the predicted impacts on hydrology and hydrogeology during both the construction and operational phases of the development. This assessment identifies relevant sources, pathways, and receptors (pollutant linkages) and assigns a

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qualitative risk classification—'low,' 'moderate,' or 'high'—to each identified Potential Pollutant Linkage (PPL).

For a risk of surface water and groundwater 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’. The likely potential pollutant linkages identified as a result of this assessment and specific for the site have been provided in the initial 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 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 impact and the likely severity of impact in the context of the site setting and proposed future site use.

The criteria used for the risk assessment classifications as detailed in the CSM table are based on those presented in *CIRIA Report 552*.

The likely significant effects identified in this section do not take proposed mitigation measures into account, as these will be addressed in **Section 8.6**. The actual effects anticipated following the implementation of these measures are presented as Residual Effects and can be found in **Section 8.8**.

8.5.1 Do-Nothing Scenario

The proposed site is a greenfield area currently used for agriculture. If the Proposed Development does not proceed, surface water percolation and runoff would continue as part of the natural processes. The land would remain in its current agricultural use, which could potentially result in ongoing soil pollution and contamination of the local groundwater system, primarily due to suboptimal agricultural practices.

8.5.2 Receptor Sensitivity

The sensitivity of the receptors identified during the study of hydrological & hydrogeological features within the vicinity of the site are summarised in **Table 8.15** overleaf.

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Table 8.15: Receptor Sensitivity

Receptor	Receptor Importance	Receptor Sensitivity	Rationale
Groundwater	Local Level	Moderate	The Wicklow Groundwater Body (GWB) is classified as a Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones (Ll). Groundwater flow in this area is primarily local, with flow paths typically spanning a few hundred meters before discharging into nearby surface water. While the limited flow reduces the spread of contamination and supports effective mitigation, there is still a risk of contaminants reaching surface water bodies, including the hydrologically connected Arklow Town Marsh, a proposed Natural Heritage Area (NHA). The GSI map viewer classifies the site's groundwater vulnerability predominantly as "Moderate," with a small area of "High" vulnerability concentrated along the southern boundary. Site investigations reveal a consistent hydrogeological profile across the area. Groundwater was encountered in just one trial pit at a depth of 3mbgl, verifying the presence of at least a 1-meter layer of soil or subsoil in areas overlying Locally Important Aquifers. The response matrix (**Table 8.14**) would indicate that vulnerability rating assigned to the site would be “R1 Acceptable, subject to normal good practice”, indicating the development location is acceptable with respect to groundwater protection.
Surface Water	Local Level	Moderate	The receiving water bodies, the Moneylane and the Ballyduff streams have a WFD status of “Poor”, a pollution status of “Moderately Polluted”, and a condition of “Unsatisfactory” (Q3). Upstream of its hydrological connection with the Proposed Development, the Moneylane Stream supports moderately sensitive macroinvertebrate species. However, downstream of its confluence with the Rooaun Stream, the water quality declines, as evidenced by the presence of species very tolerant to pollution. The Ballyduff Stream is hydrologically connected to the River Avoca (*ca.* 2.9km downstream of the site) and to the Arklow Town Marsh proposed NHA along its banks, which is located *ca.* 3.4km downstream from the site. Significant effects on this protected area are not anticipated from the Proposed Development given the adherence to good housekeeping practices, the implementation of measures outlined in the accompanying CEMP, and effective pollution control and surface water management. With these precautions in place, the Proposed Development is not anticipated to significantly affect the ecological integrity of the Arklow Town Marsh pNHA.

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8.5.3 Sources - Construction Phase

The construction phase is likely to yield the most potentially significant effects on the surrounding water environment. A summary of these potential effects is provided in **Table 8.16**, with a detailed analysis below.

Table 8.16: Construction Phase Effects **(Unmitigated)**

Receptor	Potential Environmental Effects	Quality	Significance	Duration
Groundwater Wicklow Groundwater Body – Locally Important Aquifer	Increased Run-off and Sediment Loading	**Negative**	**Moderate**	**Temporary**
	Accidental Spillages of Harmful Substances	**Negative**	**Moderate**	**Short-Term**
	Increased Groundwater Vulnerability	**Negative**	**Significant**	**Long-Term**
	Excavation of Bedrock Aquifer	**Negative**	**Significant**	**Long-Term**
	Installation of Gas pipeline	**Negative**	**Significant**	**Long-Term**
	Excavation of Contaminated Soils	**Unlikely**	**Negligible**	**Unlikely**
Surface Water Moneylane and Ballyduff streams, River Avoca & Arklow Town Marsh pNHA	Increased Run-off and Sediment Loading	**Negative**	**Slight to Moderate**	**Temporary**
	Accidental Spillages of Harmful Substances	**Negative**	**Moderate to Significant**	**Temporary**
	Excavation of Contaminated Soils	**Unlikely**	**Negligible**	**Unlikely**
	Conversion of Permeable Soils to Hard standing	**Negative**	**Moderate**	**Temporary**

Increased Run-off and Sediment Loading

During the initial stages of the construction phase, enabling works will consist of stripping and removal of a layer of topsoil in some areas throughout the site. Earthworks will then follow to level the site and to facilitate the construction of foundations and the installation of services/drainage infrastructure which will also lead to the removal of some vegetation cover. The resulting stockpiles of the displaced soils and sediments, in the absence of suitable mitigation, will be susceptible to erosion during this period. This can create a potential pathway for silt and sediment to migrate off-site into surrounding water courses via wind-blown dust or run-off in times of heavy rain. The potential consequence for surface water receptors in this circumstance is elevated levels of silt, suspended solids, and nutrients, what can lead to water quality degradation, decline in fisheries resources and serious ecological degradation of aquatic biota.

The site investigations showed that the topsoil consists of brown earth, which is made up of gravelly silty loam and is prone to erosion. This means that soil particles can easily be carried away by water or wind, potentially reaching nearby water sources. Subsoil conditions across the site vary, leading to differing runoff patterns. The northern area, with sandy and clay layers, shows moderate permeability, with clay contributing to runoff that may carry fine particles and contaminants. Central podzolic soils are less permeable, increasing runoff with sediment and nutrients, while the central and southern gravelly clay and sandy loam exhibit mixed patterns,

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with sandy loam reducing runoff but gravelly clay prone to erosion and sediment transport.

The well-drained subsoils in the central and southern parts of the site provide a potential pathway for contaminants to reach the Wicklow Groundwater Body (GWB) via percolation. In contrast, the risk is minimised in the northern and central areas, where the moderate permeability of the subsoil reduces the likelihood of contamination reaching the GWB. Furthermore, any contamination that does occur is less likely to spread widely, as groundwater flow in these areas is limited to localised zones, facilitating more effective mitigation measures.

Although hydrogeological connection has not been confirmed, there remains a potential risk of negative impacts on surrounding wells and their users in case of groundwater contamination, which exacerbates the complexity of the impact. Within 2 km radius from the site, there are 27 no. recorded wells (boreholes), primarily used for domestic purposes.

Considering the natural topography of the proposed site and the surrounding areas along with the hydrological connection with the adjacent Rooaun Stream***, in the absence of mitigation***, uncontrolled releases of sediment run-off would result in a ***negative, slight to moderate, temporary effect*** on the water quality of the Moneyland Stream and its downstream receptors, Ballyduff Stream and Avoca River. The contamination could extend to the Arklow Town Marsh (proposed NHA), which is hydrologically connected to the site.

In the absence of mitigation, uncontrolled releases of sediment run-off would result in a ***negative, moderate, temporary effect*** on the water quality of the Wicklow Groundwater Body underlying the proposed site.

Accidental Spillages of Harmful Substances

During the construction phase, there is a possibility of a spillage of contaminants such as fuels, oils, chemicals and cement material, posing a potential risk to surface and groundwater quality. Fuels, oils and chemicals have a number of hazardous properties, and the constituents of concrete are alkaline and corrosive. Each one of these substances can have a significant deleterious effect on water quality and aquatic life should any become entrained in the receiving water environment.

The drainage characteristics of the site area, as outlined in **Section 8.4.5,** concluded that the Qbar value for the site is 10.7 l/s. In the event of any spillages, contamination would potentially be carried by the site run-off and migrate into the Moneylane Stream and subsequent downstream receptors.

The groundwater vulnerability assessment in **Section 8.4.8** concluded that groundwater vulnerability at the site was classed as ‘moderate to high’ due to the moderately to well-drained subsoils beneath the site. The moderate vulnerability at the central/northern portion of the site offers some protection to groundwater receptors providing a natural barrier between the potential release of harmful substances and the groundwater body below and making vertical migration throughout the soils difficult. In the other hand, the southern part of the site, classed as High vulnerability, presents well-drained subsoils, which provides a potential pathway for contaminants to reach the underlying aquifer. Any contamination that does occur is less likely to spread widely, as groundwater flow in these areas is limited to localised zones, facilitating more effective mitigation measures.

Although hydrogeological connection has not been confirmed, there remains a potential risk of negative impacts on surrounding wells and their users in case of groundwater contamination, which exacerbates the complexity of the impact. Within 2 km radius from the site, there are 27 no. recorded wells (boreholes), primarily used for domestic purposes.

In the absence of mitigation, uncontrolled releases of hydrocarbons, chemicals or cement

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would result in a ***negative, moderate to significant, temporary effect*** on the Moneylane Stream. This would lead to impacts on the water quality of the downstream Ballyduff Stream and River Avoca. The contamination could extend to the Arklow Town Marsh (proposed NHA), which is hydrologically connected to the site.

In the absence of mitigation, uncontrolled releases of hydrocarbons, chemicals or cement would result in a ***negative, moderate, short-term effect*** on the water quality of the Wicklow Groundwater Body underlying the proposed site. The significance of this impact is potentially reduced due to the limited flow extension of the GWB, which would likely confine the effects to a localised area.

Increased Groundwater Vulnerability

The removal and disturbance of a significant amount of soil required in order to level the site is anticipated during the construction phase which carries the potential to increase the vulnerability of a groundwater body to incidences of contamination at surface level.

The preliminary Cut and Fill analysis for the Proposed Development indicates that a total of 14,343 m³ of subsoil will be excavated, all of which will be reused on-site as capping layers and fill. Consequently, no surplus subsoil will need to be disposed of off-site. Additionally, approximately 9,657 m³ of topsoil is estimated to be excavated, with 3,715 m³ allocated for re-soiling the area and 5,393 m³ used to enhance on-site landscaping. This will leave a surplus of 549 m³, which will be disposed of at licensed facilities. These estimated volumes may be subject to change based on further ground investigations prior to construction.

Excavations up to 1.2mbgl will be required to reach the finished floor level (FFL) in the bunded area slightly south of Digester Storage Tank 2, which is located in close proximity to TP-02, where groundwater was encountered at 3.0mbgl. Despite this, given the maximum planned excavation depth in this area, significant disturbance of the groundwater body is not anticipated. Nevertheless, the possibility of encountering groundwater during the works still exists, especially after rainfall, when the water table may rise above the previously observed levels. An excavation depth of 1.2 mbgl could increase the vulnerability in this area from ‘moderate’ to ‘high’.

Once excavation to the finished floor level (FFL) has been achieved, further earthworks will commence to facilitate the construction of foundations and the installation of services and drainage infrastructure, extending into the subsoil layers. Building foundations will require excavation to depths of up to 2m below the proposed FFL, aligned with the structural layout of the buildings. Excavation for drainage infrastructure and for Wastewater Treatment Plant will extend to depths of up to 2.5mbgl in the General Yard and Car Parking area and near the site entrance on the southeastern side of the site, respectively. Excavation depths reaching 2.5mbgl in this location could elevate the vulnerability classification from 'high' to 'extreme.'

The construction of the attenuation pond in the northwest portion of the site will involve minimal excavation. The proposed pond base elevation of 46.6m AOD closely matches the existing ground level in the area. Consequently, the excavation required for the pond's construction is unlikely to have any significant impact on groundwater vulnerability.

GSI maps indicate the groundwater vulnerability throughout the site was classed as ‘moderate to high’. The groundwater protection response matrix (**LI/M to LI/H**) assigns the site a vulnerability rating of "**R1**," indicating that the development location is acceptable with respect to groundwater protection.

Desktop study suggests a subsoil depth of 5 - 10m throughout the area, given the moderate to high groundwater vulnerability on the site. Geotechnical investigations conducted on-site support this, as no bedrock was encountered during the excavation of trial pits.

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In the absence of mitigation, the removal of soil/subsoil cover during the construction phase would have a ***negative, significant, long-term effect*** on groundwater vulnerability at the Proposed Development site.

Excavation of Bedrock Aquifer

As shown in **Table 8.10**, groundwater wells in the surrounding area encounter bedrock at depths ranging from 0.9 to 15.5 mbgl. A desktop study indicates subsoil depths across the area to be approximately 5–10 meters, consistent with the site's moderate to high groundwater vulnerability. This assessment is supported by a site investigation conducted by ORS, which included the excavation of four trial pits to depths of 2.8–3.1 mbgl, none of which reached bedrock. Given that the maximum excavation depth for site levelling is projected at 1.2 mbgl, and up to 2.5 mbgl for drainage system installation, interaction with bedrock remains possible but is considered unlikely.

If excavation into bedrock is necessary and ***control and mitigation measures are not implemented***, predicted effects will have ***negative, significant and long-term effect*** on hydrogeology.

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.

The proposed gas pipeline connecting to the existing Gas Networks Ireland pipeline at the IDA Business Park (Arklow Business Park), located *ca.* 1km southeast of the site, will be installed alongside the existing L6187 road, as indicated in **Figure 8.19**. The area is predominantly classified as having High Groundwater Vulnerability, with localised occurrences of Extreme Groundwater Vulnerability and areas where rock is at or near the surface, particularly near the IDA Business Park.

This is an indicative routing of the pipeline to the site and is subject to change pending detailed network modelling and design. The final pipeline will be designed, consented and delivered by Gas Networks Ireland in accordance with the following standard: *I.S. 328 2021 Gas transmission — Pipelines and pipeline installations*.

Installation of the pipeline will involve temporary excavation work (up to 1.0 mbgl) and will result in disturbance of the underlying soil and subsoil. This may have an effect on the exposed soil and subsoil with implications for the soil surface with regard to stock piling and mobile plant. The trenches will be backfilled shortly after excavation following the installation of each section. Trenching along a road network will give rise to asphalt waste material. If unproperly managed these materials can pose a risk to the environment due to the presence of Polycyclic Aromatic Hydrocarbons (PAHs).

No process water will be discharged from the Proposed Development; consequently, no discharge pipeline is planned.

In the absence of mitigation, the removal of soil/subsoil cover during the installation of the gas pipeline would have a **negative, significant, long-term effect** on groundwater vulnerability along the proposed pipeline route.

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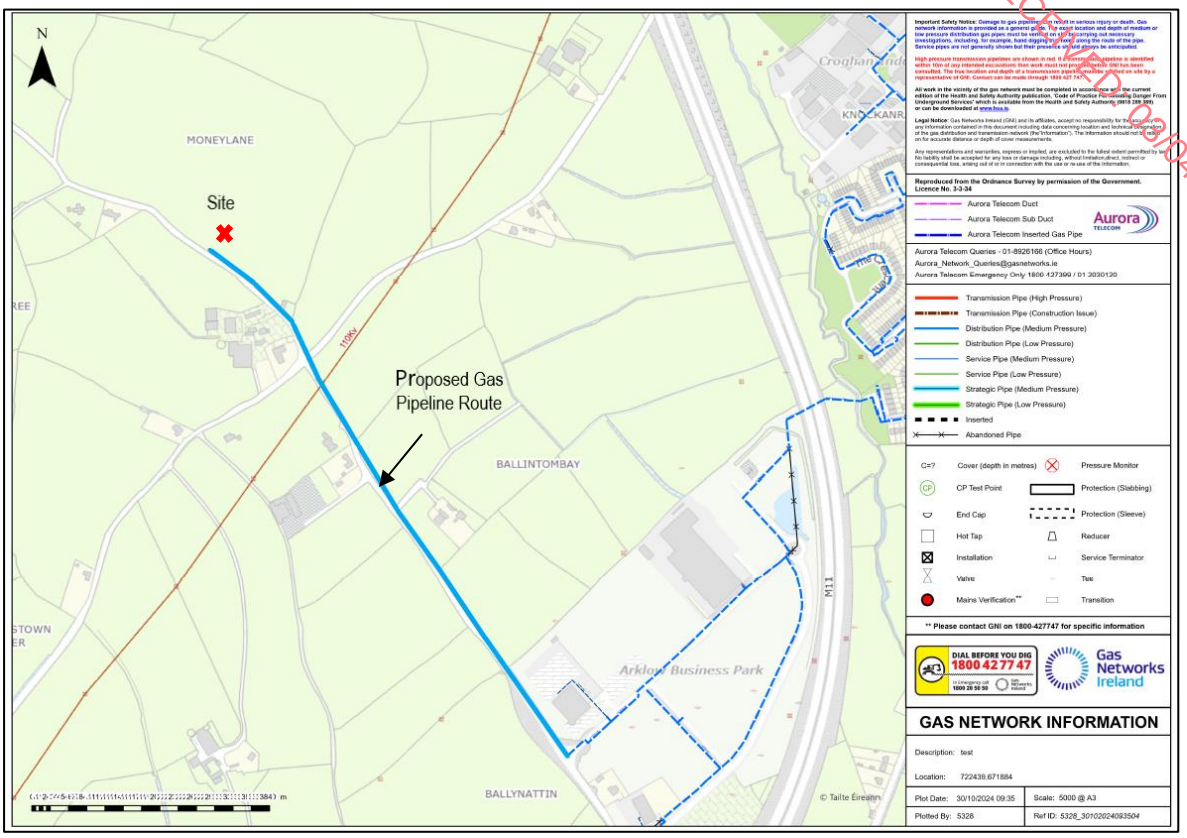

Figure 8.19: Proposed Gas Pipeline route.

Excavation of Contaminated Soils

The excavation and construction activities will require the reuse of excavated materials on site. The proposed site is a greenfield area, and historical mapping does not suggest any incidences of land use which might have result in the contamination of soils. Furthermore, a geotechnical site investigation conducted at the site in October 2024 did not detect any evidence of contaminated soils. It is not anticipated contaminated soils will be encountered during construction activities hence no adverse effects on the groundwater or surface water quality are expected as a result of contaminated soils.

The Construction Environmental Management Plan (**Document Ref: 241504-ORS-XX-XX-RP-EN-13d-010**) will include a set of procedures to be implemented in the incidence of contaminated soils encountered nonetheless despite ***negligible impact or lack of significance*** to hydrogeology and hydrology.

Conversion of Permeable Soils to Hard standing

During the construction phase, permeable soil areas will gradually be replaced by hardstanding surfaces across the site. This change will increase the risk of flooding within the receiving catchment due to the expansion of impervious surfaces and associated drainage systems, which elevate both the volume and intensity of surface water runoff. As the impervious area grows, a greater portion of rainfall will contribute to surface runoff entering the drainage system. The installation of sealed pipes to channel runoff from the Proposed Development to existing watercourses will result in larger volumes of water being discharged at specific locations over shorter time periods, further amplifying flood risks.

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In the absence of mitigation, the predicted effects of the Proposed Development resulting in an increase of flood risk to the receiving catchment are ***negative, moderate and temporary***.

8.5.4 Sources - Operational Phase

A summary of the potential operational phase effects is provided in **Table 8.17**, with a detailed analysis below.

Table 8.17: Operation Phase Effects Summary **(Unmitigated)**

Receptor	Potential Environmental Effects	Quality	Significance	Duration
Groundwater Wicklow Groundwater Body – Locally Important Aquifer	Contaminated Run-off	**Negative**	**Moderate**	**Short-Term**
	Foul Water	**Negative**	**Moderate to Significant**	**Short-Term**
	Increased Groundwater Vulnerability	**Negative**	**Significant**	**Long-Term**
	Uncontrolled Releases & Spillage of Digestate and Feedstocks	**Negative**	**Slight to Moderate**	**Temporary**
	Fire and Resultant Firewater	**Negative**	**Moderate**	**Short-Term**
	Landspreading of Biobased Fertiliser	**Negative**	**Slight**	**Short-Term**
	Attenuation Pond	**Negative**	**Moderate**	**Short-Term**
Surface Water Moneylane and Ballyduff streams, River Avoca & Arklow Town Marsh pNHA	Contaminated Run-off	**Negative**	**Moderate to Significant**	**Temporary**
	Foul Water	**Negative**	**Moderate to Significant**	**Short-Term**
	On-Site Flooding	**Negligible**	**Not significant**	**Unlikely**
	Conversion of Permeable Soils to Hard standing	**Negative**	**Moderate**	**Long-Term**
	Uncontrolled Releases & Spillage of Digestate and Feedstocks	**Negative**	**Slight to Moderate**	**Temporary**
	Fire and Resultant Firewater	**Negative**	**Slight to Moderate**	**Temporary**
	Landspreading of Biobased Fertiliser	**Negative**	**Slight**	**Temporary**
	Uncontrolled Release of Discharge	**Negative**	**Significant**	**Temporary**
	Attenuation Pond	**Negative**	**Moderate**	**Temporary**

Contaminated Run-off

Run-off from impermeable areas within the Proposed Development such as roads and car parking areas are likely to contain potentially polluting substances such as hydrocarbons, heavy metals and sodium chloride arising from de-icing of these surfaces during winter months.

The risk of failure in the runoff collection and discharge system should be considered; however, it remains unlikely. In the event of a failure, there is a potential for contaminated runoff to reach the underlying aquifer system. ***In the absence of suitable design & mitigation measures***, there would be a ***negative, moderate, short-term effects*** on the water quality of the Wicklow

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Groundwater Body.

In the absence of suitable design & mitigation measures, there would be a ***negative, moderate to significant, temporary effects*** on the water quality of the Moneylane Stream. The contamination could extend to downstream receptors, including the River Avoca and the Arklow Town Marsh pNHA.

Foul Water

A domestic scale wastewater treatment plan is proposed to cater for the foul water arising from staff facilities on-site only (Population Equivalent 'PE' of 4). The accompanying site suitability assessment has concluded that the soils at the site have sufficient absorption capacity for the installation of a percolation area suited for this PE.

The inherent risk associated with wastewater treatment systems is leakage of untreated foul water. This situation can arise from poor construction methods, inadequate maintenance and failure to scale the system to an appropriate projected population equivalent.

During incidences of leakage foul water would likely follow preferential pathways created by permeated backfill and infiltrate into the site drainage system ultimately impacting both surface water and groundwater receptors. Adverse effects associated with foul water leakages consist of contamination relating to the of the following:

- Pathogens, (E. Coli etc.).
- Elevated levels of ammonia and nitrate.
- Elevated levels of phosphorus.

