East Meath - North Dublin Grid Upgrade Environmental Impact Assessment Report (EIAR): Volume 2

Chapter 11 – Soils, Geology and Hydrogeology

EirGrid

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Contents

11. Soils, Geology and Hydrogeology

11.1 Introduction

This Chapter presents the assessment of the likely potential impacts of the East Meath - North Dublin Grid Upgrade (hereafter referred to as the Proposed Development) on soils, geology and hydrogeology during the Construction and Operational Phases. This Chapter includes an assessment of the compliance of the Proposed Development with Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (hereafter referred to as the Water Framework Directive (WFD)) in terms of groundwater.

This assessment is based on the Proposed Development, as detailed in Chapter 4 (Proposed Development Description) in Volume 2 of this Environmental Impact Assessment Report (EIAR). This Chapter considers the potential impacts during the Construction and Operational Phases associated with:

- Land, soils and geology; and
- Hydrogeology.

Proposed environmental mitigation measures to prevent and reduce the anticipated potential impacts are presented in Section 11.5.

Interrelationships exist with other chapters and supporting documents which include attributes excluded from this Chapter, namely:

- The assessment of impacts on biodiversity is discussed in Chapter 10 (Biodiversity) in Volume 2 of this EIAR;
- The assessment of surface water is presented in Chapter 12 (Hydrology) in Volume 2 of this EIAR, including a summary of flood risk. A Flood Risk Assessment (FRA) Report is included as Appendix A12.12 in Volume 3 of this EIAR; and
- The assessment of impacts on agriculture is discussed in Chapter 15 (Agronomy and Equine) in Volume 2 of this EIAR.

11.2 Methodology

11.2.1 Study Area

A study area has been defined based on the Planning Application Boundary, within which, the construction activities associated with the Construction Phase will be undertaken and any areas required for temporary access, Temporary Construction Compounds (TCCs), Horizontal Directional Drilling (HDD) Compounds, and other enabling activities.

The study area is based on a 250m (metre) corridor from the Planning Application Boundary with regard to soils and geology. This is considered a suitable distance to enable the description of baseline conditions and allow the assessment of soils and geology. In the absence of Ireland specific, or more recent guidance this study area has been based on professional judgement with reference to the National House Building Council (NHBC) and Environmental Agency (EA) Guidance for the Safe Development of Housing on Land Affected by Contamination R&D Publication 66:2008 (NHBC and EA 2008).

With regard to hydrogeology, the study area extends 1km (kilometre) from the Planning Application Boundary in addition to any TCCs and HDD Compounds and proposed construction access routes which have their own 1km buffer. The assessment also includes any WFD groundwater bodies (which are hydrogeological

receptors) which lie within this 1km buffer. The 1km buffer is informed by the design and best practice, noting that no large-scale dewatering is expected to be required for the Proposed Development, given the largely shallow nature of the works.

11.2.2 Relevant Guidelines, Policy and Legislation

This assessment has been carried out in compliance with the following guidelines, policy and legislation, and has been adapted to reflect the nature of the Proposed Development and attributes of the environmental receptors, based on professional judgement and experience:

- S.I. No. 538/2001 - European Communities (Environmental Impact Assessment) Regulations, 2001 (as amended);
- S.I. No. 722/2003 - European Communities (Water Policy) Regulations 2003;
- S.I. No. 9/2010 - European Communities Environmental Objectives (Groundwater) Regulations 2010;
- S.I. No. 366/2016 - European Union Environmental Objectives (Groundwater) Regulations 2016 (as amended);
- WFD;
- Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration (hereafter referred to as the Groundwater Directive);
- United Kingdom (UK) Environmental Agency (EA) Land Contamination Risk Management (UK EA 2023);
- British Standards Institution (BSI) British Standard (BS) 10175:2011 + A2:2017 Investigation of potentially contaminated sites. Code of practice (BSI 2017);
- Construction Industry Research and Industry Association (CIRIA) C552 Contaminated Land Risk Assessment: A Guide to Good Practice (CIRIA 2001);
- CIRIA C665 Assessing Risks Posed by Hazardous Ground Gases to Buildings (CIRIA 2007);
- Ireland-Specific Good Practice Guidance for the Development of Ground Gas Conceptual Site Models – An IBN Position Statement (Ireland Brownfield Network 2023);
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA 2022);
- The Institute of Environmental Management and Assessment (IEMA) Guide: A New Perspective on Land and Soil in Environmental Impact Assessment (hereafter referred to as the IEMA Guide) (IEMA 2022);
- Institute of Geologists of Ireland (IGI) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (IGI 2013);
- National Roads Authority (NRA) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA 2009); and
- Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites (EPA 2013).

11.2.3 Data Collection and Collation

The following data sources have been accessed during the collation of information on the baseline environment with respect to land and land use, soils and geology, and hydrogeology.

11.2.3.1 Data Sources

- Teagasc Irish Soil Information System online map (Teagasc 2024a);

- Historic Mine Sites – Inventory and Risk Classification (EPA and Geological Survey Ireland (GSI) 2009);
- Geological Survey Ireland Public Data Viewer (GSI 2024);
- 1:500,000 scale – Quaternary Geological Map of Ireland (GSI 2017);
- 1:1,000,000 scale – Bedrock Geology of Ireland (GSI 2014);
- Irish Townland and Historical Map Viewer (OSI 2024a);
- Geohive, Ordnance Survey Ireland (OSI) online spatial data viewer (OSI 2024b);
- Open Topographic Data Viewer (GSI 2023);
- EPA database and mapping (EPA 2024);
- Teagasc Agriculture and Food Development Authority soil maps (Teagasc 2023b);
- National Parks and Wildlife Service (NPWS) Public Map Viewer (NPWS 2024); and
- Map of Irish Wetlands (Wetland Ireland Surveys 2024).

11.2.3.2 Field Surveys (Ground Investigation)

A ground investigation was undertaken by Causeway Geotech Ltd. on behalf of EirGrid between 10 July 2023 and 29 September 2023 to provide geotechnical and environmental information for input to the design and construction of the Proposed Development.

Phase 1 of the ground investigation included boreholes, slit trenches, inspection pits, environmental sampling and laboratory testing and the preparation of a factual report on the findings. Further details regarding the findings of the ground investigation are presented in Section 11.3.4.

11.2.4 Appraisal Method for the Assessment of Impacts

11.2.4.1 Assessment of Importance / Sensitivity of Receptors

The potential impact of the Proposed Development on the soils, geology and hydrogeology environments has been assessed by classifying the importance of the relevant attributes and quantifying the likely magnitude of any impact on these attributes. The criteria used for assessing the importance / sensitivity of the geological and hydrogeological environments within the study area are outlined out in Table 11.1, Table 11.2 and Table 11.3.

Table 11.1: Criteria for Rating Site Importance of Geological Features (NRA 2009; IGI 2013)

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

The IEMA Guide (IEMA 2022) provides additional guidance on classifying receptor sensitivity for in-situ soils based on soil resource and soil functions, and this has also been complied with within this assessment. The IEMA Guide provides examples of UK classifications which differ to classifications in the Republic of Ireland. However, there is some commonality and Irish classifications have been input into the assessment, where appropriate and applicable. Table 11.2 describes the criteria for which soil sensitivity is based.

Table 11.2: Guidance on Rating Soil Receptor Sensitivity and Typical Soil Resource / Function Descriptions (adapted from the IEMA Guide (IEMA 2022))

Receptor Sensitivity	Soil Resource and Soil Functions
Very High	**Ecological habitat, soil biodiversity and platform for landscapes**: Soils supporting protected features within a European site (e.g., Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Ramsar sites); peat soils; soils supporting a national park, or ancient woodland. **Soil carbon**: Peat soils. Soils with potential for ecological / landscape restoration. **Soil hydrology**: very important catchment pathway for water flows and flood risk management. **Archaeology, Cultural Heritage, Community benefits and Geodiversity**: National Monuments and adjacent areas; World Heritage and European designated sites; soils with known archaeological interest; soils supporting community/recreational/educational access to land covered by national park designation. **Source of Materials**: Important surface mineral reserves that would be sterilised (i.e. without future access).
High	**Ecological habitat, soil biodiversity and platform for landscapes**: Soils supporting protected features within a European Union (EU) designated site (e.g., United Nations Educational, Scientific and Cultural Organization (UNESCO) Geoparks, or audited County Geological Sites (CGS)); National Parks; native forest and woodland soils; unaltered soils supporting semi-natural vegetation. **Soil carbon**: Organo-mineral soils (e.g., peaty soils). **Soil hydrology**: Important catchment pathway for water flows and flood risk management. **Archaeology, Cultural Heritage, Community benefits and Geodiversity**: Soils with probable but as yet unproven (prior to being revealed by construction) archaeological interest: Historic parks and gardens; audited County Geological Heritage Sites, Soils supporting community / recreational / educational access to audited County Geological Heritage Sites. **Source of Materials**: Surface mineral reserves that would be sterilised (i.e. without future access).
Medium	**Ecological habitat, soil biodiversity and platform for landscapes**: Soils supporting protected or valued features within non-statutory designated sites, Special Amenity Areas; Non-Native Forest and woodland soils. **Soil carbon**: Mineral soils. **Soil hydrology**: Important minor catchment pathway for water flows and flood risk management. **Archaeology, Cultural Heritage, Community benefits and Geodiversity**: Soils with possible but as yet unproven (prior to being revealed by construction) archaeological interest; soils supporting community / recreational / educational access to land. **Source of Materials**: Surface mineral reserves that would remain accessible for extraction.
Low	**Ecological habitat, soil biodiversity and platform for landscapes**: Soils supporting valued features within non-designated notable or priority habitats / landscapes. Agricultural soils. **Soil carbon**: Mineral soils. **Soil hydrology**: Pathway for water flows and flood risk management. **Archaeology, Cultural Heritage, Community benefits and Geodiversity**: Soils supporting no notable cultural heritage, geodiversity no community benefits; soils supporting limited community / recreational / educational access to land. **Source of Materials**: Surface mineral reserves that would remain accessible for extraction.
Negligible	As for low sensitivity, but with only indirect, tenuous, and unproven links between sources of impact and soil functions.
The table has been adapted from the IEMA Guide (IEMA 2022) to include Irish designations in place of UK examples	

The criteria for determining sensitivity of hydrogeological receptors have been adapted, based on best practice and with no key departures from the NRA Guidelines (NRA 2009). The criteria and examples for each importance status are set out in Table 11.3.

Table 11.3: Criteria for Assessing the Importance of Hydrogeological Features (NRA 2009)

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an International scale.	• Water feeding Groundwater Dependent Terrestrial Ecosystems (GWDTEs) with a high or moderate groundwater dependence with a high environmental importance and international or national value, such as Ramsar sites, SACs and SPAs. • Groundwater supports river or surface water body ecosystem protected by EU Legislation (e.g. SAC or SPA status). • Public potable water supply groundwater abstractions.
Very High	Attribute has a high quality or value on a Regional or National scale.	• Regionally Important Aquifer with multiple wellfields. • Groundwater supports river or surface water body ecosystem protected by national legislation (e.g. Natural Heritage Area (NHA) status). • Water feeding GWDTEs of low groundwater dependence with a high environmental importance and International or National value, such as Ramsar sites, SACs and SPAs; or water feeding highly or moderately GWDTE with a national priority. • Regional potable water source supplying >100 homes or other high volume groundwater usage (such as for bottling plant, large industry or large agricultural farm). • Inner source protection area for regionally important water source. • Buildings of regional or national importance.
High	Attribute has a high quality or value on a Local scale.	• Regionally Important Aquifer. • Groundwater provides large proportion of baseflow to local rivers. • Water feeding GWDTEs of low groundwater dependence with a national priority. • Locally important potable water source supplying >50 homes or used for local activities such as local medium scale industry or medium scale farming. • Outer source protection area for regionally important water source. • Inner source protection area for locally important water source. • Residential and commercial properties.
Medium	Attribute has a medium quality or value on a Local scale.	• Locally Important Aquifer. • Water feeding GWDTEs of feeding highly or moderately groundwater dependent GWDTE sites with no conservation designation. • Potable water source supplying <50 homes or sustaining local small scale activity such as small scale farming. • Outer source protection area for locally important water source. • Unoccupied residential and commercial properties and buildings.
Low	Attribute has a low quality or value on a Local scale.	• Poor Bedrock Aquifer. • Water feeding GWDTEs of low groundwater dependence with no designation. • Back-up private water supply used on an ad-hoc basis or used for secondary activities such as gardening when the main potable supply is provided by another source. • Industrial buildings that are currently not summarised, all derelict buildings and infrastructure that serves a single dwelling.

11.2.4.1.1 WFD Assessment Methodology

The design of the Proposed Development was screened against the various characteristics for groundwater bodies which can impact both the quantitative and qualitative status of the WFD groundwater body. This will determine whether the works will require further assessments to be compliant with the WFD with regard to groundwater. With regard to surface water, the WFD Assessment Report in Volume 5 (Supporting Documents) of the EIAR assesses the potential impact on WFD surface water bodies.

The following quantitative and qualitative elements of the WFD groundwater bodies have been scoped in for this assessment:

- Impact of groundwater on surface water ecological / quantitative and chemical status test;
- Quantitative and qualitative GWDTE test;
- Quantitative water balance;
- Qualitative drinking water protected areas; and
- General chemical test.

11.2.4.1.2 Magnitude of Impact

The scale or magnitude of potential impacts depends on both the degree and extent to which the Proposed Development may impact the geological and groundwater receptors during the Construction and / or the Operational Phase.

Table 11.4 describes the assessment of the magnitude of impacts to geological receptors based on the IGI Guidelines (IGI 2013), which can be described as adverse or beneficial.

Table 11.4:Criteria for Assessing the Magnitude of Impact on Geology and Soils (IGI 2013)

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute.	• Loss of high proportion of future quarry or pit reserves. • Irreversible loss of high proportion of local high fertility soils. • Removal of entirety of geological heritage feature. • Requirement to excavate / remediate entire waste site. • Requirement to excavate and replace high proportion of peat, organic soils and / or soft mineral soils beneath alignment.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute.	• Loss of moderate proportion of future quarry or pit reserves. • Removal of part of geological heritage feature. • Irreversible loss of moderate proportion of local high fertility soils. • Requirement to excavate / remediate significant proportion of waste site. • Requirement to excavate and replace moderate proportion of peat, organic soils and / or soft mineral soils beneath alignment.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute.	• Loss of small proportion of future quarry or pit reserves. • Removal of small part of geological heritage feature. • Irreversible loss of small proportion of local high fertility soils and/or high proportion of local low fertility soils. • Requirement to excavate / remediate small proportion of waste site. [NOTE1] • Requirement to excavate and replace small proportion of peat, organic soils and / or soft mineral soils beneath alignment.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity.	No measurable changes in attributes.
Minor Beneficial	Results in minor improvement of attribute quality.	Minor enhancement of geological heritage feature.
Moderate Beneficial	Results in moderate improvement of attribute quality.	Moderate enhancement of geological heritage feature.
Major Beneficial	Results in major improvement of attribute quality.	Major enhancement of geological heritage feature.
Note 1: Refer to Section 11.2.4.1.4 for further details of methodology for assessment of land contamination		

For hydrogeological receptors, the NRA Guidelines (NRA 2009) for determining the magnitude of impacts are utilised. The NRA Guidelines do not define beneficial impacts in their summary of impacts on hydrogeological features, and therefore, the magnitude of potential impacts is assessed on a scale of 'Negligible' to 'Large Adverse'. The criteria for determining the magnitude of impacts for hydrogeological receptors are outlined in Table 11.5.