In the absence of suitable design & mitigation measures, such leakages could degrade the water quality of both surface and groundwater bodies, potentially leading to negative consequences for aquatic life. Overall, the predicted effects of foul water leakage on hydrological & hydrogeological receptors are ***negative, moderate to significant and short-term.***

Increased Groundwater Vulnerability

The proposed Finished Floor Levels (FFL's) will be up to 1.2m below the existing elevation of the site, located within the bunded area and at the attenuation pond. TP-02, where groundwater was encountered at 3.0mbgl, is located within the proposed location for the bunded area. Despite this, given the maximum planned excavation depth in this area, significant disturbance of the groundwater body is not anticipated. Nevertheless, the possibility of encountering groundwater during the works still exists, especially after rainfall, when the water table may rise above the previously observed levels. An excavation depth of 1.2mbgl could increase the vulnerability in this area from 'moderate' to 'high'.

In the absence of mitigation measures, the removal of soil/subsoil cover to reach the proposed FFL's would have a ***negative, significant, long-term effect*** on groundwater vulnerability at the Proposed Development site.

On-Site Flooding

A flood event occurring on the Proposed Development would cause the Sustainable Urban Drainage Infrastructure (SuDS) to become overwhelmed, creating additional pathways for

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potential contaminants to migrate off-site into downstream receptors along with elevated flow rates.

The Proposed Development is not located in a Flood Zone, according to the OPW and the likelihood of flooding occurring on the site is very low. Please refer to Site Specific Flood Risk Assessment (**Document Ref: 241504-ORS-XX-XX-RP-EN-13d-011**) which accompanies the application.

Overall, ***in the absence of suitable design & mitigation measures,*** the predicted effects of the occurrence of a flood event on hydrological receptors is ***negligible, not significant, and unlikely*** to occur.

Conversion of Permeable Areas to Hard standing

The operational phase will see a portion of the existing greenfield site converted to areas of hardstanding. Under this scenario, the risk of flooding within the receiving catchment will increase due to an increase in impervious land area and associated drainage systems, which leads to an increase in volume and intensity of surface water run-off within a given catchment.

The increase in impervious area means that a greater proportion of the incident rainfall will appear in the drainage system as surface run-off. The provision of sealed pipes to convey run-off from the Proposed Development to existing drainage ditch along the northern boundary of the site, which will eventually flow into the Moneylane Stream, will result in larger (concentrated) volumes being discharged at point locations within a shorter duration, thereby increasing flood risks.

In the absence of mitigation, the predicted effects of the Proposed Development resulting in an increase of flood risk to the receiving catchment are ***negative, moderate, and long-term.***

Uncontrolled Releases & Spillages of Digestate and Feedstocks

During the operational phase, there is a possibility of leakage or spillage of biobased fertiliser or feedstocks via vehicle movements or from a failure of a tank or feed line. While such substances are significantly less hazardous than fuels, oils, chemicals, and cement material, they still pose a potential risk to surface and groundwater quality. Biobased fertiliser or animal slurries in high quantities can have a deleterious effect on water quality and aquatic life if they reach any water receptors.

Uncontrolled releases of biobased fertiliser, feedstock, hydrocarbons or chemicals, ***in the absence of mitigation measures***, would result in ***negative, slight to moderate, temporary effects*** on the water quality of the Moneylane Stream and the Wicklow Groundwater Body. The contamination could extend to downstream receptors, including the River Avoca and the Arklow Town Marsh pNHA.

Fire and Resultant Firewater

Appropriate storage facilities will be provided for combustible and flammable materials (i.e. fuel) required for the operation of the Proposed Development. In the event of a fire, significant quantities of water resources will be utilised to quench the fire. Water used to quench a fire is known as “firewater”. Firewater is known to contain the following harmful substances:

- Products of combustion
- Extinguishing foam / fluid

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- Hazardous substances (fuels, oils & chemicals)

Due to the presence of these hazardous substances, firewater poses a significant risk to surface and groundwater quality.

Uncontrolled releases of firewater ***in the absence of mitigation measures***, would result in ***negative, slight to moderate, temporary effects*** on the water quality of the Moneylane Stream. The contamination could extend to downstream receptors, including the River Avoca and the Arklow Town Marsh pNHA.

Uncontrolled releases of firewater, ***in the absence of mitigation measures***, would result in ***negative, moderate, short-term effects*** on the water quality of the Wicklow Groundwater Body underlying the proposed site.

Uncontrolled Release of Discharge

The Proposed Development includes digestate treatment using separation, ultrafiltration, and reverse osmosis to recover the water content within the digestate.

At full capacity it is proposed that the total tonnages for transportation off-site from the Proposed Development as biobased fertiliser to local agricultural operators will be ca. 8,000 tonnes of Digestate Fibre and ca. 17,000 tonnes of Digestate Liquid Concentrate. Of the maximum 90,000 tonnes of annual feedstock intake to the Proposed Development, ca. 36,500 tonnes of untreated manures and slurries would normally be land spread locally. Following, digestate treatment and pasteurisation there will be 8,000 tonnes of solid and 17,000 tonnes of liquid biobased fertiliser. This represents a significant reduction, ca. 11,500 tonnes per annum, in the hydraulic loading of land spreading locally.

The digestate treatment process involves the following stages:

- Screwpress Separation
- Ultrafiltration
- Reverse Osmosis

The Reverse Osmosis (RO) system will maintain a steady maximum outflow volume of 10m^3 per hour. Following the RO stage, the purified water generated by the process will be stored in a balance tank before being reused onsite for cleaning activities and returned to the process as a feeding liquid. No process water will be discharged off-site.

Uncontrolled releases of discharge ***in the absence of mitigation measures*** would result in ***negative, significant, temporary effects*** on the water quality of the Moneylane stream, the River Avoca and further downstream receptors as the Arklow Town Marsh pNHA.

Landspreading of Biobased Fertiliser

The biobased fertiliser produced will be a rich source of nutrients that will be used by customer farmers for the fertilisation of their land. In the worst-case scenario and in absence of mitigation, any inappropriate land-spreading of the biobased fertiliser could lead to impacts upon the receiving waters in local catchments and it can result in eutrophication, algal blooms, fish kills and loss of biodiversity. Designated habitats and species can be impacted upon. There is a greater risk when groundwater vulnerability at the lands for spreading is high, or when land-spreading is undertaken close to drains or streams. In these situations, the Pollution

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Impact Potential for both phosphates and / or nitrates is high.

The farms of the customer farmers have been identified; however, these will be subject to local change on an annual basis. All farmers will use the biobased fertiliser on lands that have an agronomic requirement for fertiliser. Spreading will be done in accordance with the specific Nutrient Management Plan for the farm and in accordance with S.I. 113 of 2022. Records for the movement of all biobased fertiliser will be kept.

Inappropriate land spreading ***in the absence of mitigation measures*** would result in ***negative, slight, temporary effects*** on the water quality of the of the Moneylane stream, the River Avoca and further downstream receptors as the Arklow Town Marsh pNHA.

The potential for contamination of the local groundwater body will depend on the specific characteristics of the land where the biobased fertiliser is applied. However, with proper management practices, contamination is unlikely to occur. If contamination is to reach the groundwater body, ***in the absence of mitigation measures***, the effects would be ***negative, slight, and short-term.***

The positive benefits of using the biobased fertiliser produced must also be considered, as this provides an alternative to the land-spreading of liquid slurry. Using biobased fertiliser presents several scientific advantages over the continued use of untreated manures, slurries, or chemical fertilisers, particularly concerning plant nutrient availability and the mitigation of nutrient leaching into watercourses. The benefits are outlined below.

- **Balanced Nutrient Availability:** Biobased fertiliser typically contains a balanced mix of essential nutrients, including nitrogen (N), phosphorus (P), potassium (K), and micronutrients crucial for plant growth. This balanced nutrient profile contrasts with chemical fertilisers, which often supply only specific nutrients. Studies have shown that the diverse nutrient composition of biobased fertiliser supports comprehensive plant nutrition, contributing to improved crop yields and overall plant health (Möller and Müller, 2012)[6].

- **Slow-Release Nutrients:** Biobased fertiliser releases nutrients gradually over time as it decomposes in the soil. This gradual release mechanism ensures a sustained supply of nutrients to plants, contrasting with untreated manures, slurries and chemical fertilisers, which can be prone to leaching or volatilisation. The slow-release nature of biobased fertiliser reduces the risk of nutrient loss and enhances nutrient uptake efficiency by plants (Yao et al., 2011)[7]. Analysis has shown that approximately 80% of the total nitrogen in biobased fertiliser is present as readily available nitrogen. Digestion of livestock slurry has also been shown to increase the plant availability of nitrogen in slurry by *ca*. 10%.

  Compared to untreated manures and slurries, biobased fertiliser poses a lower risk of nutrient leaching into watercourses. The balanced nutrient composition and slow-release nature of biobased fertiliser minimise the likelihood of excess nutrients washing away into streams or groundwater. This reduction in nutrient leaching coupled with land spreading best practice helps mitigate water pollution and eutrophication, safeguarding aquatic ecosystems and maintaining water quality (Möller and Müller, 2012).

- **Enhanced Soil Health:** Rich in organic matter, biobased fertiliser improves soil structure,

[6] Möller, K., & Müller, T. (2012). Effects of anaerobic digestion on biobased fertiliser nutrient availability and crop growth: a review. Engineering in Life Sciences, 12(3), 242-257.
[7] Yao, R., Li, G., Xie, H., Zhao, B., & Liu, H. (2011). *Release characteristics of nutrients from aerobic composted swine manure in soil. Journal of Soils and Sediments*, 11(1), 103-111.

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promotes water retention, and stimulates microbial activity. These soil health benefits contribute to improved nutrient cycling, root development, and overall soil fertility (De Vries et al., 2015).[8]

- **Biobased Fertiliser Usage:** At full capacity the total tonnages for transportation off-site as biobased fertiliser to local agricultural operators are summarised below:
    - Biobased fertiliser Fibre - 8,000 tonnes
    - Biobased fertiliser Liquid Concentrate - 17,000 tonnes

Of the maximum 90,000 tonnes of annual feedstock intake, circa 36,572 tonnes of untreated manures and slurries would normally be land spread locally. Following the AD, pasteurisation, and biobased fertiliser treatment there will be 8,000 tonnes of solid and 17,000 tonnes of liquid biobased fertiliser. This represents a significant reduction in the hydraulic loading of land spreading locally of circa 11,500 tonnes per annum.

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

All biobased fertilisers will be used in accordance with S.I. 113 of 2022 European Communities (Good Agricultural Practice for Protection of Waters Regulations, 2022). The spreading of the biobased fertiliser on the customer farms will be done on accordance with the specific Nutrient Management Plan for that farm.

Attenuation Pond

The Proposed Development includes an attenuation pond located to the northwest of the site, designed to manage surface water runoff from roads, yards, roofs, and the impermeable bunded area. Site investigations in the area, which included the excavation of a trial pit to a depth of 2.8mbgl, found no bedrock. The proposed plan indicates that the construction of the attenuation pond will involve minimal excavation. The proposed pond base elevation of 46.600m AOD closely matches the existing ground level in the area. As a result, no significant impacts on groundwater vulnerability are expected.

If inappropriately constructed, the attenuation pond may pose a risk to the underlying aquifer. As such, it will be lined with an impermeable membrane to limit the risk of contaminants leaching into the underlying locally important bedrock aquifer. There is also a potential risk of contaminants to reach surface water receptors via run-off.

Although hydrogeological connection has not been confirmed, there remains a potential risk of negative impacts on surrounding wells and their users in case of groundwater contamination, which exacerbates the complexity of the impact. Within 2 km radius from the site, there are 27 no. recorded wells (boreholes), primarily used for domestic purposes.

The attenuation pond, ***if not properly constructed and in the absence of mitigation measures,*** is foreseen to have potentially ***negative, moderate, and temporary to short-term effects*** on surface water bodies and on the groundwater body.

[8] De Vries, J. W., Groenestein, C. M., & Kool, P. L. (2015). *Effects of anaerobic digestion and composting on reducing the environmental impact of pig manure*. Journal of Environmental Management, 162, 230-237.

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8.6 Mitigation Measures

Mitigation measures proposed in this section relate primarily to the preservation of the existing subterranean drainage regime, the protection of groundwater receptors and the protection of surface water receptors.

Mitigation Measures proposed in this section are in response to the risks identified in **Section 8.5.**

8.6.1 Construction Phase

General Mitigation Measures

The Construction Environmental Management Plan (CEMP) accompanying this application will be implemented and updated (as required) by the main contractor during the construction phase. These are practical documents which will include detailed procedures to address the main potential effects on surface water and groundwater.

Increased Run-off and Sediment Loading

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. The following recommendations are provided in accordance with the Eastern Regional Fisheries Board guidelines for the protection of nearby watercourses during the construction phase:

- 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.
- Covers are to be provided over soil stockpiles when high wind and inclement weather are encountered if required.
- Harmful materials and stockpiles should, whenever possible, be stored away from the drainage ditch located at the northern boundary of the site, given its direct pathway to nearby surface waterbodies.
- Excavations to be backfilled as soon as possible to prevent any infiltration of contaminants to the subsurface and the aquifer.
- Landscaping should be carried out as soon as possible to minimise weathering.

Accidental Spillages of Harmful Substances

The following measures will minimise the risk of a release of fuels, oils, chemicals or cement products at the site:

- Establishment of bunded oil and chemical storage areas.
- Refuelling of mobile plant in designated areas provided with spill protection.
- Fuel bowsers should be located within bunded areas designed to contain 110% of the primary vessel's capacity or 25% of the total volume of substances stored within the bunded area. They should not be placed immediately adjacent to the northern boundary of the site, given the presence of the drainage ditch, or in the southern portion, where groundwater vulnerability is higher compared to other areas of the site.
- Only appropriately trained site operatives permitted to refuel plant and machinery on-site.
- Regular inspections carried out on plant and machinery for leaks and general condition.

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- Emergency response plan.
- Spill kits readily available throughout the site.
- Use of ready-mixed supply of wet cement products.
- Scheduling cement pours for dry days.

Increased Groundwater Vulnerability / Excavation of Bedrock Aquifer / Gas Pipeline

The site has been assigned a moderate to high groundwater vulnerability rating. Planned excavations of up to 1.2mbgl in the centre of the site could increase vulnerability in specific areas from 'moderate' to 'high'. Additionally, deeper excavations of up to 2.5mbgl are expected in the southern part of the site for the installation of services and drainage systems, potentially raising local groundwater vulnerability from 'high' to 'extreme.'

Although the gas pipeline route crosses areas classified as 'extreme' vulnerability and 'X - Rock at or Near Surface', its installation would not pose significant risks to the groundwater body, given excavation depth will be up to 1.0 mbgl only. This will be delivered by Gas Network Ireland, which will also be responsible for the design and implementation of specific mitigation measures.

Mitigation measures to ensure maximum protection of groundwater include:

- Excavations to be backfilled as soon as possible to prevent any infiltration of contaminants to the subsurface and the aquifer.
- Landscaping should be carried out as soon as possible to minimise weathering.
- Installation of impermeable liner is recommended under the attenuation pond.
- Implementation of phased excavation with regular monitoring for groundwater levels to promptly identify and mitigate any breaches or increased vulnerability.
- Installation of temporary barriers around excavation sites to limit groundwater exposure.

Excavation of Contaminated Soils

It is not anticipated contaminated soils will be encountered during construction activities hence no adverse effects on the groundwater or surface water quality are expected as a result of contaminated soils.

- 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.

Conversion of Permeable Areas to Hard standing

The construction phase will involve the gradual conversion of the existing greenfield site to areas of hardstanding. The following measures will be implemented in the construction phase to minimise an increase of flood risk to the receiving catchment:

- The rate of surface water discharge to the stream will be restricted to a maximum permissible rate of 10.7 lit/sec. This rate is calculated in accordance with criteria defined in the Greater Dublin Strategic Drainage Study ['GDSDS'] to ensure the Proposed Development will not affect the flow / flood regimes in the receiving environment

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- Floor levels upstream of the storage areas are at least 500mm above the top water level in the detention basins for the 100-year event.
- Overtopping does not occur during rainfall events ranging from 30 minutes to 1440 minutes. No risk of flooding of adjacent areas.
- Attenuation Pond will accommodate the total catchment area capacity and will provide a minimum storage capacity of 1,619.534 m^3 (designed to accommodate the estimated rainfall events)

8.6.2 Operational Phase

General Mitigation Measures

An Environmental Management System (EMS) will be prepared and implemented by the operator 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 Development 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:

- Site specific trigger levels will be established and agreed with the EPA.
- 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

Contaminated Run-off

It is proposed to take run-off from the buildings and yards in the facility in a sealed pipe network which will discharge to the watercourse. Rain falling on the bunded area will be collected in a separate sealed drainage network and discharged to a sump, from which it will be pumped to the surface water drainage system for the remaining areas of the facility. The system is designed to accommodate the 1:100-year rainfall event plus normal design parameter of +20% based on a combination of duration and volume.

Design criteria adopted for the development include:

- Overtopping from rainfall is concentrated at the detention basin only.
- Floor levels upstream of the storage areas are at least 500mm above the top water level in the detention basins for the 100-year event.
- Drainage systems will be designed to attenuate excess surface water runoff with suitable storage volumes
- Reduction of outflow rate to below the existing greenfield runoff rate before discharging into the watercourse from the attenuation pond.
- Sumps in gullies and manholes collect silts in run-off from roads
- Class 1 discharge bypass separator treats surface water for hydrocarbons run-off before its discharge to the attenuation pond

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- All surface water run-off will discharge to the attenuation pond. The floor of the basin will be shaped to allow for the retention of silts in the pond.
- Regular inspection and maintenance of all treatment measures to remove accumulated silts and disposed of to an appropriately licenced landfill
- Regular testing prior to discharge to ensure treatment effectiveness.
- The digestion process area will be completely bunded and constructed to Eurocode standard (BS EN 1992-3)
- The rate of discharge to the stream will be restricted to a maximum permissible rate of 10.7 lit/sec. This rate is calculated in accordance with criteria defined in the Greater Dublin Strategic Drainage Study [‘GDSDS’] to ensure the Proposed Development will not affect the flow / flood regimes in the receiving environment.

Foul Water

A domestic scale wastewater treatment plant is proposed to cater for the foul water arising from staff facilities on-site only (Population Equivalent ‘PE’ of 4). A Site Suitability Assessment conducted by *Geoenvironmental* in line with the EPA Code of Practice for onsite domestic wastewater treatment systems (2022) has concluded that the soils at the Proposed Development have sufficient absorption capacity for the installation of a percolation area suited for this PE.

The sizing of the proposed packaged wastewater treatment plant shall be minimum of 4PE @150l/day = 600l/day + 2,000 litres = 2,600l (minimum) rounded up to a $3m^3$ tank.

The overburden is determined to be ‘suitable for percolation purposes’ and available to support Groundwater Protection Responses (GWPR). The wastewater treatment plant will comprise a secondary treatment system with a soil polish filter, followed by a percolation area.

The final effluent from the WWTS is to be pumped from a sump chamber using 2” rising main to a 50mm distribution manifold connected to 8 * 32mm diameter 6.25m long lateral percolation pipes. The new sump/pump chamber installed should have a min volume capacity of 140 litres below the invert from the treatment system.

The 8 * 32mm lateral pipes are to be located at 1.25m intervals and placed over a (8-32mm) 250-mm layer of distribution stone and covered with 150mm of protection stone and this layer and entire stone footprint overlain by a geotextile with a min 250mm of topsoil back to new raised surface. The distance between the perforations should also be 1.25m. Each of the 3/16” (4.78mm) orifices in the pipework should be protected by orifice shields. Max depth of distribution stone should be -0.3m bgl to ensure a min of 0.9m to clayey subsoil below 1.2m.

The treatment plant will be specified and installed by an appropriately qualified technician and in accordance with EPA COP 2021. It also will be subject to regular desludging and maintenance, as per manufacturers recommendations. Pressure tests and CCTV surveys will be carried out prior to commissioning to ensure absence of defects.

The percolation area is proposed to be located at the southeastern part of the site. The Site Suitability Assessment along with the technical drawings and specifications can be found in **Appendix 8.2**.

Increased Groundwater Vulnerability

The proposed Finished Floor Levels (FFL’s) will be up to 1.2m below the existing elevation of

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the site in certain places, which may increase the vulnerability of the underlying locally important aquifer from 'High' to 'Extreme' in the southern portion of the site, and from 'Moderate' to 'High' in the other areas. Mitigation measures to ensure maximum protection of groundwater include:

- The soil/subsoil layer thickness will be kept at 1m minimum as recommended for areas overlying Locally Important Aquifers.
- The site bunding is designed in accordance with IPC Guidance Note on storage and Transfer of Materials for Scheduled Activities (EPA, 2004)
- The tank farm area will be bunded in its entirety to ensure enough containment is provided in the unlikely event of a leak.
- The bund will be impermeable and provide the required storage volume i.e., a minimum of 110% of the largest single tank volume.
- 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.
- All bunds and pipelines (foul & process) will be subject to integrity assessments every 3 years by a suitably qualified engineer.

On-Site Flooding

The existing flood risk to the Proposed Development is negligible with the proposed site located in 'Flood Zone C'. No specific mitigation measures to alleviate flood risk to the site are recommended.

The proposed stormwater management system is designed in accordance with industry standards and is projected to emulate the current runoff rates calculated at the site.

Uncontrolled Releases and Spillage

An Environmental Management System (EMS) will be implemented and accredited to ISO: 14001:2015. The Proposed Development will operate under an Industrial Emissions Licence (IEL) issued by the Environmental Protection Agency (EPA), containing 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:

- 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 or 25% of the total volume of the substance which could be stored withing the bunded area (in compliance with Guidance to storage and Transfer of Materials for Scheduled Activities, EPA 2004)
- EMS to include site specific standard operating procedures pertaining to waste management and emergency response.
- Impermeable membrane liner will be installed under the attenuation pond to limit percolation of contents into the underlying locally important aquifer.
- The entire tank farm area of the Proposed Development will be bunded.
- The Reception Hall, Digestate Storage building, and Nutrient Recovery Building will each be self-bunded.

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- All bunds and underground pipelines (foul and process) will be subject to integrity assessments every 3 years by a suitably qualified engineer.
- Ongoing monitoring of stormwater discharge to the local hydrologic system.

Fire and Resultant Firewater

The Proposed Development 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.

The conclusions and recommendations of the Firewater Risk Assessment Report will ensure that fire response and firewater retention are adequately scaled for the size of the facility. The operator of the facility will be obliged to ensure:

- A Firewater Risk Assessment will be commissioned within the first six months of operation and will determine the volume of firewater retention storage require on site.
- Adequate firewater retention capacity is installed and maintained on-site in the event of a worst-case scenario fire event.
- Firewater retention will be the containment bund and underground tank in the reception building.
- All retention infrastructure systems will be automatically activated in the event of a fire alarm being triggered.
- All retention tanks, etc., shall be maintained empty, or at least to a point where the required retention capacity is available.
- Bunds and tanks will be constructed to Eurocode standard (BS EN 1992-3:2006).

Conversion of Permeable Soils to Hard standing

The operation phase will involve the conversion of the existing greenfield site to areas of hardstanding. The following measures will be implemented to minimise an increase of flood risk to the receiving catchment during the operation phase:

- Sustainable Urban Drainage Systems (SuDS) such as such as sediment chambers, oil traps into drainage ditches and attenuation ponds included.
- Drainage systems will be designed to attenuate excess surface water runoff with suitable storage volumes for the Proposed Development and reduce the outflow rate to below the estimated greenfield rate before discharging.
- An attenuation pond is provided to facilitate the existing gradients on the site. The attenuation pond is designed for a 1:100-year event and well as to regulate the outflow from the site.

Land Spreading of biobased fertiliser

The operation phase will involve the production of a biobased fertiliser which will be used by customer farmers for the fertilisation of their land. Mitigation measures to ensure maximum protection of receiving environment include:

- Nutrient management plans to avoid excess fertiliser application
- Farmers to comply with the Nitrates Action Plan
- "Lay-off" period of 21 days for grazing or harvesting following application
- Biobased fertiliser will be pasteurised in accordance with Regulation (EU) 142/2011 on use of animal by products as organic fertiliser.

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Uncontrolled Release of Discharge

The Proposed Development includes digestate treatment using separation, ultrafiltration, and reverse osmosis to recover the water content within the digestate.

The Reverse Osmosis (RO) system will maintain a steady maximum outflow volume of 10m^3 per hour. Following the RO stage, the purified water generated by the process will be stored in a balance tank before being reused onsite for cleaning activities and returned to the process as a feeding liquid.

Since no process water will be discharged off-site, the implementation of specific mitigation measures is not required.

Attenuation Pond

The Proposed Development includes an attenuation pond to the northwest of the site which will be used for attenuating surface water run-off from roads, yards, roofs and the impermeable bunded area. The following mitigation measures are proposed in order to ensure maximum protection of the surface and groundwater systems:

- The attenuation pond is designed for a 1:100 year event and well as to regulate the outflow from the site.
- Installation of Sustainable Urban Drainage Systems (SuDS) features such as Sumps in gullies and catchpits collect silts in run-off from roads, filter drains, discharge bypass separator and an attenuation pond.

8.7 Cumulative Effects

8.7.1 Interactions

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

Hydrology and hydrogeology are linked with land soils and geology as discussed in Chapter 7. In terms of hydrogeology specifically, the recharge capacity at the site will be diminished as a function of surface sealing, which has the potential to adversely enhance flood events downstream of the site. This is addressed in the above sections in regard to flood risk assessment and mitigation i.e. attenuation and SUDs and more detailed information can be found in the Site-Specific Flood Risk Assessment accompanying this application.

Hydrology is linked with ecology and biodiversity as discussed in Chapter 5. With the successful implementation of adequate mitigation measures potential hazards will be managed and the likelihood of environmental incidents occurring is very low. Any potential impacts are therefore resolved or minimised.

8.7.2 Potential Cumulative Impacts

Construction Phase

The commencement or phasing of other permitted developments in the area could lead to

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multiple construction sites operating simultaneously with the Proposed Development. A review of planning applications in the region identifies several pending proposals, which could result in cumulative impacts on the local hydrology and hydrogeology if construction periods overlap.

However, with the implementation of the mitigation measures outlined in this report, and assuming their successful application, the Proposed Development is not expected to significantly contribute to cumulative adverse impacts on the hydrological network. Nevertheless, cumulative socio-environmental impacts could still arise, such as potential overloading of foul sewer systems with construction water trade effluents, particularly if other developments fail to adopt similar mitigation strategies.

Operational Phase

In the absence of mitigation measures, surface sealing (paving, buildings on previously exposed ground), reduction in recharge to groundwater, and rapid transmission of runoff to surface water systems has the potential to significantly contribute to the cumulative / catchment hydrological response to rainfall.

The planned discharge of surface water into the local hydrological system is not anticipated to have a cumulative adverse impact on water quality. The discharge of process water is not expected as part of this development.

Considering the mitigation measures outlined in this report and the expected residual effect pending successful implementation of those measures, the development is not considered to significantly contribute to cumulative adverse impacts to the associated hydrological network.

8.8 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 hydrological and hydrogeological features.

The purpose of this assessment is to specify mitigation measures where appropriate to minimise the ‘risk factor’ to all aspects of the water environment such as to minimise the potential for hydrocarbons to contaminate the streams or groundwater, reduce the risk of erosion and 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.

8.8.1 Construction Phase

A summary of the predicted effects associated with the construction phase in terms of quality, significance, and duration, along with the proposed mitigation measures and resulting residual effects are summarised in **Table 8.18**.

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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***, ***imperceptible*** to ***sligh***t, and ***temporary.***

8.8.2 Operational Phase

A summary of the predicted effects associated with the operational phase in terms of quality, significance, and duration, along with the proposed mitigation measures and resulting residual effects are summarised in **Table 8.19.**

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

There are no controlled or uncontrolled emissions anticipated as a result of the Proposed Development.

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Table 8.18: Summary of predicted construction phase effects, mitigation measures and residual impact

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Increased Run-off and Sediment Loading	**Surface Water** *Moneylane and Ballyduff streams, River Avoca & Arklow Town Marsh pNHA*	During the construction phase, groundworks, soil exposure, and erosion from stockpiles of exposed soils could result in the migration of silt, sediments, and organic matter into surface water receptors through dust dispersal and surface runoff.	***Negative***	***Slight to Moderate***	***Temporary***	• 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. • Covers are to be provided over soil stockpiles when high wind and inclement weather are encountered if required. • Harmful materials and stockpiles should, whenever possible, be stored away from the natural drainage ditch located at the northern boundary of the site, given its direct pathway to nearby surface waterbodies.	***Neutral, Slight, Temporary***
	Groundwater *Wicklow Groundwater Body – Locally Important Aquifer*	Loose sediments becoming entrained in open excavations.	***Negative***	***Moderate***	***Temporary***	• Excavations to be backfilled as soon as possible to prevent any infiltration of contaminants to the subsurface and the aquifer. • Landscaping should be carried out as soon as possible to minimise weathering.	***Neutral, Slight, Temporary***
Accidental Spillages of Harmful Substances	**Surface Water** *Moneylane and Ballyduff streams, River Avoca & Arklow Town Marsh pNHA*	Spillage of contaminants such as fuels, oils, chemicals and cement material and subsequent migration into surface water receptors	***Negative***	***Moderate to Significant***	***Temporary***	• Establishment of bunded oil and chemical storage areas. • Refuelling of mobile plant in designated areas provided with spill protection. • Fuel bowsers should be located within bunded areas designed to contain 110% of the primary vessel's capacity or 25% of the total volume of substances stored within the bunded area. They should not be placed immediately adjacent to the northern boundary of the site or in the southern	***Negative, Slight, Temporary***

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Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
	Groundwater *Wicklow Groundwater Body – Locally Important Aquifer*	Spillage of contaminants in soils and subsoils, particularly in open excavations and/or in the southern portion of the site, and subsequent migration to the underlying aquifer.	***Negative***	***Moderate***	***Short-term***	portion, where groundwater vulnerability is higher compared to other areas of the site. • Only appropriately trained site operatives permitted to refuel plant and machinery on-site. • Regular inspections carried out on plant and machinery for leaks and general condition. • Emergency response plan. • Spill kits readily available throughout the site. • Use of ready-mixed supply of wet cement products. • Scheduling cement pours for dry days.	***Neutral, Slight, Temporary***
Increased Groundwater Vulnerability	**Groundwater** *Wicklow Groundwater Body – Locally Important Aquifer*	Excavation depths of up to 3.5 meters below ground level (mbgl) could significantly increase groundwater vulnerability in certain areas. In the southern part of the site, vulnerability could rise from 'High' to 'Extreme,' while in other areas, it could escalate from 'Moderate' to 'High'.	***Negative***	***Significant***	***Long-Term***	• Excavations to be backfilled as soon as possible to prevent any infiltration of contaminants to the subsurface and the aquifer. • Landscaping should be carried out as soon as possible to minimise weathering. • Installation of impermeable liner is recommended under the attenuation pond. • Implement phased excavation with regular monitoring for groundwater levels to promptly identify and mitigate any breaches or increased vulnerability. • Install temporary barriers around excavation sites to limit groundwater exposure.	***Negative, Slight, Temporary***
Excavation of Bedrock Aquifer		Potential removal of bedrock in certain parts of the site to create a uniform base.	***Negative***	***Significant***	***Long-Term***		***Negative, Slight, Long-term***
Gas Pipeline		Removal of soil/subsoil cover during the installation of the gas pipeline	***Negative***	***Significant***	***Long-Term***		***Negative, Slight, Temporary***

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Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Excavation of Contaminated Soils	**Surface Water** *Moneylane and Ballyduff streams, River Avoca & Arklow Town Marsh pNHA*	There is no indication of any incidences of land use which might result in the contamination of soils; hence excavation of contaminated soils is unlikely.	***Unlikely***	***Negligible***	***Unlikely***	• 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.	***Unlikely, Negligible, Unlikely***
	Groundwater *Wicklow Groundwater Body – Locally Important Aquifer*		***Unlikely***	***Negligible***	***Unlikely***		***Unlikely, Negligible, Unlikely***
Conversion of Permeable Soils to Hard standing	**Surface Water** *Moneylane and Ballyduff streams, River Avoca & Arklow Town Marsh pNHA*	The gradual conversion of the site to hardstanding areas may increase the volume and intensity of surface water runoff within the receiving catchment, potentially elevating the risk of flooding both upstream and downstream of the proposed site.	***Negative***	***Moderate***	***Temporary***	• The rate of surface water discharge to the stream will be restricted to a maximum permissible rate of 10.7 lit/sec. This rate is calculated in accordance with criteria defined in the Greater Dublin Strategic Drainage Study [‘GDSDS’] to ensure the Proposed Development will not affect the flow / flood regimes in the receiving environment • Floor levels upstream of the storage areas are at least 500mm above the top water level in the detention basins for the 100-year event. • Overtopping does not occur during rainfall events ranging from 30 minutes to 1440 minutes. No risk of flooding of adjacent areas. • Attenuation Pond will accommodate the total catchment area capacity and will provide a minimum storage capacity of 1,619.534 m3 (designed to accommodate the estimated rainfall events)	***Negative, Slight, Temporary***

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Table 8.19: Summary of predicted construction phase effects, mitigation measures and residual impact

Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Contaminated Run-off	**Surface Water** *Moneylane and Ballyduff streams, River Avoca & Arklow Town Marsh pNHA*	Run-off from impermeable areas within the Proposed Development site discharging into surface water bodies	***Negative***	***Moderate to Significant***	***Temporary***	• Overtopping from rainfall is concentrated at the detention basin only. • Floor levels upstream of the storage areas are at least 500mm above the top water level in the detention basins for the 100-year event. • Drainage systems will be designed to attenuate excess surface water runoff with suitable storage volumes • Reduction of outflow rate to below the existing greenfield runoff rate before discharging into the watercourse from the attenuation pond. • Sumps in gullies and manholes collect silts in run-off from roads • Class 1 discharge bypass separator treats surface water for hydrocarbons run-off before its discharge to the attenuation pond • All surface water run-off will discharge to the attenuation pond. The floor of the basin will be shaped to allow for the retention of silts in the pond. • Regular inspection and maintenance of all treatment measures to remove accumulated silts and disposed of to an appropriately licenced landfill • Regular testing prior to discharge to ensure treatment effectiveness. • The digestion process area will be completely bunded and constructed to Eurocode standard (BS EN 1992-3) • The rate of discharge to the stream will be restricted to a maximum permissible rate of 10.7 lit/sec.	***Neutral, Slight, Temporary***
	Groundwater *Wicklow Groundwater Body – Locally Important Aquifer*	Run-off from impermeable areas within the Proposed Development site infiltrating downwards through soils into aquifer	***Negative***	***Moderate***	***Short-term***		***Neutral, Imperceptible, Short-term***

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Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Foul Water	**Surface Water** *Moneylane and Ballyduff streams, River Avoca & Arklow Town Marsh pNHA*	Leakage of untreated foul water and infiltration via preferential pathways to site drainage system and subsequent discharge to surface water receptors	***Negative***	***Moderate to Significant***	***Temporary***	• A domestic scale wastewater treatment plant is proposed to cater for the foul water arising from staff facilities on-site only. • The wastewater treatment plant will comprise a secondary treatment system with a soil polish filter, followed by a percolation area. • The 8 * 32mm lateral pipes are to be located at 1.25m intervals and placed over a (8-32mm) 250-mm layer of distribution stone and covered with 150mm of protection stone and this layer and entire stone footprint overlain by a geotextile with a min 250mm of topsoil back to new raised surface. • The treatment plant will be specified and installed by an appropriately qualified technician and in accordance with EPA COP 2021. It also will be subject to regular desludging and maintenance, as per manufacturers recommendations. Pressure tests and CCTV surveys will be carried out prior to commissioning to ensure absence of defects. • Programme of inspection and maintenance to ensure any defects are repaired	***Negative, Slight, Temporary***
	Groundwater *Wicklow Groundwater Body – Locally Important Aquifer*	Leakage of untreated foul water and infiltration downwards through sediments into aquifer	***Negative***	***Moderate to Significant***	***Short-Term***		***Negative, Slight, Short-term***
Increased Groundwater Vulnerability	**Groundwater** *Wicklow Groundwater Body – Locally Important Aquifer*	The proposed Finished Floor Levels (FFL's) will be up to 1.5m below the existing elevation of the site in certain places, which may increase the vulnerability of the underlying locally important aquifer from 'High' to 'Extreme' in the southern portion of the site, and from 'Moderate' to 'High' in the other areas.	***Negative***	***Significant***	***Long-Term***	• The soil/subsoil layer thickness will be kept at 1m minimum as recommended for areas overlying Locally Important Aquifers. • The site bunding is designed in accordance with IPC Guidance Note on storage and Transfer of Materials for Scheduled Activities (EPA, 2004) • The tank farm area will be bunded in its entirety to ensure enough containment is provided in the unlikely event of a leak. • The bund will be impermeable and provide the required storage volume i.e., a minimum of 110% of the largest single tank volume. • Dedicated hard standing for off-loading areas, with a minimum separation distance from adjacent water courses.	***Negative, Slight, Short-term***

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Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
						• 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. • All bunds and pipelines (foul & process) will be subject to integrity assessments every 3 years by a suitably qualified engineer.	
On-Site Flooding	**Surface Water** *Moneylane and Ballyduff streams, River Avoca & Arklow Town Marsh pNHA*	The site is located at an elevated point within its catchment and the likelihood of flooding occurring on the site are unlikely.	***Negligible***	***Not significant***	***Unlikely***	• The proposed Finished Floor Levels are above the estimated 1 in 1000-year return period fluvial flood event placing the units within Flood Zone C • The proposed stormwater management system is designed in accordance with industry standards and is projected to emulate the current greenfield runoff rates calculated at the site.	***Negligible, Imperceptible, Unlikely***
Uncontrolled Releases & Spillage of Digestate and Feedstocks	**Surface Water** *Moneylane and Ballyduff streams, River Avoca & Arklow Town Marsh pNHA*	During the operational phase, there is a possibility of leakage or spillage of biobased fertiliser or feedstocks via vehicle movements or from a catastrophic failure of a tank or feed line. While such substances are significantly less hazardous than fuels, oils, chemicals	***Negative***	***Slight to Moderate***	***Temporary***	• 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 or 25% of the total volume of the substance which could be stored withing the bunded area (in compliance with Guidance to storage and Transfer of Materials for Scheduled Activities, EPA 2004) • EMS to include site specific standard operating procedures pertaining to waste management and emergency response.	***Neutral to Negative, Slight, Temporary***

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Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
	Groundwater *Wicklow Groundwater Body – Locally Important Aquifer*	and cement material, the still pose a potential risk to surface and groundwater quality.	***Negative***	***Slight to Moderate***	***Temporary***	• Impermeable membrane liner will be installed under the attenuation pond to limit percolation of contents into the underlying locally important aquifer. • The entire tank farm area of the Proposed Development will be bunded. • The Reception Hall, Digestate Storage building, and Nutrient Recovery Building will each be self-bunded. • All bunds and underground pipelines (foul and process) will be subject to integrity assessments every 3 years by a suitably qualified engineer. • Ongoing monitoring of stormwater discharge to the local hydrologic system.	***Neutral to Negative, Slight, Temporary***
Fire and Resultant Firewater	**Surface Water** *Moneylane and Ballyduff streams, River Avoca & Arklow Town Marsh pNHA*	Given the presence of flammable substances on the site, there is a risk of fire prevalent at the facility, during the operational phase. In the event of a fire, significant quantities of water resources will be utilised to quench the fire. Water used to quench a fire is known as “firewater”. Firewater is known to contain several harmful substances, as detailed in **Section 8.5.4.**	***Negative***	***Slight to Moderate***	***Temporary***	• A Firewater Risk Assessment will be commissioned within the first six months of operation and will determine the volume of firewater retention storage require on site. • Adequate firewater retention capacity is installed and maintained on-site in the event of a worst-case scenario fire event. • Firewater retention will be the containment bund and underground tank in the reception building. • All retention infrastructure systems will be automatically activated in the event of a fire alarm being triggered. • All retention tanks, etc., shall be maintained empty, or at least to a point where the required retention capacity is available. • Bunds and tanks will be constructed to Eurocode standard (BS EN 1992-3:2006).	***Negative, Slight, Temporary***
	Groundwater *Wicklow Groundwater Body – Locally Important Aquifer*		***Negative***	***Moderate***	***Short-Term***		***Negative, Slight, Short-Term***

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Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Conversion of Permeable Soils to Hard standing	**Surface Water** *Moneylane and Ballyduff streams, River Avoca & Arklow Town Marsh pNHA*	The conversion of a significant area of the site to hardstanding areas may increase the volume and intensity of surface water runoff within the receiving catchment, potentially elevating the risk of flooding both upstream and downstream of the proposed site.	***Negative***	***Moderate***	***Long-Term***	• Sustainable Urban Drainage Systems (SuDS) such as such as sediment chambers, oil traps into drainage ditches and attenuation ponds included. • Drainage systems will be designed to attenuate excess surface water runoff with suitable storage volumes for the Proposed Development and reduce the outflow rate to below the estimated greenfield rate before discharging. • An attenuation pond is provided to facilitate the existing gradients on the site. The attenuation pond is designed for a 1:100-year event and well as to regulate the outflow from the site.	***Neutral, Slight, Long-term***
Land Spreading of biobased fertiliser	**Surface Water** *Moneylane and Ballyduff streams, River Avoca & Arklow Town Marsh pNHA*	Application of processed biobased fertiliser to agricultural land. Reduction in chemical fertiliser use, pathogen and diseases which may be contained and spread in untreated manures Discharge of contaminated materials into the attenuation ponds may have the potential to percolate into the underlying aquifer and to reach surface water receptor via run-off.	***Negative***	***Slight***	***Temporary***	• Nutrient management plans to avoid excess fertiliser application • Farmers to comply with the Nitrates Action Plan • “Lay-off” period of 21 days for grazing or harvesting following application • Biobased fertiliser will be pasteurised in accordance with Regulation (EU) 142/2011 on use of animal by products as organic fertiliser.	***Positive, Imperceptible, Temporary***
	Groundwater *Wicklow Groundwater Body – Locally Important Aquifer*		***Negative***	***Slight***	***Short-Term***		***Positive, Imperceptible, Short-term***

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Potential Source	Environmental Receptor	Impact Description	Quality	Significance	Duration	Mitigation	Residual Impact
Uncontrolled Release of Discharge	**Surface Water** *Moneylane and Ballyduff streams, River Avoca & Arklow Town Marsh pNHA*	The Proposed Development includes digestate treatment using separation, ultrafiltration, and reverse osmosis to recover the water content within the digestate. No process water will be discharged off-site.	***Negative***	***Significant***	***Temporary***	Since no process water will be discharged off-site, the implementation of specific mitigation measures is not required.	***Negligible, Imperceptible, Unlikely***
Attenuation Pond	**Surface Water** *Moneylane and Ballyduff streams, River Avoca & Arklow Town Marsh pNHA*	Discharge of contaminated materials into the attenuation pond may have the potential to percolate into the underlying aquifer and to reach surface water receptor via run-off.	***Negative***	***Moderate***	***Temporary***	• The attenuation pond is designed for a 1:100 year event and well as to regulate the outflow from the site. • Installation of Sustainable Urban Drainage Systems (SuDS) features such as: Sumps in gullies and catchpits collect silts in run-off from roads, filter drains, discharge bypass separator and an attenuation pond.	***Neutral, Slight, Long-term***

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8.9 Monitoring

The Construction Environmental Management Plan (CEMP) and Environmental Management System (EMS) and the Industrial Emissions Licence (IEL) will include provision for the monitoring of construction related activities including the following:

- Water Quality Monitoring of the surface water receptors *ca.* 500m north to the site boundary – Moneylane Stream U/S and D/S
- Daily inspections for housekeeping and site cleanliness
- Dust Suppression on dry days or during concrete cutting
- Risk assessment for the prevention of fuel spillages
- Monitoring of stockpiles to determine if further measures are required to prevent erosion
- Daily site inspections to ensure procedures outlined within the CEMP are adhered through throughout the Proposed Development.

The site will be subject to inspection by the Environmental Protection Agency (EPA) who will critically assess the site's compliance with Surface Water Regulations (S.I. No. 77/2019)

Monitoring for the Proposed Development will be conducted in line with BAT Waste treatment CID and conditions set out in the proposed EPA licence. Monitoring results will be reported to the EPA annually. The site will be subject to inspection by the Environmental Protection Agency who will critically assess the site's compliance with the conditions of the Industrial Emissions licence (IEL).

8.10 Summary of Significant Effects

The surface water receptors considered in this assessment include the Moneylane Stream, the Ballyduff Stream, and, further downstream, the River Avoca as well as the Arklow Town Marsh pNHA. The groundwater receptor is the Wicklow Groundwater Body, a Locally Important Aquifer underlying the Proposed Development. While the development has the potential to adversely impact these sensitive receptors, the implementation of the recommended mitigation measures will reduce the risk of such effects to negligible levels.

8.11 Statement of Significance

The significance of impact upon local & regional hydrology and hydrogeology systems have been assessed for both the construction and operational phases. The results of the assessment are presented on **Table 8.18** and **Table 8.19**.

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***, ***imperceptible*** to ***slight***, and **unlikely to *temporary***.

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

There are no controlled or uncontrolled emissions anticipated as a result of the Proposed Development.

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APPENDIX 8.1

KILGALLEN & PARTNERS CONSULTING ENGINEERS		**TECHNICAL NOTE**
Subject Surface Water Drainage / SUDS – Wastewater – Water Supply		Reference No 24118-TN-SUDS
Project Proposed AD Facility, Moneylane, Arklow, Co. Wicklow	Author RE	Issue No PL01
Job No 24118	Checker PB	Date 14/01/2025

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1. Introduction

This technical note describes the surface water drainage system and SUDS regime designed to serve an AD Facility ['the proposed development'] proposed on lands ['the Site'] at Moneylane, Arklow, Co. Wicklow. It has been prepared for inclusion with the plans and particulars to be submitted to Wicklow County Council in support of an application for planning permission for the proposed development.