Table 11.5: Criteria for Assessing the Magnitude of Impact on Hydrogeology (NRA 2009)

Magnitude of Impact	Criteria	Typical Example
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute.	• Removal of large proportion of aquifer. • Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems. • Potential high risk of pollution to groundwater from routine runoff*. • Calculated risk of serious pollution incident >2% annually. • Dewatering effects create significant differential settlement effects on existing infrastructure and buildings leading to extensive repairs required.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute.	• Removal of moderate proportion of aquifer. • Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems. • Potential medium risk of pollution to groundwater from routine runoff*. • Calculated risk of serious pollution incident >1% annually†. • Dewatering effects create moderate differential settlement effects on existing infrastructure and buildings leading to consideration of undertaking minor repairs.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute.	• Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems. • Potential low risk of pollution to groundwater from routine runoff*. • Calculated risk of serious pollution incident >0.5% annually†. • Dewatering effects create minor differential settlement effects on existing infrastructure and buildings which may need to be monitored but where repairs may be avoidable.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity.	• Calculated risk of serious pollution incident <0.5% annually†. • Dewatering effects create no or no noticeable differential settlement effects on existing infrastructure and buildings.
Notes: *Design Manual for Roads and Bridges (DMRB) Volume 4, Section 2, Part 1 Road Drainage and the Water Environment, Appendix A, Method C (Transport Infrastructure Ireland (TII) 2015) † DMRB Volume 4, Section 2, Part 1 Road Drainage and the Water Environment, Appendix A, Method D (TII 2015)		

11.2.4.1.3 Significance of Impact

The significance of impacts depends on both the importance / sensitivity of the geological and groundwater receptors during the Construction and/or the Operational Phases and the magnitude of impact. Table 11.6 defines the impacts and Table 11.7 describes the assessment of the significance of impacts to geological / groundwater receptors based on the NRA Guidelines (NRA 2009), which can be described as (ranging from least to greatest impact): Imperceptible, Slight, Moderate, Significant, Severe, and Profound.

Table 11.6: Description of Impact

Significance of Impact	Description
Imperceptible	• An impact capable of measurement but without significant consequences.
Slight	• An impact which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate	• An impact that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant	• An impact which, by its character, magnitude, duration or intensity, alters a sensitive aspect of the environment.
Severe	• An impact which, by its character, magnitude, duration or intensity, significantly alters a sensitive aspect of the environment.
Profound	• An impact which obliterates sensitive characteristics.

Table 11.7: Rating of Significance of Impacts on Geological and Hydrogeological Receptors

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

11.2.4.1.4 Assessment of Land Contamination

As part of the risk-based approach to assessing the potential risk from contaminated land mandated by the EPA (EPA 2013; EPA 2007), a Conceptual Site Model (CSM) has been developed to describe the relationship between:

- Contaminant source;
- Pathway; and
- Receptor.

The presence of a contamination source does not automatically infer a risk; if one or more of either a source, a linking pathway or a receptor are absent a viable or complete pollutant linkage is not present and therefore a risk is not present.

The preliminary CSM is presented in Appendix A11.1 in Volume 3 of this EIAR and has been used as the basis for the contaminated land risk assessment. The methodology is in line with the Land Contamination Risk Management guidance (UK EA 2023) which includes the consideration of:

- The likelihood of the event (probability), which takes into account both the presence of the hazard and receptor and the integrity of the pathway; and
- The severity of the potential consequence, which takes into account both the potential severity of the hazard and the sensitivity of the receptor.

The classification of likelihood (based on C552 (CIRIA 2001)) is detailed in Table 11.8 and the classification of consequence is detailed in Table 11.9.

Table 11.8: Classification of Likelihood

Classification	Definition
High Likelihood	An event is very likely to occur in the short-term, and is almost inevitable over the long-term OR there is evidence at the receptor of harm or pollution.
Likely	It is probable that an event will occur. It is not inevitable, but possible in the short-term and likely over the long-term.
Low Likelihood	Circumstances are possible under which an event could occur. It is by no means certain that even over a longer period such an event would take place, and less likely in the short-term.
Unlikely	It is improbable that an event would occur even in the very long-term.

Table 11.9: Classification of Consequence

Classification	Definition
Severe	Acute risks to human health. Short-term risk of pollution of sensitive water resource (e.g. major spillage into the water environment). Impact on surface water or groundwater (e.g. large-scale pollution or very high levels of contamination). Catastrophic damage to buildings or property (e.g. explosion causing building collapse). Ecological system effects – irreversible adverse changes to a protected location. Immediate risks.
Medium	Chronic risks to human health. Pollution of sensitive water resources (e.g. leaching of contaminants into the water environment). Ecological system effects – substantial adverse changes to a protected location. Significant damage to buildings, structures and services (e.g. damage rendering a building unsafe to occupy such as foundation damage).
Mild	Non-permanent health effects to human health. Pollution of non-sensitive water resources. Damage to buildings, structures and services (e.g. damage rendering a building unsafe to occupy, such As foundation damage). Substantial damage to non-sensitive environments (unprotected ecosystems e.g. crops).
Minor/Negligible	Non-permanent health effects to human health (easily prevented by appropriate use of PPE). Minor pollution to non-sensitive water resources. Minor damage to non-sensitive environments (unprotected ecosystems e.g. crops). Easily repairable effects of damage to buildings, structures, services or the environment (e.g. discoloration of concrete, loss of plants in a landscaping scene).

To determine the overall risk to the identified receptor, the likelihood and severity of the potential hazard are combined in accordance with the risk assessment matrix outlined in Table 11.10. The definitions of the outcomes are summarised in Table 11.11.

Table 11.10: Risk Assessment Matrix

		Consequence			
		Severe	Medium	Mild	Minor/Negligible
Probability (Likelihood)	High	Very high risk	High risk	Moderate risk	Moderate/low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low	Moderate risk	Moderate/low risk	Low risk	Negligible risk
	Unlikely	Moderate/low risk	Low risk	Negligible risk	Negligible risk

Table 11.11: Definitions of Risk

Term	Description
Very high risk	Severe harm to a receptor may already be occurring OR a high likelihood that severe harm will arise to a receptor unless immediate remedial action works/mitigation measures are undertaken.
High risk	Harm is likely to arise to a receptor, and is likely to be severe, unless appropriate remedial actions/mitigation measures are undertaken. Remedial works may be required in the short term, but likely to be required over the long-term.
Moderate risk	Possible that harm could arise to a receptor but low likelihood that such harm would be severe. Harm is likely to be medium. Some remedial works may be required in the long term.
Moderate/low risk	Possible that harm could arise to a receptor, but where a combination of likelihood and consequence results in a risk that is above low but is not of sufficient concern to be classified as medium. It can be driven by cases where there is an acute risk which carries a severe consequence, but where the exposure is unlikely.
Low risk	Possible that harm could arise to a receptor. Such harm would at worst normally be mild.
Negligible risk	Low likelihood that harm could arise to a receptor. Such harm unlikely to be any worse than mild.

11.2.4.2 Limitations to the Assessment

Information from the sources detailed in Section 11.2.3 has been used to inform the assessment of baseline geology and soil conditions, where available.

The identification of potential land contamination sources has been solely reliant on desk-based assessments and the accuracy of historical mapping and no ground truthing or field surveys of these features were carried out.

The ground investigation, while conducted in accordance with best practice and considered suitable for the current stage of the Proposed Development, only investigates and samples a small quantity of the sub-surface. As such, uncertainty is inherent in such investigations and final confirmation of ground conditions is only possible at the Construction Phase.

Data sets obtained from GSI have, in some cases, limitations. Specific to this assessment, the following data sets have the following limitations:

- GSI Groundwater Karst Data: It should be noted that the GSI Groundwater Karst Data has known limitations, since it is "*not a complete database*" and that "*many karst features are not included in this database*" (GSI 2024). GSI notes that karst data in the database is only data gathered by GSI or submitted to GSI; and
- GSI Groundwater Wells and Springs: It is not required for private supplies to be registered with GSI and so there is the possibility of additional supplies present without being registered. The GSI record may also include historical abstractions which are no longer active.

Limitations inherent in the exploratory hole construction techniques used, means full characterisation of the groundwater regime may not be possible, for example due to:

- The use of casing in supporting the borehole walls during drilling may seal out groundwater strikes; and

- The use of water to aid drilling may mean groundwater is not always identified, especially the case with water flush, as used in rotary.

11.3 Baseline Environment

The study area for assessing the land, soils and geology impacts of the Proposed Development has been defined as a 250m lateral buffer around the Planning Application Boundary.

The study area for assessing the hydrogeological impacts of the Proposed Development has been defined as the area of the Planning Application Boundary and the area extending 1km from this, in addition to any TCCs, HDD Compounds, or construction access routes which will have their own 1km buffer. The study area also includes any WFD groundwater bodies (which are hydrogeological receptors) which lie within this 1km radius.

The 1km buffer is informed by the design noting that no large-scale dewatering is expected to be required, given the largely shallow nature of the works.

The following sections present a desk-based overview of the baseline conditions of all land use, soils, geological, and hydrogeological receptors which lie within the relevant study area.

11.3.1 Land Cover

The baseline land use for the Proposed Development has been derived from the CORINE land cover dataset (CORINE 2018), as summarised in Table 11.12. This baseline land use information has been used to inform the assessment, including the potential for land contamination, and is not considered as an attribute subject to assessment in itself.

The land use that covers the majority of the study area is agricultural land used for pasture. Within the areas of pasture there are small patches of non-irrigated arable land. Areas of discontinuous urban fabric are associated with the towns / villages of Dunboyne and Hollystown.

A summary of the land use and approximate locations is provided in Table 11.12.

Table 11.12: Summary of Land Use Types (CORINE 2018)

Land Use Type	Distribution
Agricultural (pastures)	Located along the majority of the proposed cable route and the surrounding area.
Agricultural (non-irrigated arable land)	Located in small sections throughout the pastures, across the entire study area.
Mixed Forest	In the western part of the study area adjacent to Barstown Industrial Estate.
Discontinuous urban fabric	At the towns / villages of Warrenstown, Dunboyne and Hollystown.
Road and rail networks and associated infrastructure	Along the M3, M2 and M1 Motorways.
Complex cultivation patterns	Located at the eastern end of the proposed cable route adjacent to Stockhole Lane.
Airport	Dublin Airport which is located at the eastern end of the proposed cable route adjacent to the M1 Motorway.
Industrial or commercial units	Dunboyne Industrial Estate.
Construction sites	West of Dublin Airport.
Sports and leisure facilities	West of Hollystown.

11.3.2 Soils and Geology

11.3.2.1 Soils

Soil types have been identified using Teagasc mapping (Teagasc 2024a). The majority of the study area is underlain by a variety of soil types, comprising fine loamy drift with limestone (reflecting the underlying limestone bedrock, as presented in Figure 11.1 in Volume 4 of this EIAR). Soils described as river alluvium are found within the study area along the courses of the rivers and their floodplains, with the most extensive areas present along the River Tolka in the centre of the study area, as outlined in Table 11.13.

Table 11.13: Summary of Soils Within the Study Area

National Soil Series	Substrate Group	Substrate Type	Description	Textural Criteria	Sensitivity
Straffan	Limestones	Drift	Fine loamy drift with limestones	Fine loamy	Medium
Elton	Limestones	Drift	Fine loamy drift with limestones	Fine loamy	Medium
River Alluvium	Alluvium	Clay	Variable clay, silt, sand and gravel	N/A	Low
Urban	N/A	N/A	Made ground of unknown nature	N/A	Low

The river alluvium is indicated as having poor drainage potential, has a limited lateral extent and either forms part of agricultural fields or has no specified land use. This soil type is assigned low sensitivity based on the methodology presented in Table 11.2. Elton sub-soil is encountered at Dunboyne and to the east of Dublin Airport. According to the Teagasc online mapper it is composed of fine loamy drift with limestones and has a moderate drainage potential. This soil type is assigned medium sensitivity based on the methodology outlined in Table 11.2. Straffan is primarily associated with agricultural land with no other designations or protections in place. This soil type is assigned a sensitivity of Medium according to the methodology detailed in Table 11.2.

11.3.2.2 Geomorphology

The landscape and geomorphology within the study area have been formed by glacial action and sub-glacial deposition (mapped geomorphological features are presented in Figure 11.2 in Volume 4 of this EIAR). Formation of the lakes, peat bogs and drumlins are linked to the Midlandian Cold Stage (75,000 to 10,000 years ago) of the last Ice Age. Landscapes within the Proposed Development are defined as mega-scale glacial lineations, glaciofluvial terraces and a composite thrust block moraine. All of the geomorphological features are not designated as protected features on a local or a national scale, according to GSI records (GSI 2024), and in accordance with the IGI Guidelines (IGI 2013), are considered to have low sensitivity.

11.3.2.3 Bedrock and Superficial Geology

Bedrock and superficial (quaternary) deposits were identified using GSI datasets (GSI 2024) including 1:100k bedrock and 1:50k quaternary datasets (GSI 2014) (mapped bedrock and quaternary deposits are presented in Figure 11.3 and Figure 11.4 in Volume 4 of this EIAR).

In general, till derived from limestone is the most common quaternary deposit, which is present across the central and southern parts of the Proposed Development. The proposed cable route, from approximate Chainage 0 to 4,825 is mainly underlain by till derived from Namurian sandstones and shales. Areas of mapped alluvium and gravels derived from limestone correlate with mapped watercourses and their floodplains. Sediments of gravels derived from limestones are present throughout the majority of the study area. A summary of quaternary deposits within the study area and those that will be crossed by the Proposed

Development is provided in Table 11.14. The depth to the bedrock encountered during ground investigation ranged from 1.4m bgl to 11.02m bgl (metres below-ground level).

As the proposed cable route will run from west to east from Woodland Substation to Belcamp Substation, it will cross multiple bedrock types with some faulting present along the central section of the Proposed Development, mainly in a north-west to south-east orientation. The geology along the Proposed Development comprises multiple limestone formations, with some mudstone, sandstone and shale formations interbedded. An outcrop of the Lucan Formation is present to the south of Dublin Airport. A summary of the bedrock geology along with locations is provided in Table 11.14.

Table 11.14: Summary of Quaternary Deposits and Bedrock Within the Study Area

Unit Name	Description	Receptor Value	Location (Approximate Chainages)
Quaternary Deposits			
Till derived from Namurian sandstones and shales	Clay to sand matrix containing variable cobbles and boulders.	Low	Covers the west section of the study area (Chainages 0 – 2,140, 2,350 – 2,750, 2,850 – 4,850).
Gravels derived from limestones	Gravel, variable minor clay, silt or sand content.	Low	Small sections bordering alluvium between Chainage 15,390 – 16,150, 16,175 – 16,275, 26,060 – 26,410, 31,975 – 33,080.
Alluvium	Variable clay, silt, sand and gravel.	Low	Underlying the River Tolka, Pinkeen, Ward and Mayne and their tributaries, as well as a tributary of the River Santry (Chainages 2,140 – 2,350, 10,710 – 10,870, 12,560 – 12,660, 12,715 – 13,000, 13,075 –13,190, 16,150 – 16,175, 18,010 – 18,060, 19,045 – 19,150, 31,245 – 31,255).
Till derived from limestone	Clay to sand matrix containing variable cobbles and boulders, likely to be calcareous.	Low	Covers the majority of the Proposed Development study area (Chainages 4,850 – 10,710, 10,870 – 12,560, 12,660 – 13,020, 13,200 – 15,350, 16,300 – 18,000, 18,075 – 19,000, 19,150 – 21,800, 21,900 – 22,050, 22,100 – 22,200, 22,400 – 25,700, 26,450 – 29,350, 29,550 – 30,450, 30,550 – 30,600, 30,900 – 31,200, 31,300 – 31,950, 33,100 – 37,253).
Lacustrine sediments	Not Classified	Low	Chainage 2,750 – 2,850.
Bedrock			
Lucan Formation	Dark limestone and shale.	Low	Primarily at the western extent of the study area beginning at the start of the proposed cable route, from the town of Woodland to Ward Upper/Lower on the east side of the M2 Motorway. Outcrop of the Lucan Formation is next seen south of Dublin Airport towards the end of the proposed cable route (Chainages 0 – 23,950, 24,350 – 24,410, 35,610 – 36,880).
Rush Conglomerate Formation	Conglomerate, shale, limestone.	Low	Mapped at the central area of the study area, north-east of the M2 Motorway and underlying much of Corrstown Golf Course (Chainages 23,950 – 24,350, 24,410 – 26,145).
Tober Colleen Formation	Calcareous shale, limestone conglomerate.	Low	This bedrock geology can be found at the north-eastern boundary of the study area, east of Swords near Dublin Airport and west of Swords. The bedrock transects the study area from north-east extending south-west beyond the N2 National Road (Chainages 26,145 – 28,315, 31,260 – 31,420, 33,580 – 35,610, 36,880 – 37,253).

Unit Name	Description	Receptor Value	Location (Approximate Chainages)
Waulsortian Limestones	Massive, unbedded lime-mudstone.	Low	This limestone is scarce and sparse across the study area and the proposed cable route will pass through it at one location (west of Junction 2 of the M1 Motorway, Dublin Airport) (Chainage 33,075 – 33,580).
Malahide Formation	Argillaceous bioclastic limestone, shale.	Low	Found in the eastern extent of the study area between Swords at the north-east to the N2 National Road, south-west of St. Margaret's (Chainages 28,315 – 31,260, 31,420 – 33,075).

11.3.2.4 Geohazards

Geohazards are identified as any karst features, areas of peat, areas susceptible to landslides / subsidence, or mining and quarrying areas that would need to be considered prior to development. Given the nature of the bedrock, there is the potential for the presence of karst features within the limestone and these include sinkholes, caves, some types of springs and turloughs.

According to the GSI Landslide Susceptibility Map (GSI 2024), no landslide events were recorded within the study area. There are no areas identified as prone to landslides in the study area (the landslide susceptibility classification of the area is presented in Figure 11.5 in Volume 4 of this EIAR). Areas of peat are not expected to directly underlie the proposed cable route. One spring is mapped at the eastern boundary of the study area (not on the proposed cable route). This spring is known as 'St. Doolagh's Well', and emanates from the boundary between the Waulsortian Limestone and the Malahide Formation.

11.3.2.5 Current and Historic Mining Sites

Parts of the study area have been affected by historic surface mining according to the information review. The historic gravel pits and quarries identified in the study area using the Irish Townland and Historical Map Viewer (OSI 2024a) are summarised in Table 11.15. The gravel pits are located on quaternary deposits of gravels derived from limestones, while the quarries are located over an area of exposed shale and sandstone bedrock, surrounded by till derived from Namurian sandstones and shales. Further details on these features are presented in the review of potential contamination sources in Section 11.3.2.10.

Table 11.15: Historic Quarries and Gravel Pits Within the Study Area

Ground Gas Source	Approximate Chainage	Approximate Distance from the Planning Application Boundary (m)
Historical Marl Pit	11,675	140m west
Historical Gravel Pit	18,150	175m south
Historical Gravel Pit	18,525	130m north
Historical Quarry	22,050	On Proposed Development alignment
Historical Quarry	23,100	200m east
Historical Quarry	24,050	25m east
Historical Gravel Pit	25,450	100m south
Historical Quarry	25,700	90m north
Historical Quarry	26,200	60m north-east
Historical Sand Pit	26,950	90m north
Historical Quarry	29,700	250m south
Historical Quarry	30,600	250m north-west
Historical Quarry	30,800	145m north-west
Historical Quarry	30,825	240m north-west
Historical Quarry	30,900	150m north
Historical Quarry	33,400	120m south
Historical Quarry	33,450	30m south
Historical Quarry	33,500	100m south
Historical Lead mine	34,550	30m south

No operational quarries have been identified within the study area, based on information available at the time of writing (EPA 2024).

The potential for future extraction of aggregate materials within the study area has been considered. Future aggregate potential of crushed rock and granular material across Ireland has been mapped by the GSI (GSI 2024), and is presented in Figure 11.6 and Figure 11.7 in Volume 4 of this EIAR.

The majority of the land within the study area is not classified as having granular aggregate potential. The relatively small areas that are classified are summarised in Table 11.16. It is considered that, of the classified areas, those with very low and low classifications are unlikely to be viable prospects for future extraction while those with moderate or high classifications could be suitable subject to current and future proposed land use. If areas are currently developed (urban or infrastructure development), they are unlikely to be suitable for future extraction, while agricultural land could in theory be suitable for future extraction, depending on planning and land purchase constraints. These factors have been taken into account in qualitative terms in Table 11.16.

Table 11.16: Granular Aggregate Potential in the Study Area

Granular Aggregate Potential	Location Description and Approximate Chainage	Potentially Viable?	Sensitivity
High	In the vicinity of Pace, approximate Chainage 12,450 – 12,550.	Unlikely - land used as dual carriageway.	Low
	In the vicinity of Corrstown, approximate Chainage 26,250 – 26,425.	Possible. Large area, however land used as established fields.	Medium
	In the vicinity of Dublin Airport, approximate Chainage 32,550 – 32,700.	Unlikely – land occupied by daa.	Low
Very High	In the vicinity of Bennetstown, approximate Chainage 11,600 – 11,700.	Possible. Large area, however land used as established fields.	Medium

Areas of sand and gravel of economic value, associated with alluvial deposits from the River Tolka (undifferentiated) and glaciofluvial sands and gravels (undifferentiated) are located within the study area and underlying parts of the proposed cable route. At Belcamp, there are small areas of till with gravel of carboniferous limestone.

Approximately half of the land within the study area is not classified for crushed rock potential. This classification is separate to the likelihood of these areas being available for aggregate extraction.

The presence of superficial deposits will reduce the likelihood of future development, while the presence of current developments (urban and infrastructure) will also constrain future development. It is considered that, of the classified areas, those with very low and low classifications are unlikely to be viable prospects for future extraction, while those areas with moderate to very high classifications could be suitable subject to land use. These factors have been taken into account in qualitative terms within Table 11.17.

Table 11.17: Crushed Rock Aggregate Potential in the Study Area

Granular Aggregate Potential	Location Description and Approximate Chainage	Potentially Viable?	Sensitivity
High	In the vicinity of Dunboyne, approximate Chainage 10,255 – 10,550.	Unlikely - land occupied by current development.	Low
	In the vicinity of Piercetown, approximate Chainage 13,100 – 13,550.	Unlikely - land occupied by current development.	Low
	In the vicinity of Gallanstown, approximate Chainage 21,250 – 22,450.	Possible. Large area, however land used as established fields.	Medium
	In the vicinity of Ward Upper, approximate Chainage 23,700 – 24,050.	Unlikely – land occupied by current development.	Low
	In the vicinity of Corrstown, approximate Chainage 25,350 – 26,400.	Possible. Large area, however land used as established fields.	Medium
	Lands surrounding Dublin Airport, approximate Chainages 29,300 – 29,600, 29,750 – 30,350, 31,025 – 31,250, 31,925 -32,525, 36,575 – 33,025.	Unlikely – land occupied by daa.	Low
Very High	In the vicinity of Gallanstown, approximate Chainages 21,850 – 21,975, 22,100 – 22,400.	Possible. Large area – however land used as established fields.	Medium
	In the vicinity of Ward Upper, approximate Chainage 23,775 – 23,875.	Unlikely – land occupied by industrial units.	Medium
	In the vicinity of Newpark, approximate Chainages 25,425 – 25,800, 25,875 – 25,925, 26,000 – 26,175.	Possible. Large area – however land used as established fields.	Medium
	In the vicinity of Dublin Airport, approximate Chainages 28,875 – 29,300, 29,625 – 29,725, 30,425 – 31,025, 33,075 – 33,725.	Unlikely – lands occupied by daa.	Medium

11.3.2.6 Irish Geological Heritage Sites

The GSI provides scientific appraisal and interpretative advice on geological and geomorphological sites and is responsible for the identification of important sites that are capable of being conserved as County Geological Sites (CGS) or Natural Heritage Areas (NHAs). The Department of Housing, Local Government and Heritage have the responsibility of designation and management of sites, with appropriate advice from the GSI. At present, the GSI has compiled a list of sites proposed for designation as proposed Natural Heritage Areas (pNHAs) noted on the GeoHive interactive map (OSI 2024b). No NHAs or pNHAs are present within the study area.

The GSI has also determined a secondary list of County Heritage Sites, which may be considered for protection at local authority functional control level. CGS are generally incorporated into County Development Plans. There are no CGS in the study area for the Proposed Development.

11.3.2.7 Waste Facilities

One material recovery facility has been identified within the study area noted from the EPA online mapper (EPA 2024). Padraig Thornton Waste Disposal Ltd. is located approximately 130m east from Chainage 11,400. For the purposes of Article 48 of S.I. No. 395/2004 - Waste Management (Licensing) Regulations 2004, this facility is classed as a non-hazardous materials recovery facility and a hazardous and non-hazardous civic amenity.

11.3.2.8 Radon

Radon is a naturally occurring radioactive gas which originates from the decay of uranium in rocks and soils. It is colourless, odourless and tasteless. As radon decays, radiation is given off in the form of alpha particles. After inhalation, the alpha particles are absorbed by the lungs and cause localised damage, which can lead to lung cancer.

Radon can accumulate in enclosed or poorly ventilated spaces, such as buildings, houses and tunnels. The receptors to radon in relation to the Proposed Development are construction and maintenance workers, future site users and adjacent residents.

Radon concentration is measured in becquerels per cubic metre of air (Bq/m^3). The becquerel is a unit of radioactivity and corresponds to one radioactive disintegration per second.

The Radiological Protection Institute of Ireland (RPII) (part of the EPA) has issued information and guidance on radon entitled, Advice on Setting a Reference Level for Radon Concentrations in Long-Stay Institutions (EPA 2019a). The reference level for long-term exposure to radon in a house, above which the need for remedial action will be considered, is $200Bq/m^3$ (determined in accordance with the RPII's standard protocol). Based on current knowledge, it is estimated that in Ireland, for the population as a whole, a lifetime exposure (i.e., 70 years) to radon in the home at the Reference Level of $200Bq/m^3$ carried a risk of about one in 50 of contracting fatal lung cancer.

Radon risk is determined by the percentage of homes in a given area that are estimated to be above the $200Bq/m^3$ Reference Level. The online Radon Map of Ireland (EPA 2024) has been used to provide an indication of the level of risk associated with the Proposed Development. According to this map, the majority of the study area is located within medium or high-risk areas.

11.3.2.9 Ground Gas

'Ground gas' refers to gases, including carbon dioxide, methane, carbon monoxide and hydrogen sulphide, which can occur naturally and from anthropogenic sources within the ground. Volatile and Semi-Volatile Organic Compounds (VOC/SVOCs) within the ground can also produce potentially harmful vapours. Typical sources of ground gases and vapours include:

- Ground gases from the breakdown of organic materials in the sub-surface from natural sources such as wetlands, peat and alluvium, and anthropogenic sources such as landfills;
- Vapours and ground gases from anthropogenic sources such as landfills or spillages / improper disposal of volatile materials such as petrol, oils or solvents;
- Methane, carbon dioxide, carbon monoxide and hydrogen sulphide from coal measures; and
- Carbon dioxide from carbonate-rich soils or bedrock.

Potential ground gas sources have been identified within the study area using the EPA online mapper (EPA 2024) and the Irish Townland and Historical Map Viewer (OSI 2024a) including natural soils with high organic content (e.g. alluvium), waste recovery facilities, gravel pits and other types of former superficial extraction

sites which may have been backfilled with decomposable infill. An overview of the sources is provided in Table 11.18, and these sources are also mapped on Figure 11.8 in Volume 4 of this EIAR.

Table 11.18: Potential Ground Gas Sources within the Study Area

Potential Ground Gas Source	Approximate Chainage	Approximate Distance from the Planning Application Boundary (m)
Materials Recovery Facility	11,400	50m east
Historical Marl Pit	11,675	140m west
Historical Gravel Pit	18,150	175m south
Historical Gravel Pit	18,525	130m north
Historical Quarry	22,050	Within Planning Application Boundary
Historical Quarry	23,100	200m east
Historical Quarry	24,050	25m east
Historical Gravel Pit	25,450	100m south
Historical Quarry	25,700	90m north
Historical Quarry	26,200	60m north-east
Historical Sand Pit	26,950	90m north
Historical Quarry	29,700	250m south
Historical Quarry	30,600	250m north-west
Historical Quarry	30,800	145m north-west
Historical Quarry	30,825	240m north-west
Historical Quarry	30,900	150m north
Historical Quarry	33,400	120m south
Historical Quarry	33,450	30m south
Historical Quarry	33,500	100m south
Historical Lead mine	34,550	30m south
Unlicensed landfill	37,200	245m south

11.3.2.10 Contaminated Land

Land affected by anthropogenic contamination can pose constraints to the Proposed Development in a number of ways, such as:

- Limitations to materials reuse and increased costs of handling and disposal;
- Impact to human health of construction workers, residents and adjacent land users;
- Mobilisation of contaminants impacting the surface water, groundwater and ecological sites; and
- Impact to the integrity of construction materials.

Land contamination can be caused by activities such as historical industrial land use, waste disposal, historical mining and quarrying and pollution from accidents and spills. Potential contaminants can include a variety of elements and chemical compounds including heavy metals, hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), VOCs, SVOCs, per- and polyfluoroalkyl (PFAS) and ground gas.

The potential sources of contaminated features from the Irish Townland Historical Map Viewer (OSI 2024a) are shown on Figure 11.8 in Volume 4 of this EIAR. The desk-based study information review identified the following potential sources of contamination within the 250m study area:

- Historical marl pit;
- Historical gravel pit;
- Historical sand pit;

- Historical quarries;
- Historical lead mines;
- Areas of made ground;
- Graveyards;
- Historical smithies
- Former railway;
- A concrete works;
- Top Oil service station;
- Depot yard
- Car mechanic
- Integrated Pollution Control / Integrated Pollution Prevention Control (IPC / IPPC) licensed sites;
- Operational landfill; and
- Discharge licenses under Section 4 of Number 1 of 1977 - Local Government (Water Pollution) Act, 1977.

Of the 32 identified attributes in the study area, only six were located on or immediately adjacent to the proposed cable route:

- Railway at approximate Chainage 12,950;
- Historical quarry at approximate Chainage 22,050;
- Industrial depot at approximate Chainage 22,600;
- Car mechanic at approximate Chainage 25,500;
- Graveyard at approximate Chainage 26,850; and
- Historical smithy at approximate Chainage 33,360

Based on the review of historical and current land use, there are no current large scale polluting industries present within the study area, and while some historically potentially contaminative land uses have been identified, these are generally small scale, local and of relatively low contamination potential comprising infilled pits, infilled quarries and former railways. Specific land uses, as detailed above, may have resulted in localised impacts on soil and groundwater, as well as made ground associated with the construction of infrastructure and farming waste and chemicals (e.g. fertilisers, sheep dip and pesticides). A summary of the potential contamination sources within the study area, with associated information, is provided in Appendix A11.1 in Volume 3 of this EIAR.