This technical note is to be read in conjunction with drawings listed in Table 1.

Drawing No.	Title
24118-DR-0101	Civils Infrastructure – General Layout
24118-DR-0102	Civils Infrastructure – Sightlines for Site Entrance – Ballyduff S.
24118-DR-0103	Civils Infrastructure – Arrivals of Design HCV Swept Path & Passing Bay
24118-DR-0104	Civils Infrastructure – Departures of Design HCV Swept Path & Passing Bay
24118-DR-0105	Civils Infrastructure – Site Sections
24118-DR-0106	Civils Infrastructure – Signs, Roadmarkings, Kerbs, & Wall Details
24118-DR-0501	Civils Infrastructure – Drainage General Layout & Bulk Earthworks Schedule
24118-DR-0502	Civils Infrastructure – Surface Water Drainage – Longitudinal Sections

Table 1 Reference Drawings

2. Site Details

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General

The Site measures 3.86 hectares on plan and is in a rural area and surrounded by agricultural lands except at its southwest boundary, which adjoins Ballyduff S., a rural country road.

The existing site drains to the northern direction and the existing ground level slopes at 1%-5% gradient towards the northern boundary. All the lands within the Site drain towards the northern boundary towards a regional natural pond.

Figure 1 shows the existing ground level as a colour coded map, with arrows denoting the direction of fall.

Ground Conditions

Ground conditions at the Site are known to be relatively poor with low sub-soil permeability. There is therefore little scope for the concentration of run-off to discrete infiltration areas such as soakaways.

Outfall

Given the low sub-soil permeability, it will not be possible to infiltrate all run-off to ground and so discharge to the existing drainage to the North of the Site will be necessary.

There is an existing small stream tributary to the Ballyduff Stream located to the north of our site where local drainage flows. Our outfall will discharge to a local drainage channel/ditch and be conveyed to the Ballyduff Stream.

Figure 1 Site Topography

3. Proposed Development

Details of the proposed development are shown on the reference drawings.

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In broad terms, the development comprises:

- the facility, which comprises buildings, ancillary yards and grassed landscaped areas;
- a storage area which will be bunded to prevent potential contamination in the event of a failure of any of the storage facilities;
- landscaped areas surround the site with the majority at the corners of the proposed site.

In drainage terms, the proposed development will comprise two separate networks:

- run-off from the buildings and yards in the facility will be collected in a sealed pipe network which will discharge to the existing drainage path.
- rain falling on the bunded area will be collected in surface open channel concrete gutters and routed to a grated sump manhole with penstock, sampling chamber and pump, from which it will be pumped to the surface water drainage system for the remaining areas of the facility.

4. Hydrology

Rainfall values used in the design of the surface water sewer network and SUDS measures are based on IDF (intensity / duration / frequency) for the site location created using the Flood Studies Report. Both Winter and Summer storm profiles are used.

A climate changer factor of +20% was applied to the rainfall values predicted by the FSR.

Further details of rainfall data are provided in Appendix B.

5. Run-off Coefficients

Run-off coefficients used in the design are shown in Table 2.

Surface Type	Run-off Coefficient
Buildings	1.00
Yard	0.95
Bunded Area	0.95
Grassed Areas	0.00

Table 2 Run-off Coefficients

6. Design

A model for the surface water drainage system was designed using AutoDesk Infodrainage. Details of this model are provided in Appendix B. The results of design calculations for the critical 1% AEP rainfall events are provided in Appendix C.

7. SUDS Regime - Quantity

Discharge Rate

Subsoils are unsuited to infiltration of all surface water run-off and so it will be necessary to discharge surface water run-off to an outfall that is positioned to maintain the natural drainage course as best as possible.

The rate of discharge to the stream will be restricted to a maximum permissible rate of 10.6 lit/sec. This rate is calculated in accordance with criteria defined in the Greater Dublin Strategic Drainage Study ['GDSDS'] to ensure the proposed development will not affect the flow / flood regimes in the receiving environment.

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Storage of attenuated surface water

The restriction on discharge will attenuate surface water run-off within the Site when the run-off from the proposed development exceeds the discharge rate.

This attenuated water will be stored temporarily in a detention basin located in a grassed landscaped area close to the watercourse. Details of this detention basin are provided on the reference drawings.

Design Calculations

Design calculations for the proposed drainage / attenuation system are provided in Appendix C.

8. SUDS Regime – Quality

Surface water run-off will be treated by the various measures described in Table 3.

Stage	Treatment Measure
1	Sumps in gullies and manholes collect silts in run-off from roads
3	Class 1 discharge bypass separator treats surface water for hydrocarbons run-off before its discharge to the detention basin
4	All surface water run-off will discharge to the detention basin. The floor of the basin will be shaped to allow for the retention of silts in the basin
5	Regular inspection and maintenance of all treatment measures to remove accumulated silts and disposed of to an appropriately licenced landfill

Table 3 Treatment Train

9. SUDS Regime – Biodiversity and Amenity

The Site is currently under agricultural use. The proposed development includes a comprehensive landscaping plan which introduce additional flora to the Site and thus increase its biodiversity.

10. Wastewater Treatment for Proposed Office Building

The existing site does not have access to a public wastewater sewer, so a private wastewater treatment system is proposed for the site. The office building will be the sole generator of wastewater and is designed for a max occupancy of 10 employees a day. A minimum 4 PE wastewater treatment system with a sump chamber and pump (min. 140 litres of volume below invert of system required) and a 60qm partially raised soils polishing filter is being proposed for the facility.

The system is designed by Geoenvironmental Consultants. Refer to Appendix D for a site-specific assessment report, testing results, and specifications. The location is shown on Drg No 24118-DR-0501 and is indicative and subject to change upon detailed design of the system.

11. Water Supply

Our site's water supply is divided into three parts: fire water, grey water, and clean water (potable).

Fire supply is collected from roof drain runoff, transported via underground piping and stored in an underground tank. An overflow invert in a roofwater chamber shall be provided for when the fire water tank is filled, the excess run-off will gravity flow into the surface water carrier pipe.

Rainwater harvesting and the water generated from the reverse osmosis process within the facility will be used for grey water.

Imported bottled water will be used to meet potable water requirements in the office.

During construction, the existing piped water source for the livestock will be utilised, supplemented by bottled water for drinking/cleaning.

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APPENDIX A – SUDS CRITERIA – QUANTITY

Criteria	Return Period (yrs)	Design Objective	Design Proposal
River Regime Protection	1	Discharge rate equal to 1-year greenfield site peak runoff rate or 2l/s/ha, whichever is the greater. Site critical duration storm to be used to assess attenuation storage volume	The surface water system is designed to comply with this sub-criterion.
	100	Discharge rate equal to 1 in 100-year greenfield site peak runoff rate. Site critical duration storm to be used to assess attenuation storage volume.	The surface water system initially designed to comply with this sub-criterion. The discharge rate was subsequently reduced to comply with Criterion 4.
Level of Service (flooding) for the Site	30	No flooding on site except where specifically planned flooding is approved. Summer design storm of 15 or 30 minutes are normally critical.	Flooding does not occur during rainfall events ranging from 30 minutes to 1440 minutes in duration.
	100	No internal property flooding. Planned flood routing and temporary flood storage accommodated on site for short high intensity storms. Site critical duration events.	Localised overtopping of occurs during rainfall events ranging from 30 minutes to 1440 minutes. This overtopping is concentrated at the locations of detention basins only.
	100	No internal property flooding. Floor levels at least 500mm above maximum river level and adjacent onsite storage retention.	Floor levels upstream of the storage areas are at least 500mm above the top water level in the detention basins for the 100-year event.
	100	No flooding of adjacent urban areas. Overland flooding managed within the development.	Overtopping does not occur during rainfall events ranging from 30 minutes to 1440 minutes. No risk of flooding of adjacent areas.
River Flood Protection (Sub-criterion 4.1, 4.2 or 4.3 to be applied)	100	"Long-term" floodwater accommodated on site for development runoff volume which is in excess of the greenfield runoff volume. Temporary flood storage drained by infiltration on a designated flooding area brought into operation by extreme events only. 100-year, 6-hour duration storm to be used for assessment of the additional volume of runoff.	It is not possible to meet either sub-criterion 4.1 or 4.2; accordingly, the surface water drainage network has been designed to meet sub-criterion 4.3. • Q_{BAR} is calculated as 12.8 lit/sec; details of this calculation are provided in Appendix B. • The Site Area is 3.74 hectares; at 2 lit/sec/ha, the equivalent rate of discharge is 7.48 lit/sec. Accordingly. the maximum permissible rate of discharge will be set at 12.8 lit/sec.
	100	Infiltration storage provided equal in volume to "long term" storage. Usually designed to operate for all events. 100year, 6-hour duration storm to be used for assessment of the additional volume of runoff.	
	100	Maximum discharge rate of QBAR or 2 l/s/ha, whichever is the greater, for all attenuation storage where separate "long term" storage cannot be provided	

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APPENDIX B – Surface Water Model

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Rainfall

24118 NRG ARKLOW:	Date: 20/12/2024		
	Designed by: RE	Checked by:	Approved By:
Report Title: Rainfall Analysis Criteria	Company Address:		

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Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Shortest
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Prefill Manhole Sumps	☐
Perform No Discharge Analysis	☐

Rainfall

FSR

Type: FSR

Region	Scotland and Ireland
M5-60 (mm)	16.4
Ratio R	0.250
Summer	☑
Winter	☑

Return Period

Return Period (years)	Increase Rainfall (%)
2.0	20.000

Storm Durations

Duration (mins)	Run Time (mins)
30	60
120	240
240	480
480	960
720	1440
1440	2880

24118 NRG ARKLOW:	Date: 20/12/2024		
	Designed by: RE	Checked by:	Approved By:
Report Title: Rainfall Analysis Criteria	Company Address:		

RECEIVED: 03/04/2025

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Shortest
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Prefill Manhole Sumps	☐
Perform No Discharge Analysis	☐

Rainfall

FSR

Type: FSR

Region	Scotland and Ireland
M5-60 (mm)	16.4
Ratio R	0.250
Summer	☑
Winter	☑

Return Period

Return Period (years)	Increase Rainfall (%)
30.0	20.000

Storm Durations

Duration (mins)	Run Time (mins)
30	60
120	240
240	480
480	960
720	1440
1440	2880

24118 NRG ARKLOW:	Date: 20/12/2024		
	Designed by: RE	Checked by:	Approved By:
Report Title: Rainfall Analysis Criteria	Company Address:		

RECEIVED: 03/04/2025

Runoff Type	Dynamic
Output Interval (mins)	5
Time Step	Shortest
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Prefill Manhole Sumps	☐
Perform No Discharge Analysis	☐

Rainfall

FSR

Type: FSR

Region	Scotland and Ireland
M5-60 (mm)	16.4
Ratio R	0.250
Summer	☑
Winter	☑

Return Period

Return Period (years)	Increase Rainfall (%)
100.0	20.000

Storm Durations

Duration (mins)	Run Time (mins)
30	60
120	240
240	480
480	960
720	1440
1440	2880

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Permissible Rate of Discharge

24118 NRG ARKLOW:	Date: 20/12/2024		
	Designed by: RE	Checked by:	Approved By:
Report Title: UK and Ireland Rural Runoff Calculator	Company Address:		

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ICP SUDS / IH 124

Details

Method	ICP SUDS
Area (ha)	3.86
SAAR (mm)	1000.0
Soil	0.3
Region	Region 1
Urban	0
Return Period (years)	0

Results

Region	QBAR Rural (L/s)	QBAR Urban (L/s)	Q 1 (years) (L/s)	Q 30 (years) (L/s)	Q 100 (years) (L/s)
Region 1	10.7	10.7	9.1	20.2	26.5

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Storage Area and Flow Control on Outlet

24118 NRG ARKLOW:	Date: 20/12/2024		
	Designed by: RE	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address:		

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Pond

Type : Pond

Dimensions

Exceedance Elevation (m)	47.600
Depth (m)	1.000
Base Elevation (m)	46.600
Freeboard (mm)	0
Initial Depth (m)	0.000
Porosity (%)	100
Average Slope (1:x)	3.08
Total Volume (m³)	1619.534

Depth (m)	Area (m²)	Volume (m³)
0.000	1405.00	0.000
1.000	1844.00	1619.534

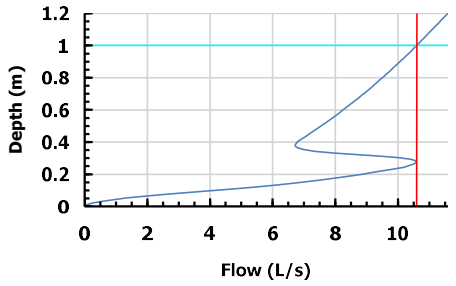
Outlets

Outlet

Outgoing Connection	Pond Outlet No Delay
Outlet Type	Hydro-Brake®

Invert Elevation (m)	46.600
Design Depth (m)	1.000
Design Flow (L/s)	10.6
Objective	Minimize Upstream Storage Requirements
Application	Surface Water Only
Sump Available	☐

Unit Reference	CHE-0142-1060-1000-1060



Advanced

Perimeter	Circular
Length (m)	46.821
Friction Scheme	Colebrook-White Roughness
Roughness (mm)	0.6

24118 NRG ARKLOW:	Date: 20/12/2024		
	Designed by: RE	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:		

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Critical Storm Per Item: Rank By: Max. Resident Volume

Stormwater Control	Storm Event	Max. US Elevation (m)	Max. DS Elevation (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Total Lost Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Pond	FSR: 100 years: +20 %: 1440 mins: Winter	47.542	47.542	0.942	0.942	62.2	1512.741	0.000	0.000	10.6	1403.278	6.594	OK

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APPENDIX C – Surface Water Calculations

24118 NRG ARKLOW:	Date: 20/12/2024		
	Designed by: RE	Checked by:	Approved By:
Report Details: Type: Inflows Summary Storm Phase: Phase	Company Address:		

RECEIVED: 03/04/2025

Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m^3)
Catchment Area	FSR: 2 years: +20 %: 30 mins: Winter	0.08	9.3	8.538
Catchment Area (1)	FSR: 2 years: +20 %: 30 mins: Winter	0.41	45.8	42.240
Catchment Area (2)	FSR: 2 years: +20 %: 30 mins: Winter	0.06	6.6	6.078
Catchment Area (3)	FSR: 2 years: +20 %: 30 mins: Winter	0.06	6.2	5.742
Catchment Area (4)	FSR: 2 years: +20 %: 30 mins: Winter	0.50	54.9	50.676
Catchment Area (5)	FSR: 2 years: +20 %: 30 mins: Winter	0.04	4.4	4.062
Reception Building	FSR: 2 years: +20 %: 30 mins: Winter	0.21	22.9	21.120
Digestate Building	FSR: 2 years: +20 %: 30 mins: Winter	0.10	11.1	10.284
Catchment Area (8)	FSR: 2 years: +20 %: 30 mins: Winter	0.01	1.6	1.494
Bunded Area	FSR: 2 years: +20 %: 30 mins: Winter	0.82	90.9	83.898
Catchment Area (11)	FSR: 2 years: +20 %: 30 mins: Winter	0.02	2.5	2.310
Office	FSR: 2 years: +20 %: 30 mins: Winter	0.02	1.9	1.794

24118 NRG ARKLOW:	Date: 20/12/2024		
	Designed by: RE	Checked by:	Approved By:
Report Details: Type: Junctions Summary Storm Phase: Phase	Company Address:		

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Critical Storm Per Item: Rank By: Max. Flooded Volume

Junction	Storm Event	Cover Elevation (m)	Invert Elevation (m)	Max. Elevation (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
S80 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	50.460	49.450	49.504	0.054	5.9	0.061	0.000	5.9	5.090	OK
S70 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	50.405	49.200	49.246	0.046	5.9	0.052	0.000	5.9	5.083	OK
CP90 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	50.290	49.430	49.552	0.122	5.9	0.138	0.000	5.9	5.089	OK
S65 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	50.272	49.000	49.046	0.046	12.2	0.053	0.000	12.2	10.512	OK
RW11 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	50.261	49.350	49.448	0.098	21.8	0.111	0.000	21.8	18.812	OK
S61a (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	50.220	47.440	49.026	1.586	33.9	1.793	0.000	33.9	27.609	OK
RW1 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	50.178	49.000	49.081	0.081	12.1	0.092	0.000	12.1	10.489	OK
RW2 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	50.151	49.200	49.270	0.070	10.6	0.079	0.000	10.6	9.185	OK
CP66 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	50.113	49.010	49.086	0.076	6.3	0.086	0.000	6.3	5.422	OK
S60 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	50.080	48.040	48.265	0.225	100.3	0.254	0.000	100.3	85.026	OK
S50 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	49.800	47.840	48.077	0.237	100.3	0.268	0.000	100.2	84.989	OK
C230 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	49.601	48.880	48.946	0.066	8.8	0.074	0.000	8.8	7.643	OK
S40 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	49.550	47.550	47.815	0.265	156.6	0.300	0.000	156.5	133.854	OK
CP220 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	49.590	48.390	48.532	0.142	8.8	0.161	0.000	8.8	7.668	OK
CP210 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	49.450	48.370	48.526	0.156	52.3	0.177	0.000	52.3	45.393	OK
CP200 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	49.320	48.254	48.412	0.158	52.3	0.179	0.000	52.3	45.347	OK
S30 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	49.230	47.200	47.462	0.262	158.9	0.296	0.000	158.7	135.617	OK

24118 NRG ARKLOW:	Date: 20/12/2024		
	Designed by: RE	Checked by:	Approved By:
Report Details: Type: Junctions Summary Storm Phase: Phase	Company Address:		

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SP01 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	47.590	46.000	46.282	0.282	86.5	0.319	0.000	86.5	74.910	OK
S20 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	48.700	46.870	47.189	0.319	245.2	0.360	0.000	243.6	210.625	OK
S10 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	47.850	46.650	47.123	0.473	243.6	0.535	0.000	242.1	209.986	OK
Pond Inlet (Surface Water)	FSR: 2 years: +20 %: 30 mins: Summer	47.600	46.600	47.066	0.466	242.1	0.527	0.000	241.4	209.324	OK
Manhole	FSR: 2 years: +20 %: 30 mins: Summer	47.000	46.540	46.540	0.000	6.5	0.000	0.000	6.5	14.421	OK
CP41	FSR: 2 years: +20 %: 30 mins: Summer	49.290	47.620	47.913	0.293	152.4	0.331	0.000	152.4	130.181	OK
CP42	FSR: 2 years: +20 %: 30 mins: Summer	49.550	47.720	47.974	0.254	100.2	0.287	0.000	100.2	84.923	OK

24118 NRG ARKLOW:	Date: 20/12/2024		
	Designed by: RE	Checked by:	Approved By:
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address:		

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Critical Storm Per Item: Rank By: Max. Flow

Connection	Storm Event	Connection Type	From	To	Upstream Cover Elevation (m)	Max. US Water Elevation (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
s1.03 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	S70 (Surface Water)	S65 (Surface Water)	50.405	49.247	0.048	5.707	1.0	0.09	6.2	OK
s1.05 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	S60 (Surface Water)	S50 (Surface Water)	50.080	48.272	0.239	95.472	1.2	0.46	105.4	OK
s1.07 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	S40 (Surface Water)	S30 (Surface Water)	49.550	47.823	0.272	150.174	1.5	0.49	164.6	OK
s1.08 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	S30 (Surface Water)	S20 (Surface Water)	49.230	47.470	0.302	152.184	1.3	0.48	166.9	OK
s1.09 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	S20 (Surface Water)	S10 (Surface Water)	48.700	47.204	0.413	236.189	1.2	0.4	256.2	OK
s1.10 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	S10 (Surface Water)	Pond Inlet (Surface Water)	47.850	47.142	0.488	235.376	1.0	0.76	254.9	OK
s2.02 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	CP220 (Surface Water)	CP210 (Surface Water)	49.590	48.537	0.154	8.511	0.3	0.23	9.3	OK
s2.04 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	CP200 (Surface Water)	S60 (Surface Water)	49.320	48.417	0.198	50.791	0.9	0.39	55.0	OK
s1.02 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	S80 (Surface Water)	S70 (Surface Water)	50.460	49.506	0.051	5.714	0.9	0.12	6.2	OK
s4.01 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	S61a (Surface Water)	S60 (Surface Water)	50.220	49.028	0.160	31.136	1.0	0.19	35.6	OK
s5.02b (Surface Water)	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	RW11 (Surface Water)	S61a (Surface Water)	50.261	49.450	0.099	21.071	1.1	0.23	22.9	OK
s5.01 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	RW2 (Surface Water)	RW1 (Surface Water)	50.151	49.272	0.078	10.289	0.8	0.12	11.1	OK
s5.02 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	RW1 (Surface Water)	S61a (Surface Water)	50.178	49.083	0.086	11.751	0.8	0.14	12.8	OK
s1.04 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	S65 (Surface Water)	S60 (Surface Water)	50.272	49.048	0.140	11.790	0.4	0.06	12.8	OK
s1.03b (Surface Water)	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	CP66 (Surface Water)	S65 (Surface Water)	50.113	49.088	0.063	6.076	0.9	0.78	6.6	OK
s1.01 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	CP90 (Surface Water)	S80 (Surface Water)	50.290	49.555	0.090	0.000	0.6	0.47	6.2	OK
s2.03 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	CP210 (Surface Water)	CP200 (Surface Water)	49.450	48.531	0.162	50.765	1.2	0.31	55.0	OK

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s2.01 (Surface Water)	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	C230 (Surface Water)	CP220 (Surface Water)	49.601	48.947	0.107	8.555	0.5	0.2	9.2	OK
No Delay	FSR: 2 years: +20 %: 30 mins: Winter	No Delay	SP01 (Surface Water)	S20 (Surface Water)		46.288	0.128	83.898	0.0		90.9	
Pond Inlet No Delay	FSR: 2 years: +20 %: 30 mins: Winter	No Delay	Pond Inlet (Surface Water)	Pond		47.083	0.119	234.615	0.0		254.2	
Pond Outlet No Delay	FSR: 2 years: +20 %: 240 mins: Summer	No Delay	Pond	Manhole		46.877	0.022	220.423	0.0		10.6	
s1.06c	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	S50 (Surface Water)	CP42	49.800	48.085	0.255	95.434	1.1	0.46	105.4	OK
s1.06b	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	CP42	CP41	49.550	47.984	0.284	95.367	1.0	0.47	105.3	OK
s1.06a	FSR: 2 years: +20 %: 30 mins: Winter	Pipe	CP41	S40 (Surface Water)	49.290	47.923	0.288	146.057	1.5	0.63	160.2	OK