11.3.3 Hydrogeology

11.3.3.1 Desk-Based Information

Hydrogeological receptors include aquifers, abstractions (public and private), groundwater / surface water interactions (baseflow contributions, groundwater dependent terrestrial ecosystems etc.) and karst features. These have been identified using the following relevant datasets:

- GSI Spatial Resources (GSI 2024); and
- EPA Geoportal (EPA 2024).

Aquifer categories, as defined by GSI, describe both resource potential (regionally or locally important, or poor) and groundwater flow type and attenuation potential (through fissures, karst conduits or intergranular) (GSI 2024). The aquifers are summarised as:

Regionally Important (R) Aquifers:

- Karstified bedrock (Rk);
- Fissured bedrock (Rf); and
- Extensive sand & gravel (Rg).

Locally Important (L) Aquifers:

- Sand & gravel (Lg);
- Bedrock which is Generally Moderately Productive (Lm);
- Bedrock which is karstified to a limited degree or limited area (Lk); and
- Bedrock which is Moderately Productive only in Local Zones (Ll).

Poor (P) Aquifers:

- Bedrock which is Generally Unproductive except for Local Zones (Pl); and
- Bedrock which is Generally Unproductive (Pu).

The superficial / quaternary deposits underlying the study area (till derived from limestones, gravels derived from limestone, and alluvium) have not been classified as locally important sand and gravel aquifers (Lg).

There are several bedrock aquifers underlying the study area which are associated with various bedrock geologies:

1. The Tober Colleen Formation (comprised of calcareous shale and limestone conglomerate);
2. The Malahide Formation (comprised of argillaceous bioclastic limestone and shales);
3. The Waulsortian Limestones (comprised of pale grey limestone);
4. The Lucan Formation (comprised of dark limestone and shale);
5. Rush Conglomerate Formation (comprised of limestone pebble, lithic sandstones and shale); and
6. Boston Hill Formation (comprised of muddy limestone and shale).

The Tober Colleen Formation partially underlies the east area of the study area (between the N2 National Road / M2 Motorway and Dublin Airport). This aquifer is classified as a poor bedrock aquifer which is unproductive except for local zones (Pl).

The Malahide Formation and Waulsortian Limestones are also underlying the eastern section of the study area (extending from the town of Swords to the N2 National Road at St. Margaret's). These aquifers are classified as locally important bedrock aquifer which is moderately productive only in local zones (Ll).

The entire western section of the study area is underlain by the Lucan Formation. This aquifer is considered a locally important aquifer and one which is moderately productive only in Local Zones (Ll).

North-east of the Cherryround Interchange is the Rush Conglomerate. This aquifer is considered a locally important aquifer and one which is moderately productive only in Local Zones (Ll).

At Kildonan, at the south-central study area boundary, is the Boston Hill Formation. This aquifer is considered a locally important aquifer and one which is moderately productive only in Local Zones (Ll).

The productivity of an aquifer was used, as outlined in Table 11.3, to assign receptor value. A summary of the aquifer types and their importance are presented in Table 11.19. Figure 11.9 in Volume 4 of this EIAR displays the locations of the aquifers.

Table 11.19: Summary of Aquifer Types within the Study Area

Unit Name	Aquifer Type	Importance	Location (including Approximate Chainages)
Quaternary Deposits			
Till derived from Namurian sandstones and shales	Not classified	Low	Covers furthest west section of the study area (in locality of Batterstown) (Chainages 0 – 2,140, 2,350 – 2,750, 2,850 – 4,850).
Gravels derived from limestones	Not classified	Low	Small sections bordering alluvium between Chainages 15,390 – 16,150, 16,175 – 16,275, 26,060 – 26,410, 31,975 – 33,080.
Alluvium	Not classified	Low	Underlying the River Tolka, Pinkeen, Ward and Mayne and their tributaries, as well as a tributary of the River Santry (Chainages 2,140 – 2,350, 10,71600 – 10,87760, 12,560 – 12,660, 12,715 – 13,000, 13,075 –13,190, 16,150 – 16,175, 18,010 – 18,060, 19,045 – 19,150, 31,245 – 31,255).
Till derived from limestone	Not classified	Low	Covers the majority of the Proposed Development study area (Chainages 4,850 – 10,710, 10,870 – 12,560, 12,660 – 13,020, 13,200 – 15,350, 16,300 – 18,000, 18,075 – 19,000, 19,150 – 21,800, 21,900 – 22,050, 22,100 – 22,200, 22,400 – 25,700, 26,450 – 29,350, 29,550 – 30,450, 30,550 – 30,600, 30,900 – 31,200, 31,300 – 31,950, 33,100 – 37,253).
Lacustrine sediments	Not classified	Low	Chainage 2,750 – 2,850.
Bedrock			
Tober Colleen Formation	Poor Aquifer- bedrock which is generally unproductive except for local zones (Pl)	Low	This bedrock geology can be found at the north-eastern boundary of the study area to the east of Swords near Dublin Airport and to the west of Swords. The bedrock transects the study area from north-east, extending south-west beyond the N2 National Road (Chainages 26,145 – 28,315, 31,260 – 31,420, 33,580 – 35,610, 36,880 – 37,253).
Malahide Formation	Locally important aquifer – bedrock which is moderately productive only in local zones (Ll)	Medium	Found in the eastern extent of the study area between Swords at the north-east to the N2 National Road to the south-west of St. Margaret's (Chainages 28,315 – 31,260, 31,420 – 33,075).
Waulsortian Limestones	Locally important aquifer-bedrock which is moderately productive only in local zones (Ll)	Medium	This limestone is scarce and sparse across the study area and the proposed cable route will pass through it at one location (west of Junction 2 of the M1 Motorway (Dublin Airport) (Chainage 33,075 – 33,580).
Lucan Formation	Locally important aquifer-bedrock which is moderately productive only in local zones (Ll)	Medium	Primarily at the western extent of the study area, beginning at the start of the proposed cable route, from the town of Woodland to Ward Upper/Lower on the east side of the M2 Motorway. Outcrop of the Lucan Formation is next seen south of Dublin Airport towards the end of the proposed cable route (Chainages 0 – 23,950, 24,350 – 24,410, 35,610 – 36,880).
Rush Conglomerate	Locally important aquifer-bedrock which is moderately productive only in local zones (Ll)	Medium	Mapped at the central area of the study area, north-east of the M2 Motorway and underlying much of Corrstown Golf Course (Chainages 23,950 – 24,350, 24,410 – 26,145).
Boston Hill Formation	Locally important aquifer-bedrock which is moderately productive only in local zones (Ll)	Medium	At Kildonan, south central study area boundary. Does not underly the proposed cable route.

11.3.3.1.1 Public Groundwater Abstractions and Source Protection Areas

There are a total of seven identified Uisce Éireann (formerly known as Irish Water) abstractions within the study area.

Three are adjacent to the R108 Regional Road (southside of the road), approximately 500m south of the proposed cable route (approximate Chainage 29,250 to 30,350). These are boreholes / wells located within the Fingal Zone. The wells are referred to as WAB1000478, WAB1000479, and WAB100080. Uisce Éireann have confirmed these abstraction points are currently out of service, and as such there is currently no source protection area associated with these abstractions. These are therefore not considered as receptors in this impact assessment.

The further four public water supply boreholes (PW1, PW2, PW3 and PW4) within the study area are located to the south of the River Tolka, approximately 750m east of Chainage 11,450 in Dunboyne. The boreholes are detailed in Table 11.20. Source Protection Areas are associated with these abstractions. An Inner Protection Area (SI) is 'designed to protect against the effects of human activities that might have an immediate effect on the source and, in particular, against microbial pollution', and an Outer Protection Area (SO) is the area 'encompassing the remainder of the zone of contribution to the groundwater abstraction point'. The Inner Protection Area extends approximately 800m from the abstraction source and the Outer Protection Area.

No group water schemes have been identified within the study area.

Table 11.20: Public Water Supply Wells

Abstraction ID	Pumping Rate (m^3/day)	Normal Consumption (m^3/day)	Depth of Borehole (m)	Importance	Bedrock
PW1	115	34	~60	Extremely High	Lucan Formation (dark limestone and shale)
PW2	175	145	~60	Extremely High	
PW3	655	N/A	61	Extremely High	
PW4	535	535	122	Extremely High	

Pumping rates and normal consumption rates have been taken from the GSI data (GSI 2024) and the Dunboyne Water Supply Groundwater Source Protection Zones (Wright 2004).

11.3.3.1.2 Private Groundwater Abstractions

The GSI database on Groundwater Wells and Springs (GSI 2024) indicates that there are 11 springs across the study area. The majority are located within bedrock outcrops and at geological boundaries (either change in bedrock and / or faulting).

A review of this dataset shows that there are over 60 boreholes / hand dug wells with recorded uses (i.e., domestic purposes, agricultural, industry etc.) within the study area.

The GSI database has known limitations. It is not required for private supplies to be registered with GSI and so there is the possibility of additional supplies present without being registered. The GSI record may also include historical abstractions which are no longer active. Due to the uncertainty of location and existence of these wells, the presence of them close to the Proposed Development cannot be ruled out.

However, as outlined in Chapter 3 (Consideration of Reasonable Alternatives) in Volume 2 of this EIAR, extensive consultations have been undertaken with the public for the Proposed Development. In addition, EirGrid's Agricultural Liaison Officers have met with each affected landowner several times to discuss the Proposed Development. These consultations and meetings have not identified any private supplies.

11.3.3.1.3 Karstic Features

No karstic features were identified on the GSI Groundwater Karst Data mapping within the study area (GSI 2024). It should be noted that the GSI Groundwater Karst Data has known limitations, since it is "*not a complete database*" and that "*many karst features are not included in this database*" (GSI 2024). Therefore, it is possible that there are karstic features present in the subsurface. One Karst Landform has been identified approximately 600m east of the study area (not on the proposed cable route). This is a spring known as 'St. Doolagh's Well' and emanates from the boundary between the Waulsortian Limestone and the Malahide Formation.

11.3.3.1.4 Groundwater Vulnerability

Areas of groundwater vulnerability are mapped on the GSI Groundwater Vulnerability mapping throughout the study area (GSI 2024). Groundwater vulnerability along the proposed cable route is categorised as 'rock at or near surface or karst', 'extreme', 'high', 'moderate', or 'low.' Over half the proposed cable route will be within a low vulnerability zone. There are localised areas where vulnerability is greater than extreme (classified as 'rock is at or near the surface / karstic'). The largest area where rock is at surface or karstic is at the south of the study area, near Huntstown, north of the M50 Motorway. Less than 2% of the proposed cable route will be within this vulnerability category.

The majority of the proposed cable route will avoid areas of high, extreme, and rock near surface or karst groundwater vulnerable areas, particularly in the western study area and the furthest extent to the east. In total, there are five areas where the proposed cable route will directly cross areas classified as either extremely vulnerable or rock at or near the surface / karstic. These are located at Cloghran (near the National Show Centre), Forrest Great, Newpark (south of the River Ward), Ward Lower, and Killamonan.

11.3.3.1.5 Surface Water / Groundwater Connectivity

The Proposed Development has multiple potential crossing points across multiple WFD designated river water bodies and their tributaries. For specific chainage for the crossing points (please refer to Section 12.3.4 of Chapter 12 (Hydrology)) in Volume 2 of the EIAR:

- Dunboyne Stream (tributary of River Tolka) ;
- River Pinkeen ;
- River Ward ;
- River Mayne ; and
- River Sluice.

For the most part, these watercourses are underlain by alluvium and till derived from limestone, with moderately permeable geology. It is likely that there is a degree of continuity between the rivers, groundwater within the alluvium, and groundwater within the underlying bedrock aquifers. The proposed cable route will cross the River Ward at a bedrock outcrop, which indicates that there is a strong likelihood that the river is receiving base flow from the bedrock aquifer. Therefore, the watercourses can be classed as groundwater receptors in terms of base flow.

Potential crossing points at non-WFD designated river water bodies have been identified from Ordnance Survey and Aerial Imagery and there are 34 in total (GSI 2024). The location and chainage of these are discussed in Chapter 12 (Hydrology) in Volume 2 of this EIAR. The nature of these water bodies is unknown as they are unnamed, though evident on Ordnance Survey Mapping (GSI 2024). It is likely in some instances that these water bodies are highway drainage ditches and other drainage canals (both urban and rural), and thus, ephemeral and not groundwater supplied.

11.3.3.1.6 Designations

There are no statutory designated sites or pNHAs located within the study area.

11.3.3.1.7 Groundwater Levels

Groundwater level data accessed in November 2024 from three EPA groundwater monitoring stations located near Maynooth, to the south-west of Dunboyne, indicate that groundwater levels within the limestone derived till and Lucan Formation have been between 1m to 3m below ground level in the past year. Table 11.21 provides a summary of this information (EPA 2024).

Table 11.21: Summary of Local Groundwater Level

Monitoring Well	EPA ID	Minimum Groundwater Elevation (mAOD)	Maximum Groundwater Elevation (mAOD)	Average Groundwater Elevation (mAOD)	Minimum Groundwater Level (mBGL)	Maximum Groundwater Level (mBGL)	Average Groundwater Level (mBGL)
RW1 Deep	IE_EA_G_008_1400_0021	57.7	59.0	58.5	3.08	1.78	2.28
RW1 Shallow	IE_EA_G_008_1400_0022	57.9	59.0	58.5	2.92	1.82	2.32
RW1 Transition	IE_EA_G_008_1400_0023	57.7	58.7	58.3	3.22	2.216	2.62
RW2 Deep	IE_EA_G_008_2300_0024	54.3	55.9	55.3	2.98	1.38	1.98
RW2 Shallow	IE_EA_G_008_2300_0025	54.4	55.8	55.3	2.92	1.52	2.02
RW2 Transition	IE_EA_G_008_2300_0026	54.6	55.9	55.4	2.75	1.45	1.95
RW3 Shallow	IE_EA_G_008_2300_0028	46.1	47.0	46.7	0.67	-0.23	0.07
RW3 Transition	IE_EA_G_008_2300_0029	46.1	47.0	46.7	0.97	0.07	0.37
RW3 Subsoil	IE_EA_G_008_2300_0030	43.8	45.6	44.7	3.32	1.52	2.42
Note: mAOD -metres Above Ordnance Datum, mBGL – metres Below Ground Level							

11.3.3.1.8 Groundwater Dependent Terrestrial Ecosystems (GWDTE)

Based on the Map of Irish Wetlands (Wetland Ireland Surveys 2024), artificial ponds associated with golf courses, urban drainage, and quarry / mining have been identified within the study area. These are not considered groundwater supplied, though flooded quarries have a natural groundwater component.

A Fossitt habitat survey was undertaken by Jacobs between January 2023 and August 2023 for the Proposed Development, with a 150m buffer from the proposed cable route, as presented in Chapter 10 (Biodiversity) in Volume 2 of this EIAR. This buffer is sufficient to identify potential GWDTE which could be impacted by the Proposed Development since any impact is expected to be localised.

Following this survey, nine potential GWDTEs were identified; seven as 'GS4' - Wet Grassland, one as 'WN5' - Riparian Woodland, and one as 'GM1' Marsh'. These are listed in Table 11.22 and shown on Figure 11.10 in Volume 4 of this EIAR. (Note, in Chapter 10 (Biodiversity) in Volume 2 of this EIAR, the ecosystems have been discussed as a group where they are in close proximity. For the purposes of this Chapter, they are discussed individually).

Table 11.22: Potential GWDTEs Within the Study Area

Feature	Description	Location and Approximate Chainage	Importance	Superficial Geology
1	Wet grassland	Chainage 2,200 – 2,650 1.6km south of Woodland Substation between Ballymaglassan and Woodcockstown.	Medium	Till derived from Namurian sandstones and shales
2	Wet grassland	Inside buffer zone (not on proposed cable route), parallel to Chainage 2,750-2,850, near Cullendragh.	Medium	Lacustrine Sediments
3	Wet grassland	Chainage 2,750 – 2,850.	Medium	Lacustrine Sediments
4	Wet grassland	Inside buffer zone (not on proposed cable route), east of Chainage 2,900 in Culcommon.	Medium	Till derived from Namurian sandstones and shales / Lacustrine Sediments
5	Wet grassland	Inside buffer zone (not on proposed cable route), south of Chainage 4,100 – 4,200 in Barstown.	Medium	Till derived from Namurian sandstones and shales
6	Wet grassland	Chainage 26,200 – 26,250, between Newpark and Corrstown.	Medium	Bedrock Outcrop
7	Wet grassland	Inside buffer zone (not on proposed cable route), north of Chainage 28,900, in Kingstown.	Medium	Till derived from limestones
8	Riparian Woodland	Inside buffer zone and extending north outside of zone. On proposed cable route at Chainage 12,500, west of Junction 5 of the M3 Motorway.	Medium	Alluvium
9	Marsh	Outside of buffer zone (50m east of the proposed cable route at Chainage 22,700).	Medium	Till derived from limestones

The locations of the potential GWDTEs are for the majority underlain by lacustrine sediment and / or till derived from Namurian sandstones and shales which can be fine grained dark grey clay and silt. The lacustrine sediment and till overlies the Lucan Formation (limestone bedrock). At Feature 6, there are no mapped deposits, but rather a bedrock outcrop of the Rush Conglomerate Formation and Feature 7 is underlain by Till derived from limestone. In the absence of groundwater level information for this area, it is likely that any near surface saturation is derived from shallow groundwater, potentially perched, within the more permeable lenses of the superficial deposits. In the case of Feature 6, desk-based information does not

indicate any superficial deposits being present. However, this has not been verified in-situ. It is therefore unclear whether the wet grassland is fed by ponding surface water or shallow groundwater (or a combination of both).

The proposed cable route will intercept the eastern most edge of Features 1 and 3 and will clip the northern point of Feature 6. Construction activities are expected to occur within a portion of these wet grasslands. The proposed cable route will also intercept the southern part of Feature 8 (riparian woodland).

11.3.3.1.9 WFD Groundwater Bodies

There are four WFD groundwater bodies within the study area. Details of these groundwater bodies are summarised in Table 11.23, their status is presented in Table 11.24, and their locations are displayed in Figure 11.11 in Volume 4 of this EIAR.

Table 11.23: Status of WFD Groundwater Bodies within the Study Area

Unit Name	Description	Location and Approximate Chainage
Swords (IE_EA_G_011)	Poorly productive bedrock	North central portion of the study area extending from St. Margaret's to Swords (Chainage 2,300 – 31,800).
Dublin (IE_EA_G_008)	Poorly productive bedrock	The western portion of study area, south central area, and eastern portion of study area extending beyond Dublin Airport (Chainages 750 – 23,200, and 34,100 – 37,253).
Industrial Facility (P0480-02) (IE_EA_G_086)	Poorly productive bedrock	Majority of Dublin Airport (runway, shops etc.) (Chainage 32,100 – 34,100).
Dunshaughlin (IE_EA_G_031)	Productive fissured bedrock	North-western boundary of the study area, and along the initial Chainage 0-750.

Table 11.24: Status of WFD Groundwater Bodies

WFD Groundwater Body	Overall Status (2016-2021)	Quantitative Status (2016-2021)	Chemical Status (2016-2021)
Swords (IE_EA_G_011)	Good	Good	Good
Dublin (IE_EA_G_008)	Good	Good	Good
Industrial Facility (P0480-02) (IE_EA_G_086)	Poor	Good	Poor
Dunshaughlin (IE_EA_G_031)	Good	Good	Good

The Dublin, Swords, and Dunshaughlin WFD groundwater bodies have good overall status and good quantitative and chemical status (EPA 2024). The Industrial Facility WFD groundwater body (P0480-02) (IE_EA_G_086) has poor overall status, with good quantitative status but poor chemical groundwater status.

11.3.4 Ground Investigation

A ground investigation was undertaken along the proposed cable route. The ground investigation was undertaken by Causeway Geotech Ltd. on behalf of EirGrid, with site works carried out between 10 July 2023 to 29 September 2023.

11.3.4.1 Ground Investigation Scope

In summary the ground investigation comprised the following:

- 71 boreholes:
  - 19 light cable percussion boreholes;
  - 12 boreholes by light cable percussive extended by rotary follow-on drilling;
  - Seven boreholes by rotary drilling; and
  - 33 boreholes by dynamic (windowless) sampling.

- Standpipe groundwater monitoring installations in 15 boreholes; and
- 10 inspection pits (two hand dug pits and eight machine dug pits).

Selected samples were submitted for a suite of geotechnical and chemical testing. The samples selected for chemical testing were variably submitted for the following analysis suite:

- Metals;
- Speciated total petroleum hydrocarbons (TPH);
- Speciated polycyclic aromatic hydrocarbons (PAH);
- BTEX compounds;
- Volatile Organic Compounds (VOCs);
- Polychlorinated biphenyls (PCBs);
- Phenols;
- Organic matter;
- Total Organic Carbon (TOC);
- Cyanides;
- Asbestos screen;
- Sulphate and sulphide;
- Sulphur;
- pH; and
- Waste acceptance criteria (WAC).

The laboratory test certificates from the Causeway Geotech Ltd. ground investigation are attached as Appendix A11.2 in Volume 3 of this EIAR.

11.3.4.2 Encountered Geology

Based on review of the 2023 ground investigation data along the proposed new cable route, the geological strata encountered is summarised in the sections below.

11.3.4.2.1 Topsoil

Topsoil was encountered in 70 exploratory hole locations ranging in thickness from 0.1m to 0.5m.

11.3.4.2.2 Made Ground

Made ground / possible made ground was encountered in isolated locations in 12 of the exploratory holes, ranging in thickness (including topsoil where present above the made ground) from 0.3m to 1m.

The made ground was generally described as consisting of reworked sandy gravelly clay or gravelly sand or silty sandy gravel fill. One exploratory hole location also recorded concrete and brick fragments.

11.3.4.2.3 Superficial Geology

Superficial quaternary deposits were identified in exploratory holes underlying the entire Proposed Development. The superficial quaternary deposits primarily consist of sandy gravelly clay, typically soft to firm in upper horizons, becoming very stiff with increasing depth, frequently with low cobble content and with occasional sand and gravel horizons.

No peat was identified in exploratory holes along the proposed cable route.

Given the above, the superficial deposits identified by the ground investigation are generally in accordance with the published geological information presented previously.

11.3.4.2.4 Bedrock Geology

Bedrock was encountered in 11 boreholes, while possible bedrock was identified in a further 24 exploratory holes. The depth to the bedrock ranged from 1.4m bgl to 11.02m bgl (with possible bedrock encountered at 1.3m at one location (BHB37 at Chainage 23,400).

Given the above, bedrock may be encountered at variable depths along the entire proposed cable route.

The bedrock predominantly comprises strong dark grey limestone interbedded with weak dark grey mudstone and no karstic features were identified. The bedrock encountered is generally in accordance with the published geological information presented in Section 11.3.2.3. However, given the spacing of exploratory hole locations, the presence of karstic features cannot be entirely ruled out.

11.3.4.2.5 Hydrogeology

During drilling / excavation groundwater strikes were recorded in nine locations ranging in depth from 1.3m bgl to 2.8m bgl.

Causeway Geotech Ltd. monitored 13 boreholes between 24 August 2023 and 4 October 2023. The recorded groundwater levels range in depth from 0.05m bgl to 3.95m bgl. Given the positioning of the borehole response zones, the data indicates that groundwater is present within the bedrock, and superficial gravels.

Generally, given the lack of groundwater strikes and their depth, shallow excavations (<1.5m bgl) proposed for the majority of the proposed cable route may not encounter groundwater. However, the data also shows that there may be localised areas of shallower groundwater in which shallower excavations may encounter groundwater.

It should, however, be noted that interpretation of the data presented here is a summary of ground investigation data and also that there are limitations due to the following:

- A limited monitoring dataset means that there may be the potential for seasonal variations in groundwater depths not identified to-date;
- The GI monitoring distribution network means that areas of shallower groundwater conditions may not be recorded;
- Limitations inherent in the exploratory hole construction techniques used means full characterisation of the groundwater regime may not be possible, for example due to:
    - The use of casing in supporting the borehole walls during drilling may seal out groundwater strikes;
    - The use of water to aid drilling may mean groundwater is not always identified, especially the case with water flush, as used in rotary; and
    - The placement of response zones within groundwater monitoring installations may not target all water bearing zones.

11.3.4.3 Chemical Testing Data

In order to provide an assessment of potential risks to human health and water environment receptors from the soils within the study area, an assessment of the soil chemical testing data generated by the ground investigation carried out in 2023 has been undertaken. The assessment was completed by comparison of the chemical testing data against appropriate generic screening criteria, selected in accordance with the Guidance

on the Management of Contaminated Land and Groundwater at EPA Licensed Sites (EPA 2013), as detailed below.

11.3.4.3.1 Human Health Assessment Methodology

Soils chemical testing data from the 2023 ground investigation for relevant substances were directly compared to published Human Health Assessment Criteria (HHAC) derived in accordance with the EPA guidance (EPA 2013), HHAC have been derived for a range of land uses. While no land use directly represents this Proposed Development, it is considered that the Public Open Space (park) land use will facilitate an appropriate assessment of long-term risks to human health receptors (future site users). This also provides an indication (albeit conservative) of the potential risk posed to construction workers. Assessment of human health risks from asbestos within soils was undertaken via screening of all soil samples for the presence of asbestos.

11.3.4.3.2 Human Health Results Assessment

Based on the lack of made ground (indicative of potential contamination) identified by the ground investigation described within the study area above, contamination representing a risk to human health is considered unlikely. This is confirmed by the chemical testing, whereby contaminants indicative of potential anthropogenic contamination (e.g., hydrocarbons, heavy metals, polychlorinated biphenyl compounds) have not been detected or if so at only very low concentrations, below the HHAC. A notable exception to this was the presence of asbestos (chrysotile present in fibre bundles) recorded in a sample taken at 0.5m bgl from made ground at WS42, Chainage 15,750 near Stokestown. It is noted that the presence of asbestos in this sample was at a level below the laboratory detection limit. Nonetheless, the identified presence of asbestos at this location could pose a risk to construction workers (and third-party residents) through inhalation of fibres.

In addition, a sample taken at 1m bgl from BHB56 around Chainage 33,400 near Cloghran, was found to contain an elevated pH level (11.9) for which there is no HHAC available. However, this pH level is most likely related to concrete which was recorded in this borehole and is therefore considered unlikely to pose a risk to human health (construction workers).

11.3.4.3.3 Water Environment Assessment Methodology

The assessment of potential risks from on-site soils to water receptors has been undertaken by comparing the results of the soil leachate testing from the 2023 ground investigation, with Controlled Waters Screening Criteria (CWSC). The results are compared against two criteria selected in accordance with Towards Setting Guideline Values For The Protection Of Groundwater In Ireland (EPA 2003) and Groundwater Threshold Values (GTVs) set out in S.I. No. 366 /2016 - European Union Environmental Objectives (Groundwater) (Amendment) Regulations 2016). The adopted CWSC provides a conservative assessment of the potential risks to water receptors from the site soils.

11.3.4.3.4 Water Environment Results Assessment

A summary of the relevant determinants and samples which exceed either of the CWSC is presented in Table 11.25.

Table 11.25: Summary Results for Substances Exceeding the CWSC

Analyte	Unit	Interim Guideline Values	Groundwater Threshold Values	Number of Results	Number Exceeding Interim Guideline Values	Number Exceeding Groundwater Threshold Values	Maximum Concentra-tion	Location of Max Concentrati-on
Cadmium	µg/l (micrograms per litre)	5	3.75	43	1	1	5.9	0.5m bgl WS75 at approximate Chainage 29,500 near Dublin Airport

As shown on Table 11.25, only a single sample has been identified with a concentration greater than the CWSC for cadmium. Given the following, the sampled soils are not considered to represent a risk to the water environment:

- The inherent conservatism in comparing leachate testing directly with the CWSC, especially given the slight exceedance of the thresholds for cadmium; and
- While the strata from which the sample was taken comprised made ground, no evidence of contamination was recorded. In addition, a further sample retrieved from this location at 1m bgl did not contain a similar slightly elevated level of cadmium.

11.3.4.3.5 Chemical Testing Results Assessment Summary

Assessment of potential risks to human health and the water environment by comparison of the chemical testing with HHAC and CWSC have confirmed that risks from site soils are likely to be low. Isolated exceedance of the HHAC and CWSC were identified in three instances. In two of the three instances (elevated pH in soil from BHB56 at Chainage 33,400 and elevated cadmium in water from WS75 at Chainage 29,500), these results were not considered to represent a viable risk, or warrant specific mitigation. However, the identified presence of asbestos (chrysotile present in fibre bundles) in shallow soils at one location could pose an unacceptable risk to human health (construction workers and third-party residents) through inhalation of fibres, and therefore, mitigation will be implemented as described in Section 11.5.1.

11.4 Potential Impacts

11.4.1 Introduction

Both the Construction and Operational Phases have the potential to affect soils, geology and hydrogeology. These potential impacts are discussed for each attribute within this Section, considering embedded design measures for the Proposed Development design. Any additional mitigation that may be required beyond embedded design measures, including any additional monitoring requirements, are discussed in Section 11.5.

The design details including embedded design measures may be found in Chapter 4 (Proposed Development Description) in Volume 2 of this EIAR. It is noted that vegetation and topsoil stripping will be required to facilitate the construction of the proposed cable trench, TCC / HDD Compound areas and any temporary Passing Bays. Additionally, for off-road sections of the Proposed Development a 30m wide temporary working strip is proposed which will also require vegetation and topsoil stripping.

11.4.2 'Do Nothing' Scenario

In the Do Nothing scenario, the Proposed Development would not be implemented and there would be no resulting impacts on the soils, geology and hydrogeology as a result of the Proposed Development. The impact would therefore be Neutral.

11.4.3 Construction Phase

11.4.3.1 Land Use

At the off-road locations, the land required to install the proposed cable route will be unavailable to the landowner throughout from initial fencing-off to the reinstatement of the land and fence removal. In addition, there will be disruption to land use from trenching for cable installation, temporary storage of excavated materials and change of land use at the TCCs and HDD Compounds. Restoration works will be carried out to restore the land back to pre-construction conditions, excluding permanent Joint Bays and permanent access tracks.

Such temporary and permanent losses of agricultural land are considered in Chapter 15 (Agronomy and Equine) in Volume 2 of this EIAR, while effects on soils are considered in Section 11.4.3.2.

11.4.3.2 Soils

Disruption to underground soils during excavation could impact the soil's physical, chemical and biological characteristics. Soils may be impacted by the following activities during the Construction Phase:

- **Loss of soil cover:** Loss of soil cover from fields affected by construction of the Proposed Development, also leading to loss of agricultural land;
- **Soil sealing:** Covering of the soil surface with an impermeable material or urban development on areas of natural undisturbed land (IEMA 2022). Depending on the degree, soil sealing reduces natural soil functions and ecosystem services within the area concerned. Soil sealing can impact biodiversity and agricultural land;
- **Soil compaction:** Soil compaction can lead to permanent loss / reduction in one or more soil functions. Soil compaction can occur through creation of access tracks outside areas of excavation and construction, plant movements, grading of stockpiles and handling / reinstatement of soils;
- **Soil erosion:** Soil erosion comprises the displacement of the upper horizon of the soil which can lead to soil mass loss, loss of soil structure, changes in chemistry and mobilisation of sediment; and
- **Degradation in chemical or organic quality:** All the above processes can result in degradation in soil quality especially from stripping, storage and reinstatement of soils during construction.