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Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m^3)
Catchment Area	FSR: 30 years: +20 %: 30 mins: Winter	0.08	17.1	15.768
Catchment Area (1)	FSR: 30 years: +20 %: 30 mins: Winter	0.41	84.5	77.988
Catchment Area (2)	FSR: 30 years: +20 %: 30 mins: Winter	0.06	12.1	11.214
Catchment Area (3)	FSR: 30 years: +20 %: 30 mins: Winter	0.06	11.5	10.596
Catchment Area (4)	FSR: 30 years: +20 %: 30 mins: Winter	0.50	101.4	93.594
Catchment Area (5)	FSR: 30 years: +20 %: 30 mins: Winter	0.04	8.1	7.494
Reception Building	FSR: 30 years: +20 %: 30 mins: Winter	0.21	42.3	39.000
Digestate Building	FSR: 30 years: +20 %: 30 mins: Winter	0.10	20.6	18.990
Catchment Area (8)	FSR: 30 years: +20 %: 30 mins: Winter	0.01	3.0	2.754
Bunded Area	FSR: 30 years: +20 %: 30 mins: Winter	0.82	167.8	154.932
Catchment Area (11)	FSR: 30 years: +20 %: 30 mins: Winter	0.02	4.6	4.260
Office	FSR: 30 years: +20 %: 30 mins: Winter	0.02	3.6	3.306

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Critical Storm Per Item: Rank By: Max. Flooded Volume

Junction	Storm Event	Cover Elevation (m)	Invert Elevation (m)	Max. Elevation (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
S80 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	50.460	49.450	49.524	0.074	10.9	0.084	0.000	10.9	9.435	OK
S70 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	50.405	49.200	49.264	0.064	10.9	0.072	0.000	10.9	9.427	OK
CP90 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	50.290	49.430	49.594	0.164	10.9	0.186	0.000	10.9	9.433	Surcharged
S65 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	50.272	49.000	49.063	0.063	22.5	0.072	0.000	22.5	19.440	OK
RW11 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	50.261	49.350	49.488	0.138	40.2	0.156	0.000	40.2	34.753	OK
S61a (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	50.220	47.440	49.058	1.618	62.6	1.830	0.000	62.5	52.432	OK
RW1 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	50.178	49.000	49.115	0.115	22.4	0.130	0.000	22.4	19.379	OK
RW2 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	50.151	49.200	49.298	0.098	19.6	0.111	0.000	19.6	16.957	OK
CP66 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	50.113	49.010	49.116	0.106	11.6	0.120	0.000	11.6	10.012	OK
S60 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	50.080	48.040	48.508	0.468	168.4	0.529	0.000	163.4	158.545	Surcharged
S50 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	49.800	47.840	48.384	0.544	163.4	0.615	0.000	160.8	158.547	Surcharged
C230 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	49.601	48.880	48.971	0.091	16.3	0.103	0.000	16.3	14.092	OK
S40 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	49.550	47.550	48.106	0.556	262.1	0.629	0.000	258.7	248.908	Surcharged
CP220 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	49.590	48.390	48.623	0.233	16.3	0.263	0.000	15.2	14.184	OK
CP210 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	49.450	48.370	48.620	0.250	95.6	0.282	0.000	93.4	83.832	OK
CP200 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	49.320	48.254	48.584	0.330	93.4	0.373	0.000	83.7	83.750	OK
S30 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	49.230	47.200	47.866	0.666	263.0	0.754	0.000	259.3	252.693	Surcharged

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SP01 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	47.590	46.000	47.413	1.413	159.7	1.598	0.000	159.7	138.330	Flood Risk
S20 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	48.700	46.870	47.653	0.783	419.0	0.885	0.000	417.9	390.818	Surcharged
S10 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	47.850	46.650	47.513	0.863	417.9	0.976	0.000	417.3	388.796	Surcharged
Pond Inlet (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	47.600	46.600	47.387	0.787	417.3	0.890	0.000	416.8	387.234	Flood Risk
Manhole	FSR: 30 years: +20 %: 30 mins: Summer	47.000	46.540	46.540	0.000	10.4	0.000	0.000	10.4	24.668	OK
CP41	FSR: 30 years: +20 %: 30 mins: Summer	49.290	47.620	48.233	0.613	255.7	0.693	0.000	254.3	242.032	Surcharged
CP42	FSR: 30 years: +20 %: 30 mins: Summer	49.550	47.720	48.304	0.584	160.8	0.660	0.000	159.2	158.494	Surcharged

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Critical Storm Per Item: Rank By: Max. Flow

Connection	Storm Event	Connection Type	From	To	Upstream Cover Elevation (m)	Max. US Water Elevation (m)	Max. Flow Depth (m)	Discharge Volume (m^3)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
s1.03 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	S70 (Surface Water)	S65 (Surface Water)	50.405	49.266	0.066	10.561	1.2	0.17	11.5	OK
s1.05 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	S60 (Surface Water)	S50 (Surface Water)	50.080	48.731	0.450	177.809	1.3	0.77	176.0	Surcharged
s1.07 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	S40 (Surface Water)	S30 (Surface Water)	49.550	48.249	0.525	279.039	1.6	0.81	271.2	Surcharged
s1.08 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	S30 (Surface Water)	S20 (Surface Water)	49.230	47.983	0.525	283.264	1.3	0.81	278.5	Surcharged
s1.09 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	S20 (Surface Water)	S10 (Surface Water)	48.700	47.740	0.600	438.004	1.6	0.68	439.5	Surcharged
s1.10 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	S10 (Surface Water)	Pond Inlet (Surface Water)	47.850	47.583	0.600	435.567	1.6	1.3	438.8	Flood Risk
s2.02 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Summer	Pipe	CP220 (Surface Water)	CP210 (Surface Water)	49.590	48.623	0.241	14.048	0.4	0.38	15.2	OK
s2.04 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	CP200 (Surface Water)	S60 (Surface Water)	49.320	48.836	0.375	93.827	1.0	0.64	89.5	Surcharged
s1.02 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	S80 (Surface Water)	S70 (Surface Water)	50.460	49.526	0.071	10.569	1.1	0.23	11.5	OK
s4.01 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	S61a (Surface Water)	S60 (Surface Water)	50.220	49.062	0.300	58.922	1.1	0.35	65.8	OK
s5.02b (Surface Water)	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	RW11 (Surface Water)	S61a (Surface Water)	50.261	49.492	0.139	38.928	1.3	0.43	42.3	OK
s5.01 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	RW2 (Surface Water)	RW1 (Surface Water)	50.151	49.301	0.110	18.997	0.9	0.23	20.6	OK
s5.02 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	RW1 (Surface Water)	S61a (Surface Water)	50.178	49.119	0.121	21.710	0.9	0.26	23.6	OK

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s1.04 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	S65 (Surface Water)	S60 (Surface Water)	50.272	49.066	0.300	21.762	0.5	0.11	23.6	OK
s1.03b (Surface Water)	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	CP66 (Surface Water)	S65 (Surface Water)	50.113	49.119	0.088	11.212	1.2	1.44	12.1	OK
s1.01 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	CP90 (Surface Water)	S80 (Surface Water)	50.290	49.599	0.123	0.000	0.7	0.87	11.5	Surcharged
s2.03 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	CP210 (Surface Water)	CP200 (Surface Water)	49.450	48.887	0.375	93.755	1.3	0.54	94.7	Surcharged
s2.01 (Surface Water)	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	C230 (Surface Water)	CP220 (Surface Water)	49.601	48.976	0.225	15.748	0.6	0.37	17.0	OK
No Delay	FSR: 30 years: +20 %: 30 mins: Winter	No Delay	SP01 (Surface Water)	S20 (Surface Water)		47.424	0.174	154.932	0.0		167.8	
Pond Inlet No Delay	FSR: 30 years: +20 %: 30 mins: Winter	No Delay	Pond Inlet (Surface Water)	Pond		47.443	0.156	433.670	0.0		438.2	
Pond Outlet No Delay	FSR: 30 years: +20 %: 30 mins: Winter	No Delay	Pond	Manhole		46.885	0.022	25.759	0.0		10.6	
s1.06c	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	S50 (Surface Water)	CP42	49.800	48.583	0.450	177.819	1.2	0.75	172.8	Surcharged
s1.06b	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	CP42	CP41	49.550	48.484	0.450	177.761	1.2	0.75	169.8	Surcharged
s1.06a	FSR: 30 years: +20 %: 30 mins: Winter	Pipe	CP41	S40 (Surface Water)	49.290	48.396	0.450	271.330	1.7	1.05	268.3	Surcharged

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Critical Storm Per Item: Rank By: Max. Inflow

Inflow	Storm Event	Inflow Area (ha)	Max. Inflow (L/s)	Total Inflow Volume (m^3)
Catchment Area	FSR: 100 years: +20 %: 30 mins: Winter	0.08	22.3	20.574
Catchment Area (1)	FSR: 100 years: +20 %: 30 mins: Winter	0.41	110.3	101.790
Catchment Area (2)	FSR: 100 years: +20 %: 30 mins: Winter	0.06	15.9	14.640
Catchment Area (3)	FSR: 100 years: +20 %: 30 mins: Winter	0.06	15.0	13.830
Catchment Area (4)	FSR: 100 years: +20 %: 30 mins: Winter	0.50	132.3	122.136
Catchment Area (5)	FSR: 100 years: +20 %: 30 mins: Winter	0.04	10.6	9.786
Reception Building	FSR: 100 years: +20 %: 30 mins: Winter	0.21	55.1	50.892
Digestate Building	FSR: 100 years: +20 %: 30 mins: Winter	0.10	26.8	24.774
Catchment Area (8)	FSR: 100 years: +20 %: 30 mins: Winter	0.01	3.9	3.588
Bunded Area	FSR: 100 years: +20 %: 30 mins: Winter	0.82	219.1	202.194
Catchment Area (11)	FSR: 100 years: +20 %: 30 mins: Winter	0.02	6.0	5.544
Office	FSR: 100 years: +20 %: 30 mins: Winter	0.02	4.7	4.314

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Critical Storm Per Item: Rank By: Max. Flooded Volume

Junction	Storm Event	Cover Elevation (m)	Invert Elevation (m)	Max. Elevation (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
S80 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	50.460	49.450	49.535	0.085	14.3	0.096	0.000	14.4	12.315	OK
S70 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	50.405	49.200	49.296	0.096	14.4	0.109	0.000	12.9	12.307	OK
CP90 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	50.290	49.430	49.632	0.202	14.3	0.229	0.000	14.3	12.313	Surcharged
S65 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	50.272	49.000	49.284	0.284	27.6	0.322	0.000	26.8	25.332	OK
RW11 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	50.261	49.350	49.534	0.184	52.5	0.208	0.000	48.1	44.633	OK
S61a (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	50.220	47.440	49.436	1.996	76.7	2.257	0.000	75.5	68.912	Surcharged
RW1 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	50.178	49.000	49.445	0.445	29.6	0.504	0.000	29.0	25.311	Surcharged
RW2 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	50.151	49.200	49.470	0.270	25.5	0.306	0.000	25.9	22.154	OK
CP66 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	50.113	49.010	49.331	0.321	15.1	0.363	0.000	14.8	13.071	Surcharged
S60 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	50.080	48.040	49.261	1.221	213.2	1.381	0.000	213.5	207.534	Surcharged
S50 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	49.800	47.840	49.111	1.271	213.5	1.437	0.000	224.5	207.572	Surcharged
C230 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	49.601	48.880	49.531	0.651	21.2	0.737	0.000	28.3	18.588	Flood Risk
S40 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	49.550	47.550	48.732	1.182	315.4	1.337	0.000	315.3	325.510	Surcharged
CP220 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	49.590	48.390	49.422	1.032	28.3	1.167	0.000	28.6	19.094	Flood Risk
CP210 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	49.450	48.370	49.414	1.044	126.1	1.181	0.000	126.1	109.890	Flood Risk
CP200 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Winter	49.320	48.254	49.330	1.076	132.4	11.607	10.402	142.1	122.512	Flood
S30 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	49.230	47.200	48.377	1.177	321.0	1.331	0.000	320.8	330.696	Surcharged

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SP01 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	47.590	46.000	47.478	1.478	208.4	1.671	0.000	208.4	180.528	Flood Risk
S20 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	48.700	46.870	48.044	1.174	529.2	1.328	0.000	529.1	510.195	Surcharged
S10 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	47.850	46.650	47.813	1.163	529.1	1.315	0.000	529.0	507.055	Flood Risk
Pond Inlet (Surface Water)	FSR: 100 years: +20 %: 30 mins: Winter	47.600	46.600	47.609	1.009	543.2	9.890	8.759	497.2	564.470	Flood
Manhole	FSR: 100 years: +20 %: 30 mins: Summer	47.000	46.540	46.540	0.000	10.3	0.000	0.000	10.3	22.099	OK
CP41	FSR: 100 years: +20 %: 30 mins: Summer	49.290	47.620	48.917	1.297	305.5	1.467	0.000	305.3	316.522	Surcharged
CP42	FSR: 100 years: +20 %: 30 mins: Summer	49.550	47.720	49.009	1.289	224.5	1.458	0.000	234.9	207.518	Surcharged

24118 NRG ARKLOW:	Date: 20/12/2024			
	Designed by: RE	Checked by:	Approved By:	
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address:			

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Critical Storm Per Item: Rank By: Max. Flow

Connection	Storm Event	Connection Type	From	To	Upstream Cover Elevation (m)	Max. US Water Elevation (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
s1.03 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Winter	Pipe	S70 (Surface Water)	S65 (Surface Water)	50.405	49.325	0.219	13.794	1.2	0.21	14.5	OK
s1.05 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Winter	Pipe	S60 (Surface Water)	S50 (Surface Water)	50.080	49.289	0.450	232.680	1.4	0.98	224.3	Surcharged
s1.07 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Winter	Pipe	S40 (Surface Water)	S30 (Surface Water)	49.550	48.771	0.525	364.763	1.5	0.95	318.4	Surcharged
s1.08 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Winter	Pipe	S30 (Surface Water)	S20 (Surface Water)	49.230	48.409	0.525	370.535	1.5	0.94	324.3	Surcharged
s1.09 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Winter	Pipe	S20 (Surface Water)	S10 (Surface Water)	48.700	48.071	0.600	571.025	1.9	0.84	543.3	Surcharged
s1.10 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Winter	Pipe	S10 (Surface Water)	Pond Inlet (Surface Water)	47.850	47.828	0.600	567.295	1.9	1.61	543.2	Flood Risk
s2.02 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	Pipe	CP220 (Surface Water)	CP210 (Surface Water)	49.590	49.422	0.300	18.402	0.4	0.71	28.6	Flood Risk
s2.04 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Winter	Pipe	CP200 (Surface Water)	S60 (Surface Water)	49.320	49.330	0.375	122.512	1.3	1.01	142.1	Flood
s1.02 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Winter	Pipe	S80 (Surface Water)	S70 (Surface Water)	50.460	49.535	0.105	13.804	1.1	0.3	15.0	OK
s4.01 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Winter	Pipe	S61a (Surface Water)	S60 (Surface Water)	50.220	49.495	0.300	77.352	1.2	0.44	82.3	Surcharged
s5.02b (Surface Water)	FSR: 100 years: +20 %: 30 mins: Winter	Pipe	RW11 (Surface Water)	S61a (Surface Water)	50.261	49.622	0.300	50.080	1.4	0.54	53.1	OK
s5.01 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Winter	Pipe	RW2 (Surface Water)	RW1 (Surface Water)	50.151	49.527	0.300	24.816	0.9	0.29	26.0	Surcharged
s5.02 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Winter	Pipe	RW1 (Surface Water)	S61a (Surface Water)	50.178	49.506	0.300	28.335	0.9	0.32	29.6	Surcharged

24118 NRG ARKLOW:			Date: 20/12/2024									
			Designed by: RE	Checked by:	Approved By:							
Report Details: Type: Connections Summary Storm Phase: Phase			Company Address:									

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s1.04 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Winter	Pipe	S65 (Surface Water)	S60 (Surface Water)	50.272	49.313	0.300	28.387	0.5	0.14	30.1	Surcharged
s1.03b (Surface Water)	FSR: 100 years: +20 %: 30 mins: Winter	Pipe	CP66 (Surface Water)	S65 (Surface Water)	50.113	49.366	0.150	14.637	1.3	1.87	15.8	Surcharged
s1.01 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Winter	Pipe	CP90 (Surface Water)	S80 (Surface Water)	50.290	49.648	0.150	0.000	0.8	1.13	15.0	Surcharged
s2.03 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Winter	Pipe	CP210 (Surface Water)	CP200 (Surface Water)	49.450	49.429	0.375	122.417	1.3	0.75	132.4	Flood Risk
s2.01 (Surface Water)	FSR: 100 years: +20 %: 30 mins: Summer	Pipe	C230 (Surface Water)	CP220 (Surface Water)	49.601	49.531	0.225	18.484	0.7	0.62	28.3	Flood Risk
No Delay	FSR: 100 years: +20 %: 30 mins: Winter	No Delay	SP01 (Surface Water)	S20 (Surface Water)		47.492	0.199	202.194	0.0		219.1	
Pond Inlet No Delay	FSR: 100 years: +20 %: 30 mins: Winter	No Delay	Pond Inlet (Surface Water)	Pond		47.609	0.166	564.476	0.0		497.2	
Pond Outlet No Delay	FSR: 100 years: +20 %: 120 mins: Summer	No Delay	Pond	Manhole		47.134	0.022	90.779	0.0		10.6	
s1.06c	FSR: 100 years: +20 %: 30 mins: Winter	Pipe	S50 (Surface Water)	CP42	49.800	49.145	0.450	232.712	1.4	0.98	225.9	Surcharged
s1.06b	FSR: 100 years: +20 %: 30 mins: Summer	Pipe	CP42	CP41	49.550	49.009	0.450	207.518	1.5	1.04	234.9	Surcharged
s1.06a	FSR: 100 years: +20 %: 30 mins: Winter	Pipe	CP41	S40 (Surface Water)	49.290	48.959	0.450	354.751	1.9	1.2	308.0	Surcharged

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APPENDIX D – Waste Treatment Specifications and Report

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Web: www.geoenvironmental.ie

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SITE SUITABILITY ASSESSMENT

Desk Study Maps & Site Photos

On behalf of

Nephin Renewable Gas - Moneylane

At

Moneylane, Arklow, Co. Wicklow

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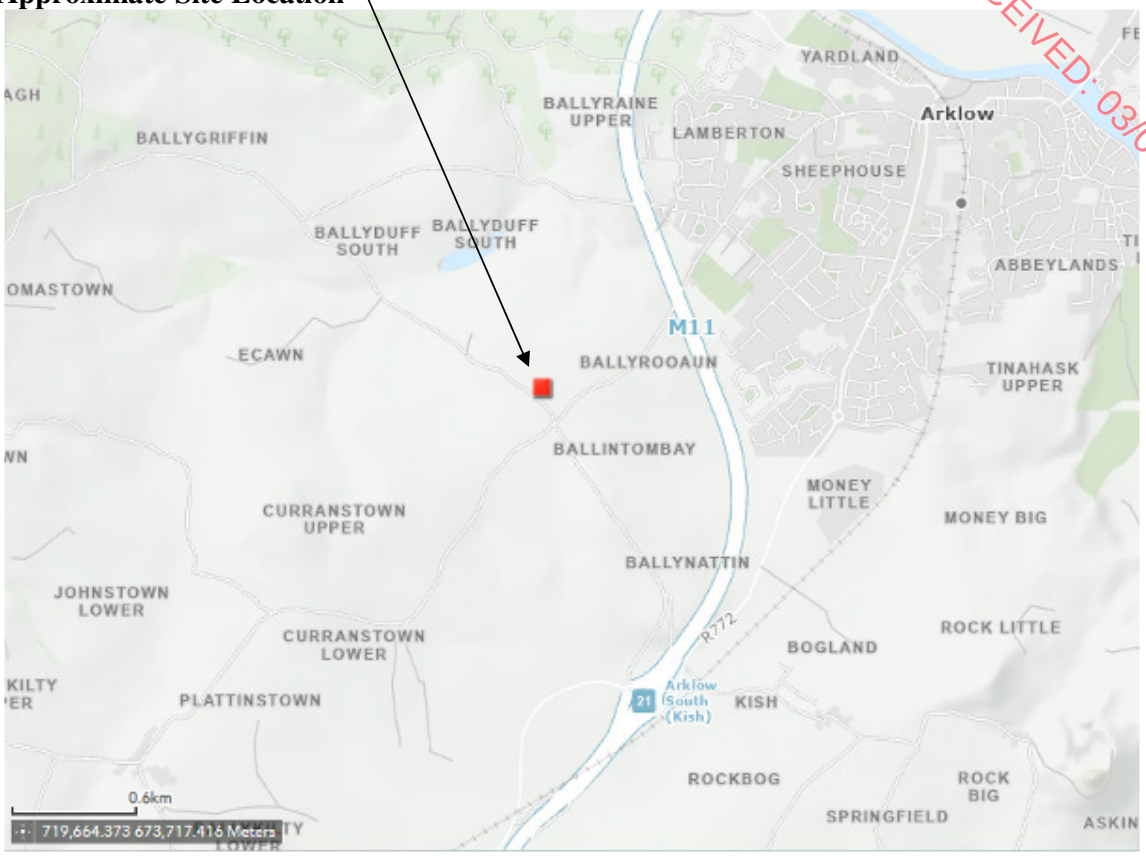
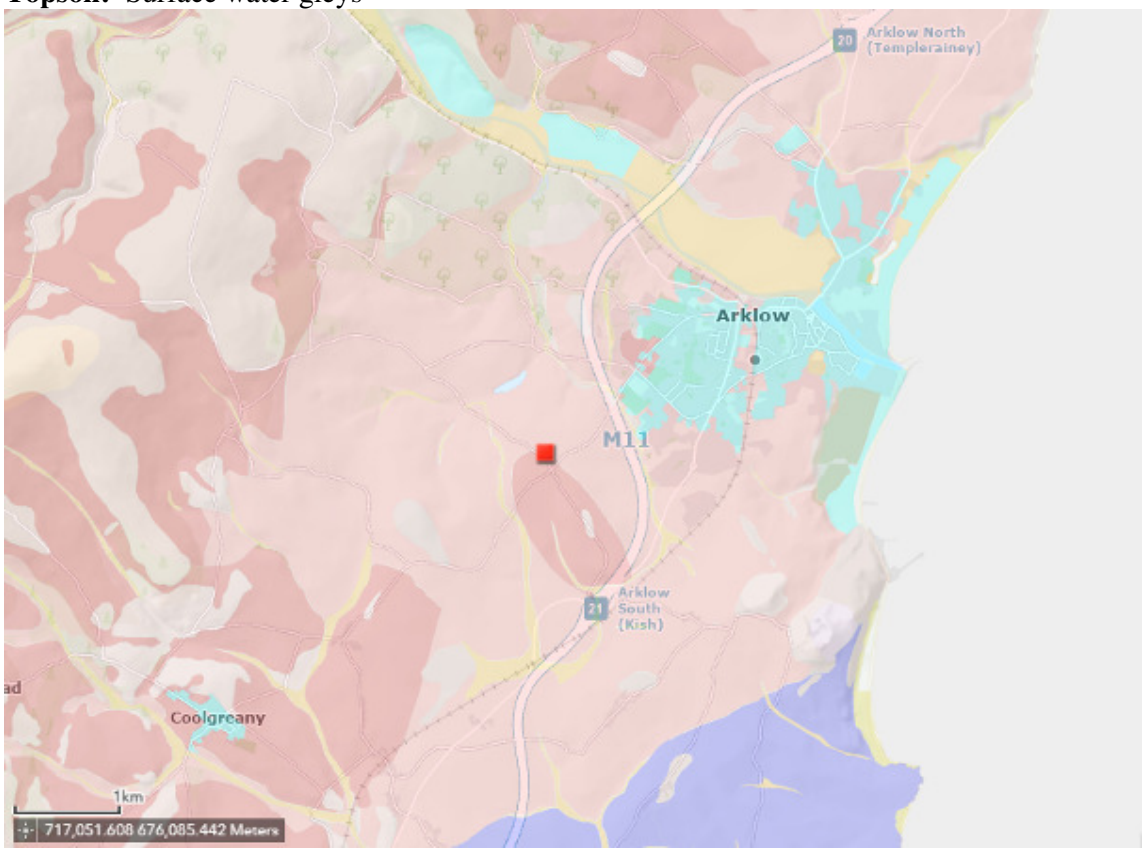
Approximate Site Location