Approximately 26km of the proposed cable route will be constructed in the public road, and approximately 11.5km in private land. As the majority (70%) of the proposed cable trench will be constructed in the public road, this will limit the extent of adjacent agricultural land affected by trenching. Notable exceptions will include off-road sections such as in the areas of Batterstown, Gallanstown, Kingstown and east of the M1 Motorway. Given that the effects on the soils will be highly localised, a small adverse magnitude of impact has been assigned. Given the low to medium baseline sensitivity of the soils, the significance of impact is assessed as Slight.

11.4.3.3 Geomorphology

Geomorphological features such as mega-glacial lineations, glaciofluvial terraces and a composite thrust block moraine, have been identified in the study area. Construction work will result in a permanent loss of part of these features where it will intersect with surface works. As such, the magnitude of impacts can be considered to be small adverse. This feature does not have any designation and is considered to have a low sensitivity. The significance of impact is assessed Imperceptible.

11.4.3.4 Superficial Geology

The superficial geological deposits within the study area comprise till from Namurian sandstones, till from limestone, gravels from limestones, pockets of alluvial sediments and lacustrine sediments. These superficial deposits have been assigned a low sensitivity. Due to the shallow depth of the trenching (up to 1.8m), large scale disturbance and excavation of superficial deposits is not planned. A small adverse magnitude of impact is likely, and in considering the low sensitivity of the attribute, the significance of impact is assessed as Imperceptible.

11.4.3.5 Bedrock Geology

The majority of the study area is underlain by limestone. No karstic features have been identified along the proposed cable route. However, the limestone units have the potential to contain karst features. Data regarding the ground conditions across the proposed cable route are limited, but bedrock or suspected bedrock was encountered at depths of between 1.4m bgl to 11.02m bgl, and therefore, there is the potential to encounter bedrock during construction. The excavation of any bedrock may lead to potential instabilities that may be significant, especially if karstic features are encountered. However, significant excavation of bedrock is unlikely to be required given the shallow workings.

Nowhere within the study area has been identified as being susceptible to landslides, and therefore, impacts associated with landslides and slope stability are not anticipated. Furthermore, no large-scale dewatering is proposed, and therefore, the risks of subsidence are negligible, and if they were to occur would be localised to the proposed cable route.

The bedrock geology within the study area does not have a heritage value and is not considered to have future economic value. Excavation of bedrock is unlikely to be required given the shallow workings. Based on the low sensitivity, and the small adverse magnitude of impact, the significance of impact is assessed as Imperceptible.

11.4.3.6 Current and Historic Mining Sites

Effects on mineral resources may occur where mineral reserves or resources are wholly or partly sterilised. This can be permanent or temporary, or where access to the resource is impaired. Mineral extraction identified within the study area is historic, with former historic sites (such as gravel pits) already sealed. The majority of the site is agricultural, with only small areas of urban and residential development, so mineral extraction in the future may be possible, subject to economic, planning and environmental constraints.

No current mining sites have been identified within the study area and have therefore not been assessed. The various historical mining / extraction sites may have been infilled or have some form of industrial residue and are considered under the assessment of land contamination.

Future extraction of aggregate materials has been considered based on the GSI aggregate (granular and crushed rock) potential maps. As summarised in Table 11.16 and Table 11.17, the granular and crushed rock aggregate potential varies across the Proposed Development and has been assessed as varying from Low to Medium sensitivity depending on local geology. The proposed cable route will be constructed mainly (70%)

along the public road and will take up a relatively small area of the exploitable deposits. Based on the low to medium sensitivity and the small adverse magnitude of impact, the significance of impact is assessed as Slight.

11.4.3.7 Radon and Ground Gas

Construction will involve excavation for Joint Bays, the installation of services such as road drainage, temporary construction access roads and trenching for electrical cabling. Construction activities will therefore create voids within which ground gases and radon could accumulate and present a human health risk, as well as potentially creating pathways for gas to migrate to new receptors. Hazards associated with ground gases and vapours include:

- Explosion / flammability (methane, hydrogen sulphide, VOCs / SVOCs);
- Asphyxiation (methane, carbon dioxide, carbon monoxide);
- Toxicity (carbon monoxide, hydrogen sulphide, VOCs / SVOCs); and
- Long term cancer risk (radon).

The Proposed Development will be located mainly within medium or high radon risk areas. Radon has the potential to result in chronic risks to human health and using the land contamination assessment methodology (UK EA 2023), has the potential to result in a Medium potential severity of impact classification. However, it will be noted that such classification is based on assessment of surface buildings over the long term rather than a detailed classification of specific geological units and assessment of short-term risks to construction workers. During construction, excavations will be formed. However, occupation of these will be temporary. As such the likelihood of a risk being realised is generally considered to be of low likelihood or unlikely. The potential risks from radon during construction are summarised in Table 11.26.

Table 11.26: Summary of Potential Impacts from Radon During Construction

Radon Potential	Location (Approximate Chainage)	Severity	Likelihood	Risk
Medium	Chainages 0 to 4,650, 11,600, 15,400 to 15,800, 21,100 to 21,850, 23,850 to 24,000, 25,350 to 25,600, 29,150 to 29,700, 30,350 to 31,050 and 33,150 to 33,600	Medium	Unlikely	Low
High	Chainages 26,250 to 36,400, 29,300 to 29,400 and 30,900 to 31,000	High	Unlikely	Moderate/Low

In Table 11.26, although severity and likelihood are the same for the two entries (based on the criteria within Table 11.9), the moderate / low classification for the second entry takes into account the greater radon potential in 'High' areas.

The Construction Phase activities have the potential to result in ground gases accumulating in voids or other enclosed spaces.

11.4.3.8 Contaminated Land

Construction activities have the potential to result in both adverse (e.g., exposure of construction workers to contaminants in the sub-surface) and beneficial (e.g., removal of contaminated material from site) effects on baseline land contamination conditions.

Given the largely rural setting of the Proposed Development and the results of the sampling / analysis and risk assessments presented in Section 11.3.4.3, contaminated soils are not anticipated to be encountered along the majority of the study area (see List of Sources and Screening Assessment in Table 2 in Appendix A11.1 in Volume 3 of this EIAR). However, asbestos was identified in made ground at one location which could pose a risk to human health through inhalation of fibres. Thirty-two potential sources of contamination were identified in the vicinity of the Proposed Development, although only six were on or immediately

adjacent to the proposed cable route. In addition, within urban areas along the proposed cable route, there is the potential for soil contamination to be present. As such, given the spacing of exploratory hole locations and inherent uncertainty associated with environmental sampling of heterogeneous subsurface materials, there remains the potential for encountering unidentified / unforeseen contamination during construction.

As mandated by current best practice (EPA 2013; EA 2021), a preliminary CSM was developed for the Proposed Development to define the relationships between the potential contamination sources, receptors which could be affected by contamination and the exposure pathways (see Table 1 in Appendix A11.1 in Volume 3 of this EIAR).

The preliminary CSM has been updated based on baseline conditions and qualitative assessment of potential risks for the Construction Phase, as summarised in Table 11.27. The likelihood of risk being realised is not uniform across the alignment. The updated CSM is presented on the basis of a precautionary approach, whereby each potential pollutant linkage is classified on the basis of the highest risk across the entire alignment (see updated CSM Table 3 in Appendix A11.1 of Volume 3 of this EIAR).

Table 11.27: Summary of Construction Phase Impacts from Land Contamination

Source	Receptor	Pathway	Pollutant Linkage (PL)	Severity	Likelihood	Risk
Contaminants within soil and groundwater	Human health (construction workers)	Dermal contact, ingestion and inhalation of impacted soil, dust, fibres (asbestos) and waters.	PL1	Medium	Likely	Moderate
		Migration of ground gases and vapours to shallow pits or enclosed spaces.	PL2	Medium	Low Likelihood	Moderate/ Low
	Human health (adjacent residents / workers, transient foot traffic)	Dermal contact, ingestion and inhalation of windblown soil, dust, fibres (asbestos) during construction.	PL3	Medium	Low Likelihood	Moderate/ Low
		Migration of ground gases into homes or workplaces via preferential pathways during construction.	PL4	Medium	Low Likelihood	Moderate/ Low
	Property	Direct contact with sub-surface materials including made ground.	PL13	Mild	Likely	Moderate/ Low
		Migration of ground gases into property through preferential pathways posing a potential explosion risk from ignition of explosive gases.	PL14	Mild	Unlikely	Negligible

11.4.3.9 Summary of Potential Impacts on Soil and Geological Receptors During Construction

The potential Construction Phase impacts are summarised in Table 11.28.

Table 11.28: Summary of Potential Impacts on Soils and Geological Receptors During Construction

Receptor	Importance	Magnitude of Impact	Significance of Impact
Soils			
Soils (including agricultural)	Medium	Small Adverse	Moderate / Slight
Geomorphology			
Geomorphology	Low	Small Adverse	Imperceptible
Superficial Geology			
Till derived from Namurian sandstones and shales	Low	Small Adverse	Imperceptible
Gravels derived from limestones			
Alluvium			
Till derived from limestones			
Lacustrine Sediments			
Bedrock Geology			
Waulsortian Limestone	Low	Small Adverse	Imperceptible
Lucan Formation			
Rush Conglomerate			
Boston Hill Formation			
Current and Historic Mining Sites			
Granular aggregate potential	Low	Small Adverse	Imperceptible
Crushed rock aggregate potential	Low	Small Adverse	Imperceptible
Contaminated Land and Ground Gas			
Refer to Section11.4.3.7 and Section 11.4.3.8			

11.4.3.10 Hydrogeology

11.4.3.10.1 Proposed Cable Route

Vegetation and topsoil stripping is required for the proposed cable trench, temporary Passing Bays, TCCs and HDD Compounds. For the off-road sections temporary working strips (including construction access tracks) will also require vegetation removal and topsoil stripping.

Changes to groundwater quality from the removal of vegetation and disturbance of ground have the potential to lead to increased suspended solid concentrations in the groundwater. In addition to this, the open trench required for the proposed cable route have the potential to create new pathways from the surface into shallow aquifer units impacting groundwater quality. These direct impacts to groundwater have the potential to lead to secondary impacts and affect the quality of groundwater discharging to surface waters. However, due to the filtering effect of the unsaturated zone and aquifer material, suspended solids would not migrate to any substantial extent in poorly productive bedrock and would attenuate relatively quickly in the locally important aquifers and potential impacts would be negligible at an aquifer scale. The significance of impact is assessed as Imperceptible.

For aquifers with fracture flow, and particularly for flow in aquifers with karstic features, suspended solids can move considerable distances and rapidly. However, no aquifer units within the study area have been described as karstified. Also, the proposed cable route will avoid most areas of high, extreme, and rock near surface or karst groundwater vulnerable areas (see Section 11.3.3.1.4). As a result, potential magnitude of impacts on groundwater quality are expected to be negligible to small adverse at the scale of the aquifer.

Aquifers underlying the study area are of low to medium importance, and therefore, the significance of impact is assessed as Imperceptible.

Contamination may also be introduced to groundwater through leaks and spillages, or from structures associated with the Proposed Development acting as a preferential pathway for contaminant transport. This would result in potential moderate adverse impact on superficial deposits and a small adverse magnitude of impact on bedrock aquifers. Taking into account the potential of superficial deposits to attenuate contamination, this would result in a significance of impact of Slight to Imperceptible, depending on sensitivities across all aquifer units.

Due to the shallow depths of the trenching (up to 1.8m) across the proposed cable route, work is generally not expected to occur below the water table. However, there is the potential for localised dewatering if groundwater levels are shallow at any point along the proposed cable route in superficial deposits. This would result in a negligible magnitude of impact at the scale of the superficial deposit aquifer. Therefore, the significance of impact is assessed as Imperceptible.

No impact would be expected on bedrock groundwater flows as the proposed cable route will not be constructed into the bedrock and so will not cause an obstruction to flow.

The proposed cable route will intercept the Inner Protection Area of Dunboyne Public Water Supply between Chainage 10,950 and 12,100. The foremost threat to the Dunboyne Public Water Supply is microbiological contamination from farming, septic tanks, and the water quality in the River Tolka upstream of the supply. The excavation of the till derived limestone along the cable route could mobilise pollutants (any legacy rural contamination, hydrocarbons from the tarmac / road, and fuels / oil spills from machinery on-site) and lead to the release of contaminated waters to the nearby upstream tributaries of the Tolka. The pathway to the bedrock aquifer would also be reduced due to the excavation increasing aquifer vulnerability. This has the potential to lead to a small adverse magnitude of impact locally to the underlying aquifer, and thus, adverse impacts to the water quality in the Dunboyne source. This is an extremely high importance receptor, and given a small adverse magnitude of impact, the significance of impact is assessed as Significant.

Based on the GSI wells and springs dataset, the proposed cable route will overlap the 1km buffer zone of two dug wells which are used for domestic supply. At present, the proposed cable route does not appear to intercept any springs or domestic wells. The majority of the proposed cable route (70%) will follow the existing roads (see Chapter 4 (Proposed Development Description) in Volume 2 of this EIAR for details) and so the risk of intercepting any groundwater wells and springs is very low. This would result in a negligible magnitude of impact and the significance of impact is assessed as Imperceptible.

The potential for unknown private supplies has been assessed to be medium. This is because of the historical development in the area (See Chapter 13 (Archaeology, Architectural Heritage, and Cultural Heritage) in Volume 2 of this EIAR for further details), the absence of group water supplies / public water supplies in the majority of the study area, the agricultural nature of land, and the hydrogeological conditions that are generally suitable for productive wells, springs, and boreholes. The review of the GSI database, public consultations, and landowner meetings have reduced the possibility of finding additional private supplies but the possibility of additional supplies is included for in this assessment (see Section 11.4 and Section 11.6 of this Chapter) (GSI 2024). Mitigation measures are identified in Section 11.5.

The proposed cable route will intercept portions of four identified potential GWDTEs between Chainage 2,200 and 2,650 (Feature 1, Wet Grassland), between Chainage 2,750 and 2,850 (feature 3, wet grassland), between Chainage 26,200 and 26,250 (feature 6, wet grassland), and around Chainage 12,500 (Feature 8, Riparian Woodland). All other potential GWDTEs identified in Section 11.3.3.1.8 are outside of the proposed cable route and either within the buffer zone or adjacent to the proposed cable route. There is a risk of intercepting shallow and / or perched groundwater when the 1.5m deep trenches are excavated. There is the potential for small scale, localised dewatering. There is also the potential for a localised impact on the

groundwater quality supporting these potential GWDTEs. Given the medium importance of these potential GWDTEs, with no conservation designation and a moderate adverse magnitude of impact (on both flow and quality), this is assessed as a potential Moderate impact on flow and quality in the short-term on these GWDTEs (Features 1, 3, 6 and 8, as outlined in Table 11.22).

11.4.3.10.2 Temporary Construction Compounds

The seven proposed TCCs (i.e., TCC0 to TCC6) will be located on locally important aquifers (moderately productive in local zones). The TCCs, along with topsoil stripping for construction access tracks and temporary Passing Bays have the potential to lead to a compaction effect on underlying shallow aquifer units and impact shallow groundwater levels, flows and quality locally. This has the potential to lead to small adverse impacts locally to the underlying aquifers. However, at an aquifer scale, the magnitude of impacts is assessed as negligible given the size of the aquifer compared to the working footprint. Therefore, the significance of impact is assessed as Imperceptible.