Topsoil: Surface water gleys



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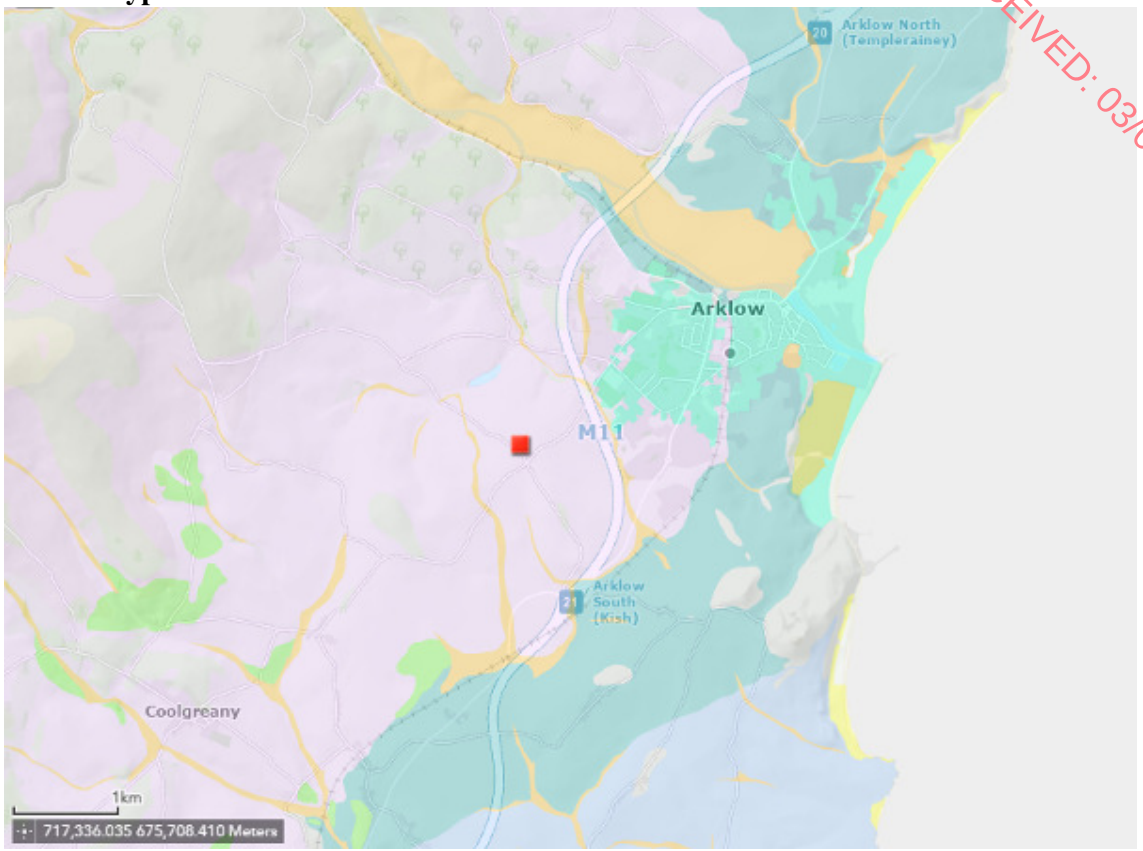
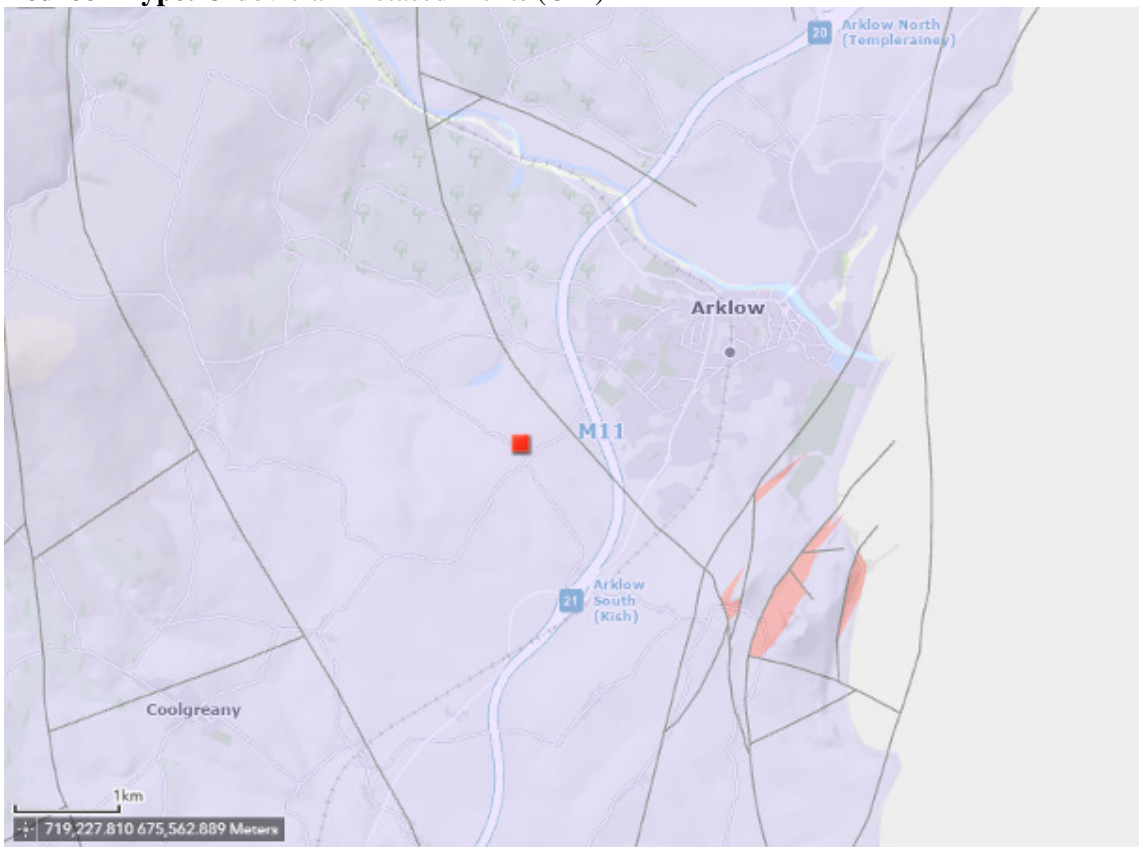
Subsoil Type: Lower Palaeozoic sandstones and shale Till



Bedrock Type: Ordovician Metasediments (OM)



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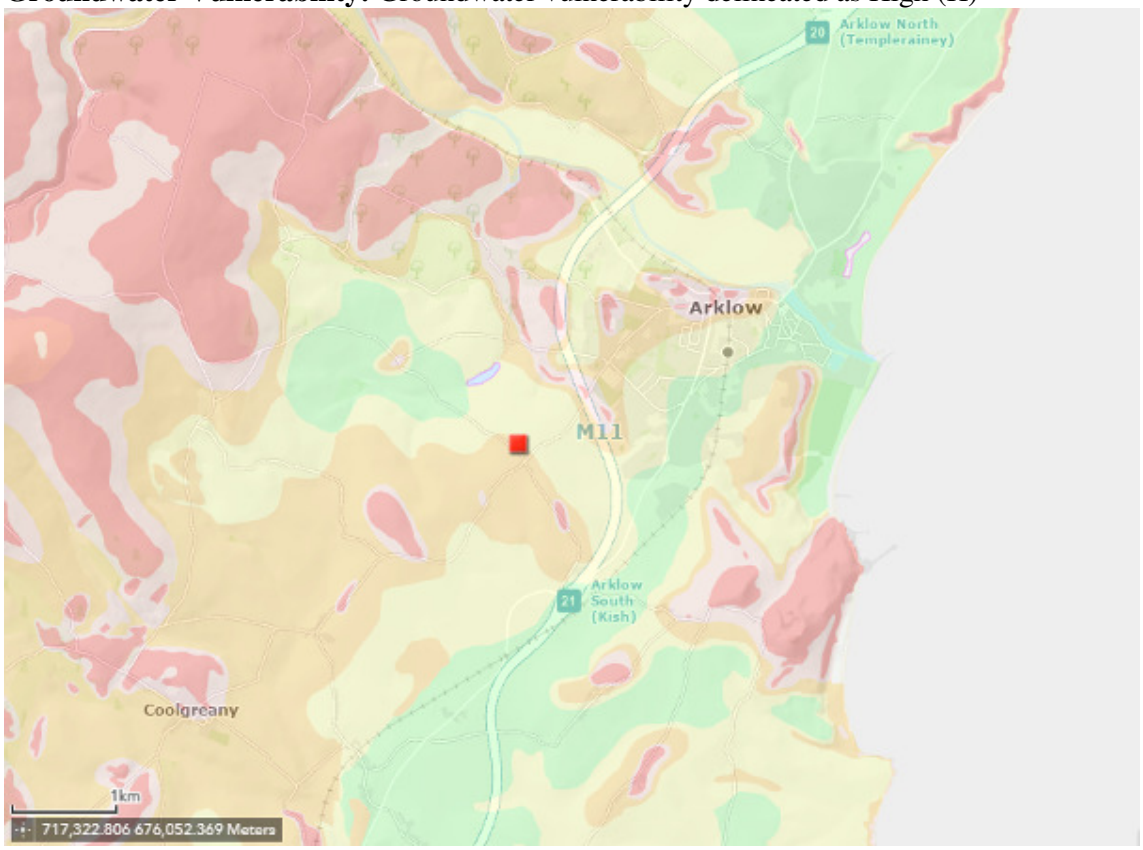
Aquifer Classification: Locally Important Aquifer (LI)

Groundwater Vulnerability: Groundwater vulnerability delineated as High (H)



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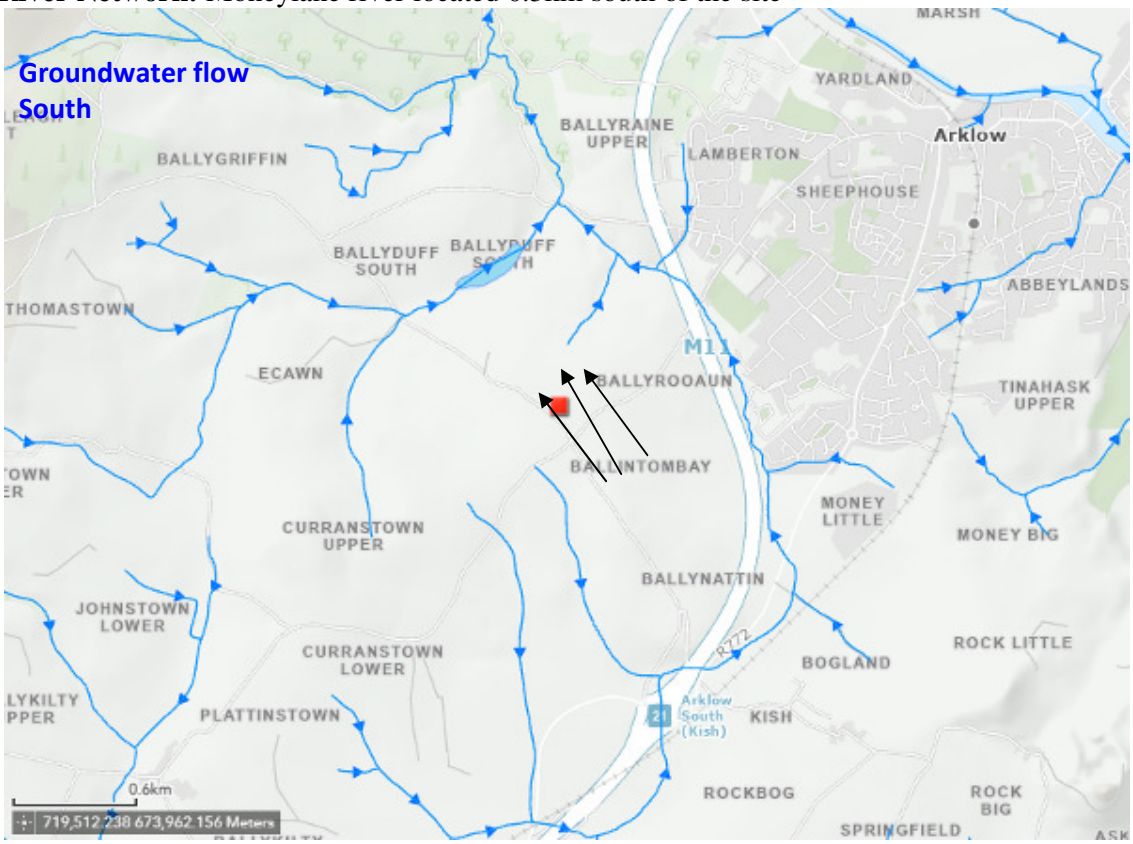
Source Protection Areas: No SPA's in the vicinity of the site

River Network: Moneylane river located 0.3km south of the site



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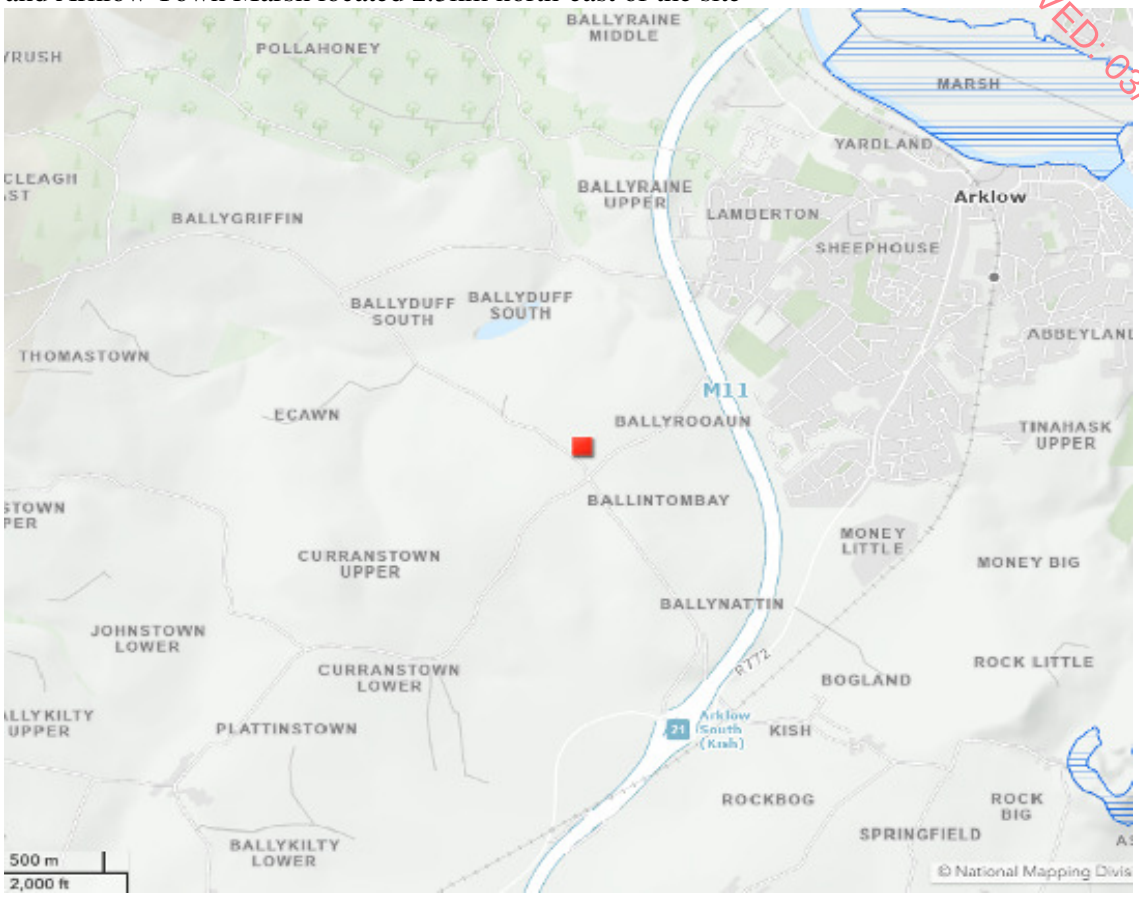
National Parks & Wildlife: pNHA - Arklow Rock-Askintinny located 2.8km south-east and Arklow Town Marsh located 2.3km north-east of the site



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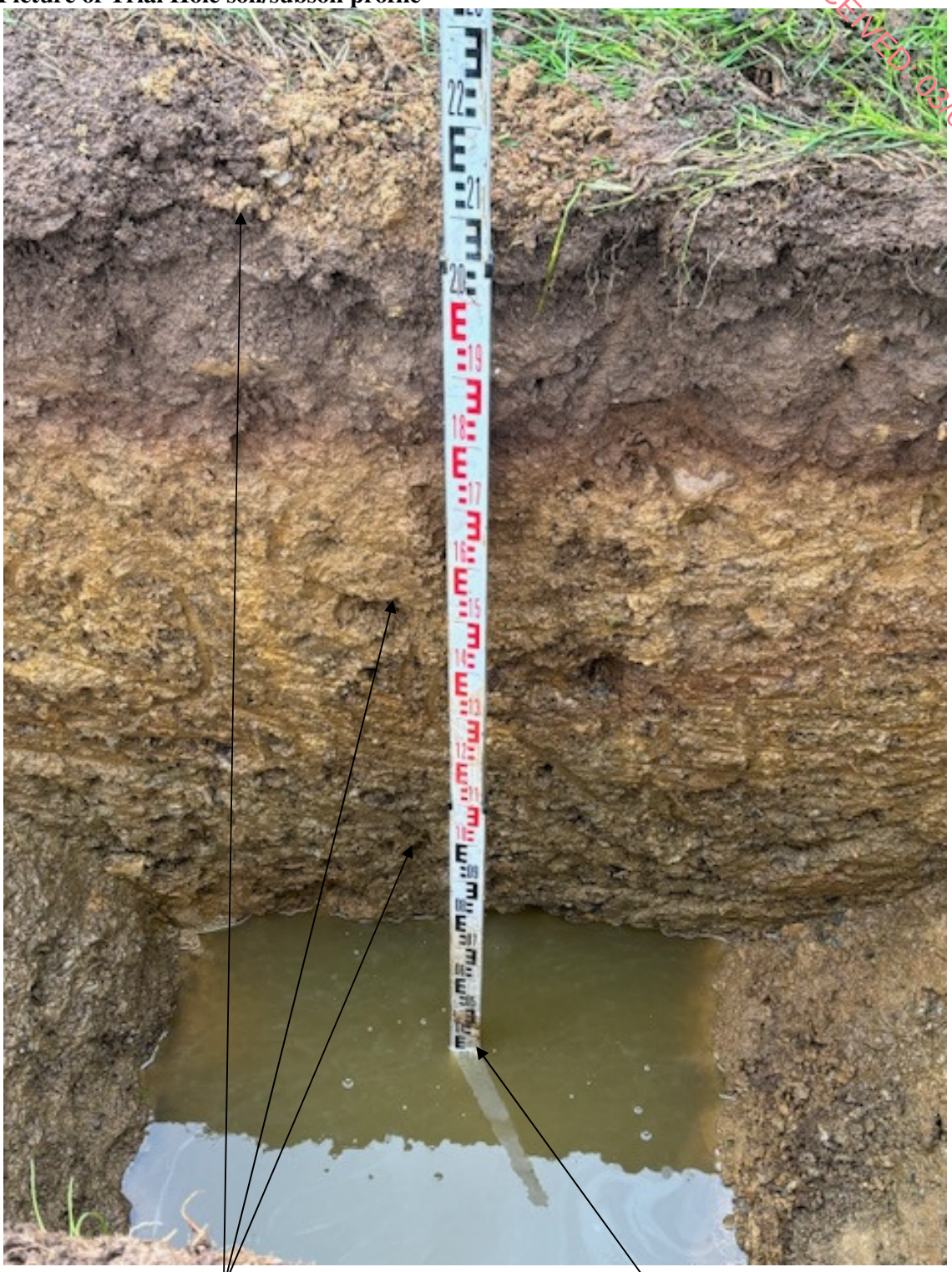
Picture of Trial Hole soil/subsoil profile



Three different soil/subsoil layers were visible during the trial hole assessment, these layers can be seen in the picture above. The site characterisation form identifies these layers in more detail.