Contamination may also be introduced to groundwater through leaks and spillages, or from structures associated with the Proposed Development acting as a preferential pathway for contaminant transport. This has the potential to result in a moderate adverse magnitude of impact on superficial deposits and a small adverse magnitude of impact on bedrock aquifers, taking into account the potential of superficial deposits to attenuate contamination. This significance of impact is assessed as Slight to Imperceptible, depending on sensitivities.

No impact is expected on potential GWDTEs and identified groundwater abstractions as a result of TCCs.

The impact on private water supplies as a result of the TCCs is covered under the proposed cable route assessment due to the uncertainty in the location and number of private water supplies in the study area.

11.4.3.10.3 Horizontal Directional Drilling Compounds

HDD Compounds will be required at three locations; crossing the M3 Motorway at Junction 5, crossing the M2 Motorway at the R121 Regional Road and crossing the M1 Motorway at Junction 2.

The HDD Compounds at M3 Motorway crossing (HDD 1a and HDD 1b) and at the M2 Motorway crossing (HDD 2a and HDD 2b) will be located on locally important aquifers (moderately productive in local zones). The HDD Compounds at the M1 Motorway crossing (HDD 3a and HDD 3b) will be located on a poorly productive aquifer (Tober Colleen Formation). As for the TCCs, there is the potential for contamination to reach this aquifer. This has the potential to result in small adverse magnitudes of impacts locally to the underlying aquifers. However, at an aquifer scale, impact magnitudes are likely to be negligible given the size of the aquifer compared to the working footprint. Therefore, the significance of impact of the HDD Compounds is assessed as Imperceptible.

The HDD Compounds at M3 Motorway crossing (HDD 1a and HDD 1b) will be between approximately 550m to 700m to the north-east of the Inner Protection Area of Dunboyne Water Supply. This is also upstream of the supply and adjacent to the River Tolka. HDD activities have the potential to create a direct contaminant pathway to the aquifer and the River Tolka which both support the water supply. Drilling is proposed to take place within the superficial deposits (alluvium and till) which have moderate interstitial permeability and do not confine the bedrock aquifer. During drilling, drilling fluids will inevitably be lost to ground. HDD activities will be temporary and are unlikely to require excessive use of drilling fluids and water flushing, so is unlikely to affect the bedrock aquifer, any effects will be within the alluvium and till. The appointed contractor will be required to use biodegradable drilling fluids as part of the HDD which will reduce this risk. This has the potential to lead to small adverse magnitude impacts locally to the underlying aquifer, and thus, adverse effects to the water quality in the Dunboyne source. This is an extremely high importance receptor, and given a small adverse magnitude of impact, the significance of impact is assessed as Significant.

No substantial dewatering is expected to result from HDD activities except potentially at launch and reception sites, which may require excavation to depths equivalent to a trench. However, dewatering effects in such cases would be expected to be negligible at the scale of the aquifer. The significance of impact of HDD activities on the bedrock aquifers is therefore assessed as Imperceptible.

It is not expected that HDD activities will occur in proximity to or on groundwater wells or springs as determined from GSI mapping (GSI 2024). Due to the lack of precision in this data set, it cannot be categorically ruled out that a spring / well will not be present along the proposed cable route. The impact on private water supplies as a result of the HDD Compounds is covered under the proposed cable route assessment due to the uncertainty in the location and number of private water supplies in the study area.

HDD activities will not cross the potential GWDTE so there will be no impact to this receptor as a result of these activities.

11.4.3.10.4 Dewatering

In the locale of Clonshagh (Chainage 36,450 to 36,650), an excavation is proposed to a depth of 3 to 4m below ground level. Desk based information indicates that groundwater levels within the superficial deposits (limestone derived till) are on average 2mBGL. Therefore, dewatering may be required for this excavation to be safely constructed.

A high-level assessment of dewatering at this location has been performed with the expectation that at least 2m of groundwater drawdown will be necessary.

The radius of influence was calculated using the empirical formula of Sichardt (CIRIA 2016). Where groundwater is intercepted, a minimum radius of influence of 30m has been set (Cashman and Preene 2021).

In the absence of ground investigation information, hydraulic conductivities from literature have been used for this formula. This area is underlain by Limestone Derived Till. The hydraulic conductivity for Glacial Till can range from 10^{-4} to 10^{-12} metres per second (m/s). As the baseline geology has a noted limestone component (and not an amalgamation of clay, sand, silt, and gravel), the conductivity value used in this instance was 10^{-6}m/s which is the lower end of conductivities for limestone and dolomite but also within the range for Glacial Till (Freeze and Cherry 1979).

The radius of influence was calculated to be 12m. A 30m search was performed about this excavation to identify sensitive receptors to the dewatering:

- The excavation is within the Dublin WFD groundwater body and the Lucan Formation, classified as a locally important aquifer which is moderately protective only in local zones. The potential impact on groundwater flows at the scale of the aquifer is assessed as an Imperceptible significance of impact;
- There are no surface water features within 30m of the excavation;
- There are no known abstractions, springs, or wells within 30m of the excavation. (Note: this information is based on GSI data which is accurate to between 10m and 1km); and
- There are no statutory or designated sites within 30m of the excavation.

Where the proposed cable route will cross smaller watercourses (i.e., the tributaries of the River Pinkeen, Tolka, and Ward), open cut trenching is proposed which will require the installation of a temporary impermeable barrier to keep the working area dry. Trenching in this area is not expected to be more than 1.3m below the watercourse bed. However, if the watercourse is groundwater fed then some localised dewatering may be required in the working area to keep it dry. This has the potential to change local groundwater flows and levels in the underlying aquifers, and interrupt baseflow contributions to the

watercourse resulting in a temporary, small adverse magnitude of impact at a local scale. However, at an aquifer scale any changes would be negligible. This is assessed as an Imperceptible significance of impact.

The water pumped out of the working area will be treated using settlement tanks prior to discharge back to the watercourse. However, there is potential that the water would need to be discharged to ground, for it to naturally drain back into the watercourse. This could lead to small impacts locally on groundwater quality. In addition, discharges to ground could occur from groundwater dewatering activities, either where the trench is shallow and requires dewatering prior to the installation of the proposed cables (likely areas of shallow groundwater conditions) or where dewatering is potentially required at trenchless crossings . This has the potential to lead to small impacts locally on groundwater quality. Given the low / moderate importance of the bedrock aquifers, the significance of impact as a result of impacted groundwater quality is assessed as Imperceptible to Slight.

At the time of writing, it is not expected that dewatering activities will occur in proximity to or on groundwater wells or springs as determined from GSI mapping (GSI 2024). Due to the lack of precision in this data set, it cannot be categorically ruled out that a spring / well will not be present along the proposed cable route. The impact on private water supplies as a result of the TCCs is covered under the proposed cable route assessment due to the uncertainty in the location and number of private water supplies in the study area.

None of the potential GWDTE are in the location of dewatering activities so there will be no impact to this receptor as a result of these activities.

As discussed in Section 11.3.2.10, no major contamination has been identified within the study area.

11.4.3.10.5 Summary of Potential Impacts to Groundwater Receptors During Construction

Taking into consideration the construction activities, pathways, and receptors identified, the potential significance of the impact to each receptor has been summarised in Table 11.29. These do not consider the proposed mitigation measures or the implementation of a Construction Environmental Management Plan (CEMP) which is included as a standalone document in this planning application pack.

For the majority of receptors, no measurable impact is assessed, or where there is noticeable change, there are no significant consequences. However, should there be an impact to the water quality supplying the Uisce Éireann public supply wells, the significance of impact will be Significant. The potential GWDTEs may undergo alteration in its environment as a result of the construction activities. However, this will be short-term and reversible.

Table 11.29: Summary of Potential Impacts to Groundwater Receptors During Construction

Receptor	Parameter	Importance	Magnitude of Impact	Significance of Impact
Uisce Éireann Public Supply Wells	Groundwater Flow	Extremely High	Negligible	Imperceptible
	Groundwater Quality	Extremely High	Small Adverse	Significant
Private Water Supplies from GSI dataset	Groundwater Flow	Medium	Negligible	Imperceptible
	Groundwater Quality	Medium	Negligible	Imperceptible
Unknown Private Water Supplies	Groundwater Flow	Medium	Large Adverse	Significant
	Groundwater Quality	Medium	Large Adverse	Significant
Potential GWDTEs	Groundwater Flow	Medium	Moderate Adverse	Moderate

Receptor	Parameter	Importance	Magnitude of Impact	Significance of Impact
	Groundwater Quality	Medium	Moderate Adverse	Moderate
Tober Colleen Formation	Groundwater Flow	Low	Small Adverse	Imperceptible
	Groundwater Quality	Low	Small Adverse	Imperceptible
Malahide Formation	Groundwater Flow	Medium	Small Adverse	Slight
	Groundwater Quality	Medium	Small Adverse	Slight
Waulsortian Limestone	Groundwater Flow	Medium	Small Adverse	Slight
	Groundwater Quality	Medium	Small Adverse	Slight
Lucan Formation	Groundwater Flow	Medium	Small Adverse	Slight
	Groundwater Quality	Medium	Small Adverse	Slight
Rush Conglomerate	Groundwater Flow	Medium	Small Adverse	Slight
	Groundwater Quality	Medium	Small Adverse	Slight
Boston Hill Formation	Groundwater Flow	Medium	Small Adverse	Slight
	Groundwater Quality	Medium	Small Adverse	Slight
Till derived from Namurian sandstones and shales	Groundwater Flow	Low	Small Adverse	Imperceptible
	Groundwater Quality	Low	Moderate Adverse	Slight
Gravels derived from limestones	Groundwater Flow	Low	Small Adverse	Imperceptible
	Groundwater Quality	Low	Moderate Adverse	Slight
Alluvium	Groundwater Flow	Low	Small Adverse	Imperceptible
	Groundwater Quality	Low	Moderate Adverse	Slight
Till derived from limestone	Groundwater Flow	Low	Small Adverse	Imperceptible
	Groundwater Quality	Low	Moderate Adverse	Slight
Lacustrine Sediments	Groundwater Flow	Low	Small Adverse	Imperceptible
	Groundwater Quality	Low	Moderate Adverse	Slight

11.4.3.10.6 WFD Groundwater Screening Assessment

The groundwater WFD assessment is summarised in Table 11.30. Only elements scoped in (as detailed in Section 11.3.3.1.9) have been assessed.

In general, the scale of the Proposed Development relative to the size of the groundwater bodies as a whole is very small, as can be seen in Figure 11.11 in Volume 4 of this EIAR. Therefore, no significant impacts are anticipated to the WFD groundwater bodies, in terms of water quality and flow. This is evidenced also by the Imperceptible / Slight significance of impact assessed for the aquifers (see Table 11.30) which the groundwater bodies flow through. As a result, the Proposed Development will not cause deterioration of the WFD status of any groundwater body either quantitatively or qualitatively or jeopardise the ability of such groundwater bodies to achieve such status.

Table 11.30: Impact Assessment for WFD Groundwater Bodies

Proposed Activity	WFD Groundwater Body	Water Balance (Quantitative)	GWDTE Test (Quantitative)	Impact of Groundwater on Surface Water Ecological / Quantitative Status Test	Drinking Water Protected Area (Chemical)	General Chemical Test	GWDTE Test (Chemical)	Impact of Groundwater on Surface Water Ecological / Chemical Status Test
Cable route trenching and HDD	Swords (IE_EA_G_011)	Trenching is expected to be to depth <1.8m. Therefore, minor dewatering may be required for the proposed cable route where groundwater is shallow. However, any changes would be short-lived and negligible on a groundwater body scale. Therefore, there is no potential for significant change to water balance.	Two potential GWDTEs were identified within this groundwater body. However, these are not part of designated / protected sites. Therefore, these do not hold a WFD status.	The proposed cable route will cross tributaries of the River Ward at multiple locations. The River Ward (Ward_003) is within the Swords groundwater body. Minor dewatering may be required for the proposed cable route where groundwater is low. Any dewatering has the potential to indirectly lower water levels the underlying aquifer if the watercourse is in hydraulic continuity with the aquifer, and vice versa. However, this impact is likely to be localised and minimal and insignificant at the scale of the groundwater body and surface water receptor. Therefore, no impact is expected.	Based on information available, no private active abstractions have been identified within this groundwater body. Due to the uncertainty and incompleteness of the data it is unknown if any other active abstractions lie within the footprint of the proposed cable route within this groundwater body.	There are potential risks of mobilising suspended solids and spillage incidents to generate contamination that could infiltrate into groundwater. Mitigation measures are required (refer to Section 11.5) to protect the aquifers.	Two potential GWDTEs were identified within this groundwater body. However, these are not part of designated / protected sites. Therefore, these do not hold a WFD status.	Small / minor changes to groundwater quality anticipated. Therefore, at a groundwater body scale there would be limited to no change in quality status.
	Dublin (IE_EA_G_008)		Seven potential GWDTEs were identified within this groundwater body. However, these are not part of designated / protected sites. Therefore, these do not hold a WFD status.	The proposed cable route will cross the Dunboyne Stream, a tributary of the River Tolka, and River Pinkeen (watercourses within the Dublin groundwater body). Any dewatering could indirectly lower water levels in underlying aquifer if the watercourses are in hydraulic continuity with the aquifer, and vice versa. However, this impact is likely to be localised and minimal and insignificant at the scale of the groundwater body and surface water receptor. Therefore, no impact is expected on WFD status.	The proposed cable route will cross an Inner Source Protection Zone associated with Uisce Éireann abstractions (Dunboyne PWS). Potential impact on this extremely high important receptor cannot be ruled out and additional mitigation measures are required (refer to Section 11.5). Based on available Information on private groundwater abstractions / springs at this stage, two abstractions have been identified. Due to the uncertainty and incompleteness of the data, it is unknown if any other active abstractions lie within the footprint of the proposed cable route or in the wider study area.		Seven potential GWDTEs was identified within this groundwater body. Two of these are on the cable route. However these are not part of designated / protected sites. Therefore, these do not hold a WFD status.	
	Industrial Facilities (PO480-02) (IE_EA_G_086)		No potential GWDTEs were identified within these groundwater bodies. Therefore, no change to quantitative status is anticipated.	The Sluice_010 watercourse is located on the boundary of this groundwater body and is approximately 125m north of the proposed cable route at its closest point. However, any dewatering is not expected to cause a drawdown beyond 30m. Therefore, no changes to the quantitative status are anticipated.	Based on available Information on private groundwater abstractions / springs at this stage, no active abstractions have been identified within this groundwater body. Due to the uncertainty and incompleteness of the data it is unknown if any other active abstractions lie within the footprint of the proposed cable route within this groundwater body.		No potential GWDTEs were identified within this groundwater body. Therefore, no change to qualitative status is anticipated.	
	Dunshaughlin (IE_EA_G_031)			The Tolka_020 watercourse is within this groundwater body but is not within close proximity to the proposed cable route. Minor dewatering may be required for the proposed cable route where groundwater is shallow. Any dewatering has the potential to indirectly lower water levels in underlying aquifer if the Tolka_020 is in hydraulic continuity with the aquifer, and vice versa. However, this impact is likely to be localised and minimal and insignificant at the scale of the groundwater body and surface water receptor. Therefore, no impact is expected on WFD status.	Of the 60 GSI wells / springs, only two hand dug wells have been identified along the proposed cable route with an accuracy of 1km within this groundwater body. It is not known whether these are a drinking water supply or even active. Due to the uncertainty and incompleteness of the data it is unknown if any other active abstractions lie within the footprint of the proposed cable route or in the wider study area.			