Water table @1.85m bgl

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Upper Profile

Lower Profile

Full Extent of Trial Hole

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Pic of Excavated Soil

T Test Trenches (T1-T3)

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Pic of T-Test

Pic of P-Test

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BS Test Classification Pics

Subsoil Upper

Subsoil Lower

Dilatancy

Ribbon

Thread

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Pic Across Test Holes

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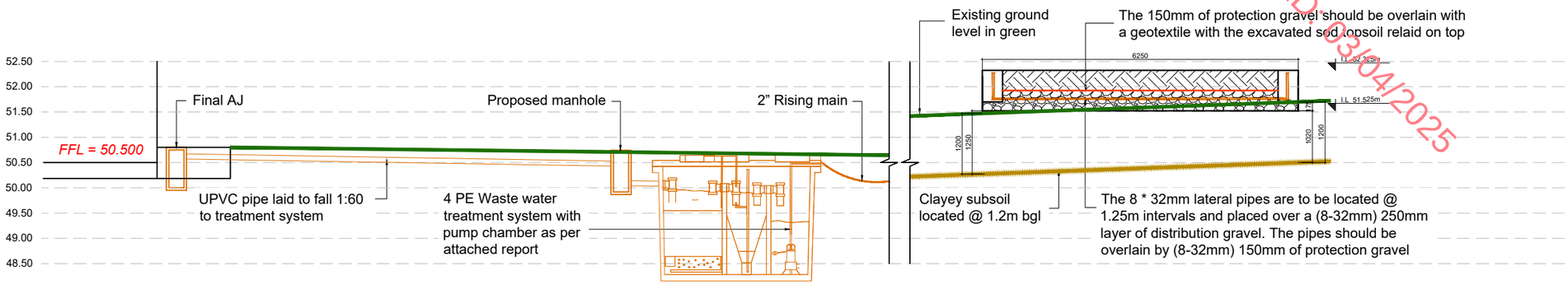
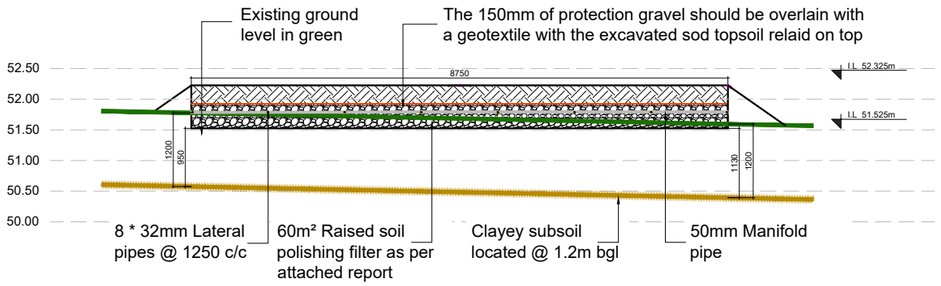


Section A-A
Scale 1:100



Section B-B
Scale 1:100

WASTEWATER DESIGN SPECIFICATION:

Proposed Commercial Premises on Site - Max occupancy of 10 employees/day at 60 litres/user as per Table 3 of EPA Small Communities Manual. 10 * 60 litres = 600litres/150 = 4 PE. WASTEWATER DESIGN SPECIFICATION:
A Minimum 4 PE wastewater Treatment system (WWTS) and and 60qm partially raised Soil Polishing Filter is proposed to serve the commercial facility The final effluent from the WWTS is to be pumped from a sump chamber using 2" rising main to a 50mm distribution manifold connected to 8 * 32mm diameter 6.25m long lateral percolation pipes. The new sump/pump chamber installed should have a min volume capacity of 140 litres below the invert from the treatment system.

The 8 * 32mm lateral pipes are to be located at 1.25m intervals and placed over a (8-32mm) 250 mm layer of distribution stone and covered with 150mm of protection stone and this layer and entire stone footprint overlain by a geotextile with a min 250mm of topsoil back to new raised surface. The distance between the perforations should also be 1.25m. Each of the 3/16" (4.78mm) orifices in the pipework should be protected by orifice shields. Max depth of distribution stone should be -0.3m bgl to ensure a min of 0.9m to clayey subsoil below 1.2m

Rev.	Details:	Made By	Date
Revisions.			

NOTE: This drawing is to be read in conjunction with the Specification and all other Engineer's and Architect's details. All work to comply with the current Building Control Act, the Building Regulations, and all relevant Codes of Practice. All dimensions to be checked on site by the Contractor and any discrepancies to be brought to the attention of the Engineer. Work to figured dimensions only.

Scales	Date	Design By	Drawn By	Job/Drawing No.	Rev.
1:100 @ A3	12-12-2024	JD	DB	-	-

Project

PROPOSED ANAEROBIC DIGESTER AT
MONEYLANE, ARKLOW, CO.WICKLOW

Client

NEPHIN RENEWABLE GAS

Title

PROPOSED WASTEWATER SECTIONS

geoenvironmental
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Thurles,
Co. Tipperary

ph : 087-7556013

SITE CHARACTERISATION FORM
COMPLETING THE FORM

RECEIVED: 03/04/2025

Note: This form requires the latest version of Adobe Acrobat Reader

and on PC's Windows 7 or later. Windows XP produces errors in calculations

Step 1:

Goto Menu Item **File, Save As** and save the file under a reference relating to the client or the planning application reference if available.

Clear Form

Use the **Clear Form** button to clear all information fields.

Notes:

All calculations in this form are automatic.

Where possible information is presented in the form of drop down selection lists to eliminate potential errors.

Variable elements are recorded by tick boxes. In all cases only one tick box should be activated.

All time record fields must be entered in twenty four hour format as follows: HH:MM

All date formats are DD-MM-YYYY.

All other data fields are in text entry format.

This form can be printed out fully populated for submission with related documents and for your files. It can also be submitted by email.

Section 3.2 In this section use an underline _____ across all six columns to indicate the depth at which changes in classification / characteristics occur.

Section 3.4 Lists supporting documentation required.

Section 4 Select the treatment systems suitable for this site and the discharge route.

Section 5 Indicate the system type that it is proposed to install.

Section 6 Provide details, as required, on the proposed treatment system.

APPENDIX A: SITE CHARACTERISATION FORM

File Reference:

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1.0 GENERAL DETAILS (From planning application)

Prefix: First Name: Nephin Renewable Gas Surname: Moneylane

Address:

Site Location and Townland: Moneylane, Arklow, Co. Wicklow

Number of Bedrooms: Maximum Number of Residents: 4

Comments on population equivalent

Proposed Commercial AD Plant - no bedrooms present (see Section 5 for more information on loading rates)

Proposed Water Supply:

Mains ☐ Private Well/Borehole ☐ Group Well/Borehole ☐

2.0 GENERAL DETAILS (From planning application)

Soil Type, (Specify Type): Surface Water Gley

Subsoil, (Specify Type): Till from Lower Paleozoic Sandstone & Shale

Bedrock Type: Ordivician Metasediments

Aquifer Category: Regionally Important | Locally Important LI Poor

Vulnerability: Extreme ☐ High ☑ Moderate ☐ Low ☐

Groundwater Body: Wicklow GWB Status Good

Name of Public/Group Scheme Water Supply within 1 km: None Close to Site

Source Protection Area: ZOC ☐ SI ☐ SO ☐ Groundwater Protection Response: R2[1]

Presence of Significant Sites (Archaeological, Natural & Historical): None Close; Arklow Rock-Askintinny pNHA 2.8km S-E; Arklow Town Marsh 2.2km

Past experience in the area: No previous test completed in this area

Comments:

(Integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, and/or any potential site restrictions).

Proposed Anaerobic Digestion Plant proposed
Wastewater design will be for up to max of 10 employees/users per day
Locally Important Aquifer with High GW Vulnerability (GWPR = R1)
No mains water - no fixed supply or private well proposed - process water will be provided by rainwater harvesting tanks; drinking water from bottles
from bottles
Closest Stream 200m South

Note: Only information available at the desk study stage should be used in this section.

3.0 ON-SITE ASSESSMENT

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3.1 Visual Assessment

Landscape Position: N52 47 10; 6 11 22
60m AOD

Slope: Steep (>1:5) ☐ Shallow (1:5-1:20) ☑ Relatively Flat (<1:20) ☐

Slope Comment: Sloping Site Approx 1:20

Surface Features within a minimum of 250m (Distance To Features Should Be Noted In Metres)

Houses:

Closest Dwelling - Farm House 150m south towards cross roads
Farm buildings 100m south

Existing Land Use:

Grassland/Pasture

Vegetation Indicators:

Managed Grass - no indicators of poor drainage

Groundwater Flow Direction: Nth-West following topography

Ground Condition:

Firm Under Foot

Site Boundaries:

Natural Hedgerow-Trees

3.0 ON-SITE ASSESSMENT

3.1 Visual Assessment (contd.)

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Roads:

Minor Public Road to Arklow/M11 20m South-West

Outcrops (Bedrock And/Or Subsoil):

None evident within 250m

Surface Water Ponding:

None - Dry Field

Lakes:

Ballyduff South Loch 800m Nth-West

Beaches/Shellfish Areas:

No beaches within 3.4kms - Irish Sea 3kms East

Wetlands:

None Close

Karst Features:

None identified close to site

Watercourses/Streams:*

Small Stream 200m Nth
Moneylane River 300m South

***Note and record** water level

3.0 ON-SITE ASSESSMENT

3.1 Visual Assessment (contd.)

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Drainage Ditches:*

None

Springs:*

No Springs indicated within 250m

Wells:*

No mains water
Well serving farm opposite 40m up-gradient of test holes

Comments:
(Integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, the suitability of the site to treat the wastewater and the location of the proposed system within the site).

Gently sloping site comprising of managed agricultural grassland
Closest Dwelling 150m; Farm buildings 100m
Well serving farm/dwelling 40m up gradient of test holes - no well proposed on site
Closest stream 200m Nth
Percolation area should be located to the south -east of proposed AD Plant ensuring that all the minimum separation distances to house (10m), site boundaries (3m) road (4m), any dwelling/occupied building (10m), existing up-gradient well (30m) as outlined in EPA 2021 are maintained. Pumping of treated effluent may be required

***Note and record** water level

3.2 Trial Hole (should be a minimum of 2.1m deep (3m for regionally important aquifers))

To avoid any accidental damage, a trial hole assessment or percolation tests should not be undertaken in areas which are at or adjacent to significant sites, (e.g. NHAs, SACs, SPAs, and/or Archaeological etc.), without prior advice from National Parks and Wildlife Service or the Heritage Service.

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Depth of trial hole (m): 2.1

Depth from ground surface to bedrock (m) (if present):

Depth from ground surface to water table (m) (if present): 1.85

Depth of water ingress: 0.35 Rock type (if present):

Date and time of excavation: 16-Nov-2024 10:05 Date and time of examination: 19-Nov-2024 10:20

Depth of Surface and Subsurface Percolation Tests		Soil/Subsoil Texture & Classification**	Plasticity and dilatancy***	Soil Structure	Density/ Compactness	Colour****	Preferential flowpaths
0.1 m		Shallow Loam Topsoil	-	Crumb	Soft	Dark Brown/Black	Grass Rootlets
0.2 m							
0.3 m							
0.4 m							
0.5 m		SILT with clay & gravel	60 55,60mm ribbons 4 5, 5 threads Dilatant	Sub-Angular	Soft- Firm	Light Brown	
0.6 m							
0.7 m							
0.8 m	T2	profile saturated from recent heavy rain					
0.9 m	T1 T3						
1.0 m							
1.1 m							
1.2 m							
1.3 m		CLAY/SILT with shale rock fragments	70 75,70mm ribbons; 6,6,7 threads Dilates with difficulty	Podzol-Sub-Angulary	Stiff	Brown	Interface of rock fragments and matrix material
1.4 m							
1.5 m							
1.6 m							
1.7 m							
1.8 m		Water Table @ 1.85m					
1.9 m							
2.0 m							
2.1 m							
2.2 m		End of Trial Hole at 2.1m					
2.3 m							
2.4 m							
2.5 m							
2.6 m							
2.7 m							
2.8 m							
2.9 m							
3.0 m							
3.1 m							
3.2 m							
3.3 m							
3.4 m							
3.5 m							

Likely Subsurface Percolation Value: 35

Likely Surface Percolation Value: 30

Note: *Depth of percolation test holes should be indicated on log above. ('Enter Surface or Subsurface at depths as appropriate).
** See Appendix E for BS 5930 classification.
*** 3 samples to be tested for each horizon and results should be entered above for each horizon.
**** All signs of mottling should be recorded.

3.2 **Trial Hole (contd.)** Evaluation:

1.85m of unsaturated soil/subsoil in trial hole to water table. Reasonable drainage to 1.3m. Profile more clayey below this depth. BS Test Results indicate that T Value should be in 20-40 range in upper subsoil profile

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3.3(a) Subsurface Percolation Test for Subsoil

Step 1: Test Hole Preparation

Percolation Test Hole	1	2	3
Depth from ground surface to top of hole (mm) (A)	450	440	480
Depth from ground surface to base of hole (mm) (B)	850	840	880
Depth of hole (mm) [B - A]	400	400	400
Dimensions of hole [length x breadth (mm)]	300 x 300	300 x 300	300 x 300

Step 2: Pre-Soaking Test Holes

Pre-soak start	Date	18-Nov-2024	18-Nov-2024	18-Nov-2024
	Time	10:00	10:01	10:03
2nd pre-soak start	Date	18-Nov-2024	18-Nov-2024	18-Nov-2024
	Time	16:10	16:11	16:12

Each hole should be pre-soaked twice before the test is carried out.

Step 3: Measuring T_{100}

Percolation Test Hole No.	1	2	3
Date of test	19-11-2024	19-11-2024	19-11-2024
Time filled to 400 mm	09:04	09:05	09:06
Time water level at 300 mm	10:30	10:41	10:37
Time (min.) to drop 100 mm (T_{100})	86.00	96.00	91.00
Average T_{100}			91.00

If T_{100} > 480 minutes then Subsurface Percolation value >120 – site unsuitable for discharge to ground
If $T_{100} \leq 210$ minutes then go to Step 4;
If T_{100} > 210 minutes then go to Step 5;

Step 4: Standard Method (where $T_{100} \leq 210$ minutes)

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Percolation Test Hole	1			2			3		
Fill no.	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	Δt (min)
1	10:30	12:15	105.00	10:41	12:42	121.00	10:37	12:30	113.00
2	12:16	14:25	129.00	12:43	15:15	152.00	12:31	14:50	139.00
3	14:26	17:07	161.00	15:16	18:23	187.00	14:51	17:44	173.00
Average Δt Value			131.67			153.33			141.67
	Average Δt/4 = [Hole No.1]		32.92 (t_1)	Average Δt/4 = [Hole No.2]		38.33 (t_2)	Average Δt/4 = [Hole No.3]		35.42 (t_3)

Result of Test: Subsurface Percolation Value = 35.56 (min/25 mm)

Comments:

T Value of 35.56 is within permitted range

Step 5: Modified Method (where $T_{100} > 210$ minutes)

Percolation Test Hole No. 1

Fall of water in hole (mm)	Time Factor = T_f	Start Time hh:mm	Finish Time hh:mm	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T – Value = 4.45 / K_{fs}
300 - 250	8.1			0.00		
250 - 200	9.7			0.00		
200 - 150	11.9			0.00		
150 - 100	14.1			0.00		
Average	T- Value		T- Value Hole 1 = (T_1)			0.00

Percolation Test Hole No. 2

Fall of water in hole (mm)	Time Factor = T_f	Start Time hh:mm	Finish Time hh:mm	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T – Value = 4.45 / K_{fs}
300 - 250	8.1			0.00		
250 - 200	9.7			0.00		
200 - 150	11.9			0.00		
150 - 100	14.1			0.00		
Average	T- Value		T- Value Hole 2 = (T_2)			0.00

Percolation Test Hole No. 3

Fall of water in hole (mm)	Time Factor = T_f	Start Time hh:mm	Finish Tim§e hh:mm	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T – Value = 4.45 / K_{fs}
300 - 250	8.1			0.00		
250 - 200	9.7			0.00		
200 - 150	11.9			0.00		
150 - 100	14.1			0.00		
Average	T- Value		T- Value Hole 3 = (T_2)			0.00

Result of Test: Subsurface Percolation Value = 0.00 (min/25 mm)

Comments:

3.3(b) Surface Percolation Test for Soil

Step 1: Test Hole Preparation

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Percolation Test Hole	1	2	3
Depth from ground surface to top of hole (mm)	0	0	0
Depth from ground surface to base of hole (mm)	400	400	400
Depth of hole (mm)	400	400	400
Dimensions of hole [length x breadth (mm)]	300 x 300	300 x 300	300 x 300

Step 2: Pre-Soaking Test Holes

		1	2	3
Pre-soak start	Date	18-Nov-2024	18-Nov-2024	18-Nov-2024
	Time	10:12	10:13	10:14
2nd pre-soak start	Date	18-Nov-2024	18-Nov-2024	18-Nov-2024
	Time	16:13	16:14	16:15

Each hole should be pre-soaked twice before the test is carried out.

Step 3: Measuring T_{100}

Percolation Test Hole No.	1	2	3
Date of test	19-Nov-24	19-Nov-24	19-Nov-2024
Time filled to 400 mm	09:08	09:09	09:10
Time water level at 300 mm	10:29	10:35	10:39
Time to drop 100 mm (T_{100})	81.00	86.00	89.00
Average T_{100}			85.33

If T_{100} > 480 minutes then Surface Percolation value >90 – site unsuitable for discharge to ground
If $T_{100} \leq 210$ minutes then go to Step 4;
If T_{100} > 210 minutes then go to Step 5;

Step 4: Standard Method (where $T_{100} \leq 210$ minutes)

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Percolation Test Hole	1			2			3		
Fill no.	Start Time (at 300 mm)	Finish Time (at 200 mm)	ΔT (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	ΔT (min)	Start Time (at 300 mm)	Finish Time (at 200 mm)	ΔT (min)
1	10:29	12:09	100.00	10:35	12:24	109.00	10:39	12:41	122.00
2	12:10	14:14	124.00	12:25	14:40	135.00	12:42	15:13	151.00
3	14:15	16:46	151.00	14:41	17:27	166.00	15:14	18:19	185.00
Average ΔT Value			125.00			136.67			152.67
	Average ΔT/4 = [Hole No.1]		31.25 (T_1)	Average ΔT/4 = [Hole No.2]		34.17 (T_2)	Average ΔT/4 = [Hole No.3]		38.17 (T_3)

Result of Test: Surface Percolation Value = 34.53 (min/25 mm)

Comments:

'P' value of '34.53". P-Test within 3-50 range

Step 5: Modified Method (where $T_{100} > 210$ minutes)

Percolation Test Hole No.	1					
Fall of water in hole (mm)	Time Factor = T_f	Start Time hh:mm	Finish Time hh:mm	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T – Value = 4.45 / K_{fs}
300 - 250	8.1			0.00		
250 - 200	9.7			0.00		
200 - 150	11.9			0.00		
150 - 100	14.1			0.00		
Average	T- Value		T- Value Hole 1 = (T_1)			0.00

Percolation Test Hole No.	2					
Fall of water in hole (mm)	Time Factor = T_f	Start Time hh:mm	Finish Time hh:mm	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T – Value = 4.45 / K_{fs}
300 - 250	8.1			0.00		
250 - 200	9.7			0.00		
200 - 150	11.9			0.00		
150 - 100	14.1			0.00		
Average	T- Value		T- Value Hole 2 = (T_2)			0.00

Percolation Test Hole No.	3					
Fall of water in hole (mm)	Time Factor = T_f	Start Time hh:mm	Finish Time hh:mm	Time of fall (mins) = T_m	$K_{fs} = T_f / T_m$	T – Value = 4.45 / K_{fs}
300 - 250	8.1			0.00		
250 - 200	9.7			0.00		
200 - 150	11.9			0.00		
150 - 100	14.1			0.00		
Average	T- Value		T- Value Hole 3 = (T_2)			0.00

Result of Test: Surface Percolation Value = 0.00 (min/25 mm)

Comments:

3.4 The following associated Maps, Drawings and Photographs should be appended to this site characterisation form.

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1. Discovery Series 1:50,000 Map indicating overall drainage, groundwater flow direction and housing density in the area.
2. Supporting maps for vulnerability, aquifer classification, soil, subsoil, bedrock.
3. North point should always be included.
4. (a) Scaled sketch of site showing measurements to Trial Hole location and
   (b) Percolation Test Hole locations,
   (c) wells and
   (d) direction of groundwater flow (if known),
   (e) proposed house (incl. distances from boundaries)
   (f) adjacent houses,
   (g) watercourses,
   (h) significant sites
   (i) and other relevant features.
5. Site specific cross sectional drawing of the site and the proposed layout[1] should be submitted.
6. Photographs of the trial hole, test holes and site including landmarks (date and time referenced).
7. Pumped design must be designed by a suitably qualified person.

[1] The calculated percolation area or polishing filter area should be set out accurately on the site layout drawing in accordance with the code of practice's requirements.

4.0 CONCLUSION of SITE CHARACTERISATION

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Integrate the information from the desk study and on-site assessment (i.e. visual assessment, trial hole and percolation tests) above and conclude the type of system(s) that is (are) appropriate. This information is also used to choose the optimum final disposal route of the treated wastewater.

Slope of proposed infiltration / treatment area:	1:200
Are all minimum separation distances met?	✓
Depth of unsaturated soil and/or subsoil beneath invert of gravel (or drip tubing in the case of drip dispersal system)	0.90

Percolation test result: Surface: 34.53 Sub-surface: 35.56

Not Suitable for Development ☐ **Suitable for Development** ✓

Identify all suitable options

1. Septic tank system (septic tank and percolation area) **(Chapter 7)** — No
2. Secondary Treatment System **(Chapters 8 and 9)** and soil polishing filter **(Section 10.1)** — Yes
3. Tertiary Treatment System and Infiltration / treatment area **(Section 10.2)** — Yes

Discharge Route [1]

Groundwater

5.0 SELECTED DWWTS

Propose to install: Secondary Treatment System and soil polishing filter

and discharge to: Ground Water

Invert level of the trench/bed gravel or drip tubing (m) -0.30

Site Specific Conditions (e.g. special works, site improvement works testing etc.

WASTEWATER DESIGN SPECIFICATION:
Proposed Commercial Premises on Site - Max occupancy of 10 employees/day at 60 litres/user as per Table 3 of EPA Small Communities Manual. 10 * 60 litres = 600litres/150 = 4 PE. WASTEWATER DESIGN SPECIFICATION:
A Minimum 4 PE wastewater Treatment system (WWTS) and and 60qm partially raised Soil Polishing Filter is proposed to serve the commercial facility The final effluent from the WWTS is to be pumped from a sump chamber using 2" rising main to a 50mm distribution manifold connected to 8 * 32mm diameter 6.25m long lateral percolation pipes. The new sump/pump chamber installed should have a min volume capacity of 140 litres below the invert from the treatment system.

The 8 * 32mm lateral pipes are to be located at 1.25m intervals and placed over a (8-32mm) 250-mm layer of distribution stone and covered with 150mm of protection stone and this layer and entire stone footprint overlain by a geotextile with a min 250mm of topsoil back to new raised surface. The distance between the perforations should also be 1.25m. Each of the 3/16" (4.78mm) orifices in the pipework should be protected by orifice shields. Max depth of distribution stone should be -0.3m bgl to ensure a min of 0.9m to clayey subsoil below 1.2m

[1] A discharge of sewage effluent to "waters" (definition includes any or any part of any river, stream, lake, canal, reservoir, aquifer, pond, watercourse or other inland waters, whether natural or artificial) will require a licence under the Water Pollution Acts 1977-90. Refer to Section 2.4.

6.0 TREATMENT SYSTEM DETAILS

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SYSTEM TYPE: Septic Tank Systems (Chapter 7)

Tank Capacity (m^3)		Percolation Area		Mounded Percolation Area	
		No. of Trenches		No. of Trenches	
		Length of Trenches (m)		Length of Trenches (m)	
		Invert Level (m)		Invert Level (m)	

SYSTEM TYPE: Secondary Treatment System (Chapters 8 and 9) and polishing filter (Section 10.1)

Secondary Treatment Systems receiving septic tank effluent (Chapter 8)

Media Type	Area (m^2)*	Depth of Filter	Invert Level
Sand/Soil			
Soil			
Constructed Wetland			
Other			

Packaged Secondary Treatment Systems receiving raw wastewater (Chapter 9)

Type	Package WWTS
Capacity PE	4
Sizing of Primary Compartment	3.00 m^3

Polishing Filter*: (Section 10.1)

Surface Area (m^2)*		Option 3 - Gravity Discharge Trench length (m)	
Option 1 - Direct Discharge Surface area (m^2)		Option 4 - Low Pressure Pipe Distribution Trench length (m)	
Option 2 - Pumped Discharge Surface area (m^2)	60.00	Option 5 - Drip Dispersal Surface area (m^2)	

SYSTEM TYPE: Tertiary Treatment System and infiltration / treatment area (Section 10.2)

Identify purpose of tertiary treatment	Provide performance information demonstrating system will provide required treatment levels	Provide design information

DISCHARGE ROUTE:

Groundwater	✓	Hydraulic Loading Rate * ($l/m^2.d$)	10.00	Surface area (m^2)	
Surface Water **		Discharge Rate (m^3/hr)			

* Hydraulic loading rate is determined by the percolation rate of subsoil

** Water Pollution Act discharge licence required

6.0 TREATMENT SYSTEM DETAILS

QUALITY ASSURANCE:

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Installation & Commissioning

The WWTS and Polishing Filter to be installed in accordance with EPA COP 2021. Installation of WWTS and Polishing filter to be certified by approved site assessor.

On-going Maintenance

The WWTS should be maintained as per manufactures guidance.

7.0 SITE ASSESSOR DETAILS

Company: Geoenvironmental Ltd

Prefix: Mr First Name: John Surname: Delaney

Address: Knocklas, Coolcotts, Wexford Town

Qualifications/Experience: BSc; MSc Contamianted Land; Fas Cert in Site Suitability Assessment

Date of Report: 12-Dec-2024

Phone: 087 7556013 E-mail john@geoenvironmental.ie

Indemnity Insurance Number: PSC00076834

Signature: John Delaney Digitally signed by John Delaney
Date: 2024.12.12 18:29:34 Z

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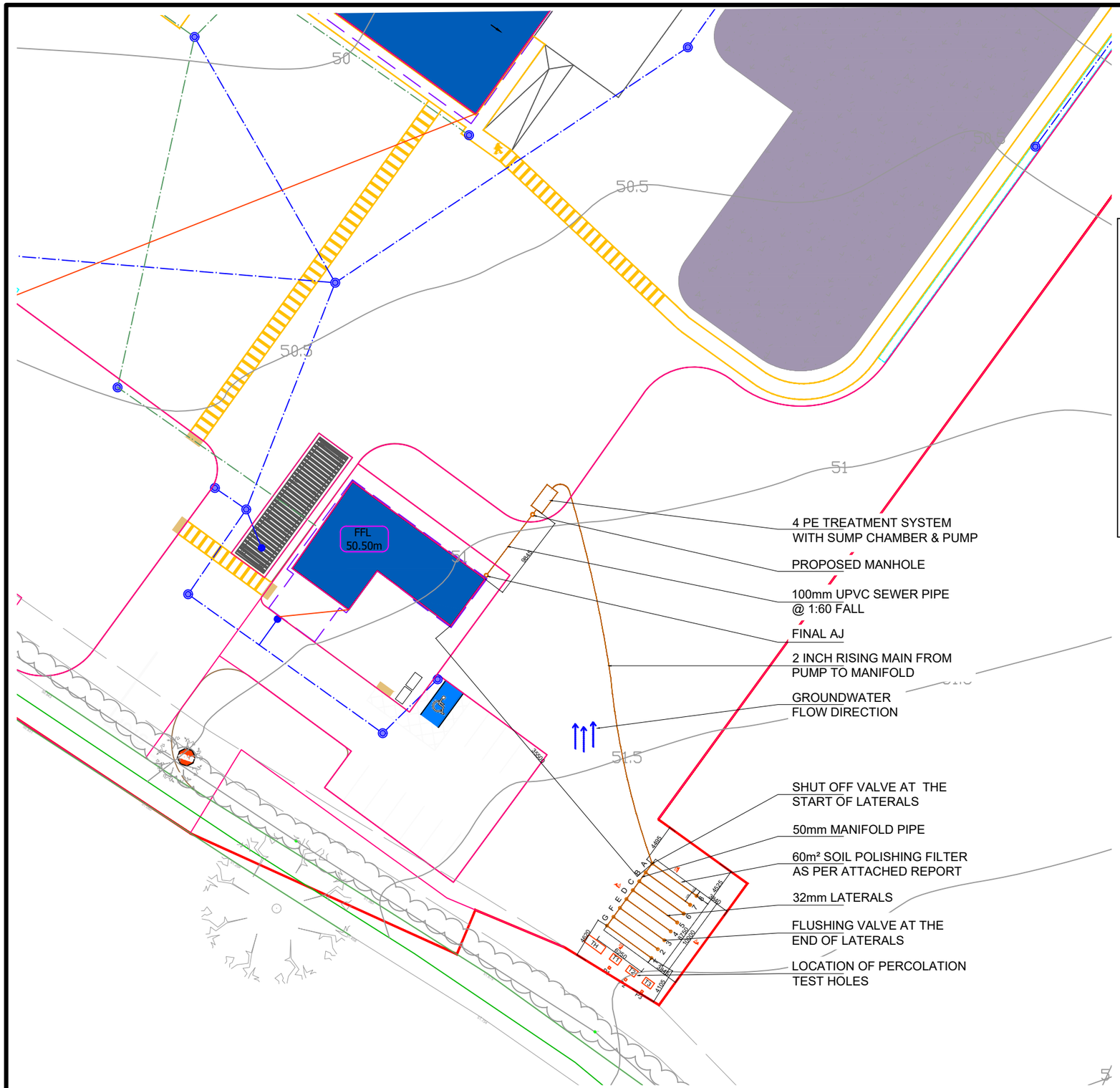

WASTEWATER DESIGN SPECIFICATION:

Proposed Commercial Premises on Site - Max occupancy of 10 employees/day at 60 litres/user as per Table 3 of EPA Small Communities Manual. 10 * 60 litres = 600litres/150 = 4 PE.
WASTEWATER DESIGN SPECIFICATION:
A Minimum 4 PE wastewater Treatment system (WWTS) and and 60qm partially raised Soil Polishing Filter is proposed to serve the commercial facility The final effluent from the WWTS is to be pumped from a sump chamber using 2" rising main to a 50mm distribution manifold connected to 8 * 32mm diameter 6.25m long lateral percolation pipes. The new sump/pump chamber installed should have a min volume capacity of 140 litres below the invert from the treatment system.

The 8 * 32mm lateral pipes are to be located at 1.25m intervals and placed over a (8-32mm) 250 mm layer of distribution stone and covered with 150mm of protection stone and this layer and entire stone footprint overlain by a geotextile with a min 250mm of topsoil back to new raised surface. The distance between the perforations should also be 1.25m. Each of the 3/16" (4.78mm) orifices in the pipework should be protected by orifice shields. Max depth of distribution stone should be -0.3m bgl to ensure a min of 0.9m to clayey subsoil below 1.2m

Rev.	Details:	Made By	Date
Revisions.			

NOTE: This drawing is to be read in conjunction with the Specification and all other Engineer's and Architect's details. All work to comply with the current Building Control Act, the Building Regulations, and all relevant Codes of Practice. All dimensions to be checked on site by the Contractor and any discrepancies to be brought to the attention of the Engineer. Work to figured dimensions only.

Scales	Date	Design By	Drawn By	Job/Drawing No.	Rev.
1:500 @ A3	12-12-2024	JD	DB	-	-

Project

PROPOSED ANAEROBIC DIGESTER AT
MONEYLANE, ARKLOW, CO.WICKLOW

Client

NEPHIN RENEWABLE GAS

Title

PROPOSED WASTEWATER LAYOUT

geoenvironmental
ENVIRONMENTAL CONSULTANTS

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APPENIDIX 8.2

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2024

Macro Invertebrate Q-Value Assessment of Water Quality, Moneylane, Arklow, County Wicklow.

Macro Invertebrate Q-Value Assessment of Water Quality, Moneylane, Arklow, County Wicklow.

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Document Control Sheet

Client:	Nephin Renewable Gas
Document No:	241504-ORS-XX-XX-RP-EN-13d-001_Macro-invertebratesurvey

Revision	Status	Author:	Reviewed by:	Approved By:	Issue Date
P01	**Draft**	**LaM**	**OD**	**JB**	**19/12/2024**

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Table of Contents

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1 Introduction

This report presents the findings of a study conducted to assess stream water quality as part of the EIAR process for the proposed NRG Biogas facility development at Arklow, County Wicklow. Macro-invertebrate sampling was employed, utilising kick sampling upstream and downstream with a sweep net, followed by examination using a taxonomic key and stereoscopic microscope. Results indicate both good water quality and poor water quality, supported by the presence of moderately sensitive species, and supplemented by compilation of vegetative characteristics including macrophytes present in the stream. These findings are essential for regulatory compliance and informed management strategies aimed at preserving and protecting freshwater ecosystems.

1.1 Regulatory Context

Surface water quality assessment is critical for maintaining ecosystem health and meeting regulatory standards such as the Water Framework Directive 2000/60/EC, the importance of assessing water quality, the regulatory framework in Ireland, and the significance of macro-invertebrates as indicators of ecological health.

The directive states that:

“The Water Framework Directive (WFD) is the primary legislation. It is supported by two so-called daughter directives on the quality and quantity of groundwater and on the quality of surface water. The WFD contains provisions regarding the deadlines for meeting the objectives of the Directive, as well as provisions on exemptions. The annexes to the WFD specify details as regards, for example, monitoring requirements, the criteria for assessing water body status, and the contents of the RBMPs.

At present, the WFD includes in its Annex X the list of priority substances that Member States must monitor in surface waters, but the standards for them are set in the Environmental Quality Standards Directive (EQSD) and must be met to achieve good surface water chemical status in accordance with WFD Article 4 and Annex V point 1.4.3. The WFD also requires Member States to set and meet Environmental Quality Standards (EQS) for substances of national concern, i.e. river basin specific pollutants; the monitoring of which currently contributes to the assessment of ecological status. This list of priority substances needs to be reviewed, and updated, if necessary, every 6 years.

Similarly, the list of pollutants and standards of EU-wide concern in Annex I to the Groundwater Directive (GWD) must also be reviewed every 6 years; these contribute to the assessment of chemical status in groundwater. That Directive also complements the WFD by including requirements as regards pollutant trends and quantitative status.”

The above directive is supported by County Council discharge license agreements, the stipulations of which, license holders must adhere to. One such stipulation is the annual monitoring of water quality upstream and downstream of a discharge site to assess biological, and concomitantly, water health via macro-invertebrate presence or absence. The biotic assessment in this report provides a long-term template for pre and post construction monitoring as well as long term monitoring for the site where a discharge license must be

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obtained.

1.2 Objectives

The primary objective of this study is to evaluate stream water quality in accordance with EPA licensing requirements. Specifically, the study aims to utilise macro-invertebrate sampling to gather Q-value ratings to obtain a biotic assessment of the local hydrological system into which surface water will be discharged. The biotic assessment will provide a Q-value rating and will be supplemented by examination of vegetative characteristics, including macrophytes present in the stream, to assess ecological health and support regulatory compliance.

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2 Methodology

Sampling was conducted at 2 sites along the Moneylane Stream see **Figure 1.1**, at Moneylane, Arklow, County Wicklow. Both upstream (Station 2) and downstream (Station 1), using kick sampling with a sweep net and of standard 1mm fine mesh to catch invertebrates. At each site, three samples were taken to provide a representative profile of each downstream and upstream section. Vegetative characteristics, including macrophytes, were compiled during sampling to provide additional ecological context. Substrate composition and, water body characteristics including flow type, and water depth and width were also measured. Collected specimens were identified to the lowest taxonomic level possible using a taxonomic key and stereoscopic microscope, following standard procedures. Q-values were assigned to identified taxa based on their sensitivity to pollution.

Figure 1.1. Map of the sampling locations 1 and 2 at the Moneylane Stream at Moneylane, Arklow, County Wicklow.

2.1 Data Analysis

Q-value ratings were calculated for each sampling site based on the composition of macro-invertebrate communities as per **Table 1**. The presence of highly sensitive species was emphasised as an indicator of good water quality. Vegetative characteristics, including macrophytes, were also included as ancillary data to supplement the assessment of stream health. The taxonomic groupings at family level, with which a Q-value may be assigned, is presented in **Table 2**. The taxa presented in this report are specific to Ireland and Britain.

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Indicator groups were calculated from their relative abundance and then into their respective proportional values per grouping. The relative abundance value helps to assign the Q Value score for each taxonomic group with the following methodology where:

1. Present = 1/2 individuals
2. Scarce/Few = <1%
3. Small Numbers = <5%
4. Fair Numbers = 5-10%
5. Common = 10-20%
6. Numerous = 25-50%
7. Dominant = 50-75%
8. Excessive = >75%

Table 1. Biotic indices ("Q Values") reflect average water quality

Q Value	WFD Status	Pollution Status	Condition
Q5, Q4-5	High	Unpolluted	Satisfactory
Q4	Good	Unpolluted	Satisfactory
Q3-4	Moderate	Slightly polluted	Unsatisfactory
Q3, Q2-3	Poor	Moderately polluted	Unsatisfactory
Q2, Q1-2, Q1	Bad	Seriously polluted	Unsatisfactory

Table 2. Taxonomic indicator groups at family level and their assigned sensitivity to pollution.

Group A	Group B	Group C	Group D	Group E
Sensitive	**Less Sensitive**	**Tolerant**	**Very Tolerant**	**Most Tolerant**
Perla Chloroperla Ecdyonurus Rithrogena Heptagenia Siphlonuridae	Protonemura Amphinemura Ephemerella Ephemera Baetidae Pschomyidae Sericostomatidae Odontoceridae Lepidostomatidae Goeridea Molannidae Beraeidae Odonata Aphelocheirus Rheotanytarsus	Caenis Baetis rhodani Limnephilidae Hydroptilidae Glossosomatidae Gammaridae Rhyacophilidae Philopotamidae Polycentropidae Hydropsychidae Coenagridae Hemiptera Tricladida Coleoptera Hydracarina Gammaridae Sialidae Tipulidae Simuliidae Ancylidae Neritidae Viviparidae Haliplidae Ceratopogonidae Elminthidae	Hirudinae Valvatidae Hydrobiidae Lymnea Physidae Planorbidae Sphaeriidae Asellidae Chironomidae Culicidae	Chironomus Tubificidae

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3 Results

Results for the Upstream Station 2 sampling location at Moneylane, Arklow are presented in **Table 4 - 6**.

A Q-value of ***Q4*** has been assigned to the upstream sample, the rationale being that taxonomic indicator group **B** were *dominant* in the sample, showing as 69% of the total sample. The second highest proportion of taxa were represented by indicator groups **C** and **D**, with a status of *common* respectively. Indicator group **C** accounted for 12% of the sample (Common) and indicator group **D** represented 17% of the sample. The Upstream sample therefore has a WFD status of "Good", a Pollution Status of "Unpolluted", and a Condition rating of "Satisfactory". Results for the Downstream Station 1 sampling location at Moneylane, Arklow are presented in **Table 7 - 9**. A Q-Value of ***Q3*** has been assigned to the Downstream site 1 sampling location, the rational being that taxonomic indicator group **D** (very tolerant) were present and "dominant" where they represented 73% of the overall sample. The taxonomic group **C** (tolerant) were present and numerous making up 27% of the kick sample. Downstream site 1 has a WFD status of "Poor", a pollution status of "Moderately Polluted", and a condition of Unsatisfactory.

Table 3 – Q Values Results of the Moneylane Stream

Station ID	Q-Value	Ecological Status
Station 1 – Downstream	Q3	Poor
Station 2 – Upstream	Q4	Good

Upstream Station 2

Table 4. Stream properties for Upstream (Site 2) sample.

GPS coordinates	52.792949, -6.184871
Water body width (cm)	195
Water depth (cm)	15 - 16
Flow type	Glide
Overhead shade (%)	80
Macrophytes	No macrophytes present
Substrate composition	Mud 100%

Table 5. Macro-invertebrates identified down to family level, their abundance, indicator groupings and proportion (%) found within the Upstream (Site 2) kick sample.

Taxon	Abundance	Indicator Group	Indicator Group Proportion (%)
Leptophlebiidae	53	B	44
Gammeridae	15	C	12
Hirudinae	4	D	3
Baetidae	31	B	25
Asellidae	16	D	14
Chironomidae	2	E	2

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Table 6. Indicator Groups representative of the kick sample and their total combined proportion (%) for the Upstream (Site 2) sample.	
Indicator Group	**Total Combined Proportion (%)**
B	69 (Dominant)
C	12 (Common)
D	17 (Common)
E	2 (Small Numbers)

Downstream Station 1

Table 7. Stream properties for Downstream (Site 1) sample.	
GPS coordinates	52.7931684, -6.1854224
Water body width (cm)	280
Water depth (cm)	49 - 53
Flow type	Glide
Overhead shade (%)	95
Macrophytes	None present
Substrate composition	Mud 100%

Table 8. Macro-invertebrates identified down to family level, their abundance, indicator groupings and proportion (%) found within the Downstream (Site 1) kick sample.			
Taxon	**Abundance**	**Indicator Group**	**Indicator Group Proportion (%)**
Asellidae	26	D	70
Gammeridae	9	C	24
Phylopotamidae	1	C	3
Hyrudinae	1	D	3

Table 9. Indicator Groups representative of the kick sample and their total combined proportion (%) for the Downstream (Site 1) sample.	
Indicator Group	**Total Combined Proportion (%)**
D	73 (Dominant)
C	27 (Numerous)

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4 Conclusion

The presence of moderated sensitive macro-invertebrate species, combined with the compilation of vegetative characteristics at Station 2, indicates that the stream ecosystem upstream from the hydrological connectivity point with the Proposed Development has a WFD status of “Good”, a pollution status of “Unpolluted”, and a condition of ‘Satisfactory’. In the other hand, the results for the same waterbody downstream from the hydrological connectivity point indicates a WFD status of “Poor”, a pollution status of “Moderately Polluted”, and a condition of ‘Unsatisfactory’. The results of this study meet the criteria outlined in the EPA license requirements, demonstrating compliance with water quality standards and regulatory thresholds. However, as water quality downstream from the hydrological connectivity point is poor, continued monitoring and management efforts are recommended to prevent further pollution, and to maintain and enhance water quality in the long term.

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5 Recommendations

Based on the findings of this study, the following recommendations are proposed:

- Implement ongoing monitoring programs to track changes in water quality over time.
- Identify and mitigate potential sources of pollution to prevent degradation of river ecosystems as per EU Water Framework Directive (2000/60/EC) and River Basin Management Plan for Ireland 2022-2027.

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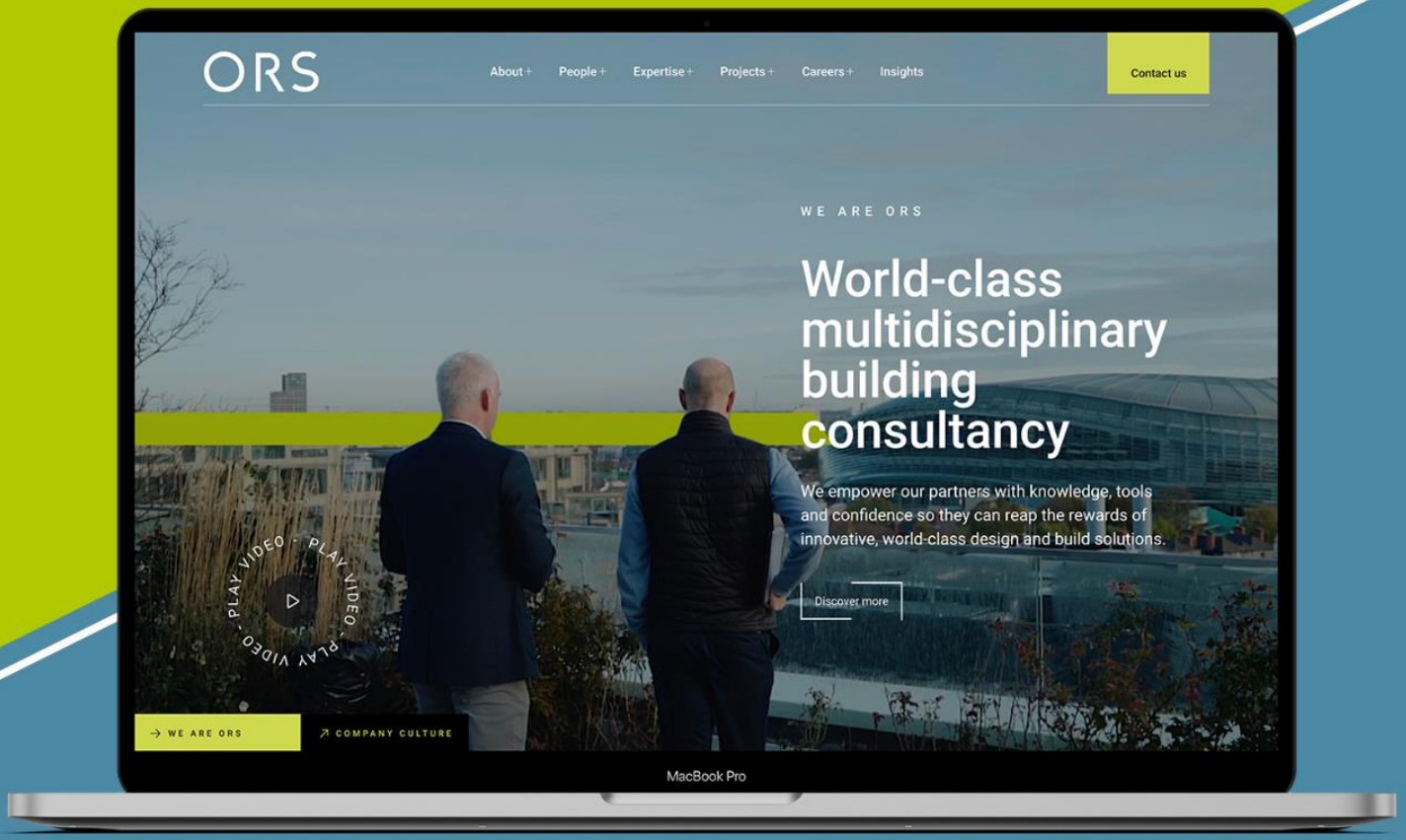

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