Proposed Activity	WFD Groundwater Body	Water Balance (Quantitative)	GWDTE Test (Quantitative)	Impact of Groundwater on Surface Water Ecological / Quantitative Status Test	Drinking Water Protected Area (Chemical)	General Chemical Test	GWDTE Test (Chemical)	Impact of Groundwater on Surface Water Ecological / Chemical Status Test
TCC and HDD Compound Areas	Swords (IE_EA_G_011)	No significant excavations or dewatering is expected to be required for the TCCs / HDD Compounds and access routes. Therefore, there is limited to no potential for significant change to water balance.	No potential GWDTEs were identified within close proximity of the proposed works. Therefore, no change to quantitative status is anticipated.	No significant excavations or dewatering is expected to be required for the TCCs / HDD Compounds. Therefore, no impacts to baseflow to surface waters are anticipated.	Based on available Information on private groundwater abstractions / springs at this stage, no active abstractions have been identified within this groundwater body. Due to the uncertainty and incompleteness of the data, it is unknown if any other active abstractions could be present. Impacts on drinking water protected areas from this activity are unlikely to cause deterioration in water quality such that additional treatment will be required.	There are potential risks of mobilising suspended solids and spillage incidents to generate contamination that could infiltrate into groundwater. Mitigation measures are required (refer to Section 11.5) to protect the aquifers.	Two potential GWDTEs were identified within this groundwater body. However, they are not in the vicinity of the proposed TCC / HDD Compound areas, and therefore, no change to qualitative status is expected.	Small / minor changes to groundwater quality expected. Therefore, at a groundwater body scale, there would be limited to no change in quality status.
	Dublin (IE_EA_G_008)				Based on available Information on private groundwater abstractions / springs at this stage, no abstractions have been identified within this groundwater body along the route. Due to the uncertainty and incompleteness of the data, it is unknown if any other active abstractions could be present. Impacts on drinking water protected areas from this activity are unlikely to cause deterioration in water quality such that additional treatment will be required.		Seven potential GWDTEs were identified within this groundwater body. However, they are not in the vicinity of the proposed TCC / HDD Compound areas, and therefore, no impact is expected.	
	Industrial Facilities (PO480-02) (IE_EA_G_086) Dunshaughlin (IE_EA_G_031)				Of the 60 GSI wells / springs, only two hand dug wells have been identified along the proposed cable route with an accuracy of 1km within this groundwater body. It is not known whether these are a drinking water supply or even active. Due to the uncertainty and incompleteness of the data, it is unknown if any other active abstractions could be present. Impacts on drinking water protected areas from this activity are unlikely to cause deterioration in water quality such that additional treatment will be required.		No potential GWDTE were identified within this groundwater body. Therefore, no change to qualitative status is expected.	

11.4.4 Operational Phase

11.4.4.1 Land Use

All areas where vegetation removal and topsoil stripping has occurred along the proposed cable trench and for TCCs, HDD Compounds, temporary access tracks and Passing Bays will be reinstated following installation of the proposed cables. As part of the off-road sections there will be small areas of land lost for agricultural use associated with permanent access tracks for off-road Joint Bays. These permanent tracks will be located mainly on agricultural land used for pasture, which covers the majority of the study area.

During the Operational Phase the proposed cables will require routine maintenance activities along its route, requiring permanent access tracks to off-road Joint Bays. The permanent access tracks will be used to reach off-road sections of the proposed cables for maintenance access. The off-road sections will be situated within agricultural land. The assessment of agricultural land use is covered in Chapter 15 (Agronomy and Equine) in Volume 2 of this EIAR.

11.4.4.2 Soils

Activities will be limited to maintenance during the Operational Phase with no further disturbance of the ground, resulting in little or no long-term loss or degradation of remaining undisturbed soil or subsoil. The magnitude of impact is considered to be negligible and the overall significance of impact is assessed as Imperceptible.

11.4.4.3 Geomorphology

No further disruption of the ground will be required during the Operational Phase, resulting in a negligible magnitude of impact for geomorphological features within the study area. This, in turn, is assessed as an Imperceptible significance of impact on geomorphology, taking into account the low significance / sensitivity of these features.

11.4.4.4 Superficial Geology

Superficial geology will not be affected by the Proposed Development during the Operational Phase, as no further ground works will be undertaken. The magnitude of impact is considered to be negligible and the overall significance of impact is assessed as Imperceptible.

11.4.4.5 Bedrock Geology

No further disturbance or excavation of bedrock geology will occur during the Operational Phase, and therefore, no measurable alterations of bedrock conditions are expected. The magnitude of impact is assessed as negligible and the overall significance of impact is assessed as Imperceptible.

11.4.4.6 Current and Historic Mining Sites

Current mining sites are not present within the study area. No further disturbance of the ground will occur during the Operational Phase and the impact on historic mining sites is therefore assessed as negligible and the overall significance of impact is assessed as Imperceptible.

No further sterilisation of aggregate potential (both granular and crushed rock) will occur during the Operational Phase. Therefore, no further impact is assessed. The magnitude of impact is considered to be negligible and the overall significance of impact is assessed as Imperceptible.

11.4.4.7 Radon and Ground Gas

During the Operational Phase, the majority of the Proposed Development will consist of a sub-surface cable with few enclosed spaces within which radon or ground gases can accumulate. The only enclosed spaces present will comprise limited service runs within Belcamp Substation. Where these are present near to ground gas and radon sources there is the potential for gas build up. A potential risk is therefore present where maintenance workers will be required to access such places. Based on the low likelihood of such risk occurring across the whole Proposed Development, the risk to maintenance workers is considered to be Moderate / Low.

11.4.4.8 Contaminated Land

Following the Construction Phase, land contamination remaining within the Proposed Development footprint may present risks to future site workers (such as maintenance staff).

The preliminary CSM for the Operational Phase of the Proposed Development has been updated on the basis of the estimated effects on baseline conditions as presented in Section 11.3, and summarised in Appendix A11.1 in Volume 3 of this EIAR. The likelihood of a risk being realised is not uniform across the Planning Application Boundary a (as detailed in the baseline), and the updated CSM is presented on the basis of a precautionary approach, whereby each potential pollutant linkage is classified on the basis of the highest risk across the Planning Application Boundary Pollutant linkages 19 to 28 have been scoped out as they are covered in hydrogeology. The operational impacts from land contamination are summarised in Table 11.31 and the operational impacts on soil and geological receptors are summarised in Table 11.32.

Table 11.31: Summary of Potential Operational Phase Impacts from Land Contamination

Source	Receptor	Pathway	Pollutant Linkage (PL)	Severity	Likelihood	Risk
Contaminants within soil and groundwater	Human health (construction workers)	Dermal contact, ingestion and inhalation of impacted soil, dust, fibres (asbestos) and waters.	PL15	Medium	Unlikely	Low
		Migration of ground gases and vapours to shallow pits or enclosed spaces.	PL16	Medium	Low Likelihood	Moderate/ Low
	Human health (adjacent residents / workers, transient foot traffic)	Dermal contact, ingestion and inhalation of windblown soil, dust, fibres (asbestos) during construction.	PL17	Medium	Unlikely	Low
		Migration of ground gases into homes or workplaces via preferential pathways during construction.	PL18	Medium	Unlikely	Low
	Property	Direct contact with sub-surface materials including made ground.	PL29	Mild	Unlikely	Negligible
		Migration of ground gases into property through preferential pathways posing a potential explosion risk from ignition of explosive gases.	PL30	Mild	Unlikely	Negligible

Table 11.32: Summary of Potential Operational Phase Impacts on Soil and Geological Receptors

Receptor	Importance	Magnitude of Impact	Significance of Impact
Soils			
Soil	Medium	Negligible	Imperceptible
Geomorphology			
Geomorphology	Low	Negligible	Imperceptible
Superficial Geology			
Till derived from Namurian sandstones	Low	Negligible	Imperceptible
Gravels derived from limestones	Low	Negligible	Imperceptible
Alluvium	Low	Negligible	Imperceptible
Till derived from limestones	Low	Negligible	Imperceptible
Lacustrine Sediments	Low	Negligible	Imperceptible
Bedrock Geology			
Waulsortian Limestone	Low	Negligible	Imperceptible
Lucan Formation	Low	Negligible	Imperceptible
Rush Conglomerate	Low	Negligible	Imperceptible
Boston Hill Formation	Low	Negligible	Imperceptible
Current and Historical Mining Sites			
Granular aggregate potential	Low	Negligible	Imperceptible
Crushed rock aggregate potential	Low	Negligible	Imperceptible
Contaminated Land and Ground Gas			
Refer to Section 11.4.4.7 and Section 11.4.4.8			

11.4.4.9 Hydrogeology

No discharge to ground is expected during the Operational Phase.

Permanent access tracks to off-road Joint Bays have the potential to lead to compaction effects which could impact shallow groundwater levels and flows. However, at an aquifer scale these impacts are likely to be negligible to small adverse. Additionally, there is the potential of accidental leaks and spills on the access tracks during the Operational Phase which have the potential to impact groundwater quality. These would be of limited extent but have the potential to result in small adverse magnitude of impact locally and would be negligible at aquifer scale. The significance of impact is assessed as Imperceptible.

Following the Construction Phase, the backfilled trench has the potential to act as a preferential flow pathway, thereby disturbing shallow groundwater flow pattern, where shallow groundwater is present. This could in places drain an area, and in other places facilitate accumulation of shallow groundwater and create localised ponding / flooding. At the scale of the superficial aquifers, this is of no significance and would be a negligible magnitude of impact, in turn, resulting in an assessed Imperceptible significance of impact.

Four GWDTEs have been identified as being intercepted by the proposed cable route. This has the potential to form an artificial drain which could direct shallow groundwater away from the potential GWDTE causing a drying up of the grassland and dieback of vegetation. Therefore, a locally moderate adverse magnitude impact would be expected in the locale of this potential GWDTE, which is assessed as a potential Moderate significance of impact.

There may be some areas where the water table is shallow in proximity to the alluvium underlying the River Tolka and its tributaries (Dunboyne Stream) and the River Pinkeen, where small changes to flows are possible

due to the presence of sub-surface structures containing the Joint Bays and the proposed cable route. The proposed cable route will cross the River Ward at a stretch of the watercourse underlain by bedrock, and therefore, small changes in water quality are possible due to operation works operating in / adjacent to an exposed bedrock aquifer (Rush Conglomerate). However, these impacts will be very localised and result in a negligible magnitude of impact on an aquifer scale. No potential impact is expected on bedrock aquifer, both in terms of flow and quality.

Table 11.33 provides a summary of potential impacts to receptors during the Operational Phase.

Table 11.33: Summary of Potential Operational Phase Impacts

Receptor	Parameter	Importance	Magnitude of Impact	Significance of Impact
Uisce Éireann Public Supply Wells	Groundwater Flow	Extremely High	Negligible	Imperceptible
	Groundwater Quality	Extremely High	Negligible	Imperceptible
Private Water Supplies from GSI dataset	Groundwater Flow	Medium	Negligible	Imperceptible
	Groundwater Quality	Medium	Negligible	Imperceptible
Unknown Private Water Supplies	Groundwater Flow	Medium	Large Adverse	Significant
	Groundwater Quality	Medium	Large Adverse	Significant
Potential GWDTE	Groundwater Flow	Medium	Moderate Adverse	Moderate
	Groundwater Quality	Medium	Negligible	Imperceptible
Tober Colleen Formation	Groundwater Flow	Low	None	N/A
	Groundwater Quality	Low	None	N/A
Malahide Formation	Groundwater Flow	Medium	None	N/A
	Groundwater Quality	Medium	None	N/A
Waulsortian Limestone	Groundwater Flow	Medium	None	N/A
	Groundwater Quality	Medium	None	N/A
Lucan Formation	Groundwater Flow	Medium	None	N/A
	Groundwater Quality	Medium	None	N/A
Rush Conglomerate	Groundwater Flow	Medium	None	N/A
	Groundwater Quality	Medium	None	N/A
Boston Hill Formation	Groundwater Flow	Medium	None	N/A
	Groundwater Quality	Medium	None	N/A
Till derived from Namurian sandstones and shales	Groundwater Flow	Low	Small Adverse	Imperceptible
	Groundwater Quality	Low	Small Adverse	Imperceptible
Gravels derived from limestones	Groundwater Flow	Low	Small Adverse	Imperceptible
	Groundwater Quality	Low	Small Adverse	Imperceptible
Alluvium	Groundwater Flow	Low	Small Adverse	Imperceptible
	Groundwater Quality	Low	Small Adverse	Imperceptible

Receptor	Parameter	Importance	Magnitude of Impact	Significance of Impact
Till derived from limestone	Groundwater Flow	Low	Small Adverse	Imperceptible
	Groundwater Quality	Low	Small Adverse	Imperceptible
Lacustrine Sediments	Groundwater Flow	Low	Small Adverse	Imperceptible
	Groundwater Quality	Low	Small Adverse	Imperceptible

11.5 Mitigation and Monitoring Measures

11.5.1 Construction Phase

The following mitigation measures will be implemented prior to the commencement and throughout the duration of the Construction Phase to limit any impacts on soils and geology:

- The results of further confirmatory ground investigations to be carried out in 2024 will be evaluated and reviewed as part of the detailed design, within the parameters of the planning application;
- The CEMP (included as a standalone document in this planning application pack) which includes good industry working practice and pollution prevention measures, with a particular focus on controlling run off and suspended solids, preventing accidental spillages, excavated material stockpile management, and ensuring safe storage of materials and product in sealed areas will be implemented;
- Topsoil stripping will be undertaken in some areas of the proposed cable route as part of constructing with the Joint Bays. A Soil Management Plan will be developed for the Proposed Development, which will include measures for segregation of soil types and to maintain soil quality during movement, stockpiling and subsequent placement;
- Risks to workers from ground gas when working within confined spaces will be mitigated through the development and adoption of an appropriate safe system of work, including the use of personal protective equipment (PPE) and Respiratory Protective Equipment (RPE) as a last resort;
- Prior to the Construction Phase commencing, appropriate health and safety and waste management procedures for working with potentially contaminated soils (including asbestos) and water will be established, including the development and adoption of safe systems of work, including the use of PPE as a last resort. With specific regard to asbestos in soils (as identified at one location) a competent asbestos specialist will develop a plan to manage risks taking into account guidance presented in Asbestos-containing Materials (ACMs) in Workplaces – Practical Guidelines on ACM Management and Abatement (Health and Safety Authority (HSA 2013), and Control of Asbestos Regulations 2012: Interpretation for Managing and Working with Asbestos in Soil and Construction & Demolition materials: Industry Guidance (shortened name CAR-SOIL™) (CL:AIRE 2012). The plan will include the use of appropriate PPE and RPE and the carrying out of air monitoring during works at relevant locations. In addition, all staff working with soils potentially containing asbestos will be trained to identify asbestos containing material;
- To mitigate potential risks from radon migration into excavations and other enclosed spaces during the Construction Phase, an occupational monitoring programme will be implemented by the relevant contractor(s) to identify whether radon migration and build up is occurring in areas where the risk is considered to be present. The monitoring will be undertaken in accordance with the EPA Protocol for the Measurement of Radon in Homes & Workplaces (EPA 2019b). If the workplace reference level of 300Bq/m^3 is exceeded (EPA 2019a), mitigation measures will

be required during the Construction Phase, such as development of safe systems of work to ensure protection of personnel, potentially including measures such as use of PPE, RPE and working time restrictions; and

- A watching brief will be implemented to identify the potential presence of previously unidentified contamination. Personnel appointed by the appointed contractor will be appropriately trained in ground contamination identification (including Asbestos Awareness Training) if involved in earthworks activities. Any such instances of previously unidentified contamination will be recorded, the associated risks assessed, and a remedial strategy developed by the appointed contractor to manage the identified risks as appropriate.

Specifically relating to individual receptors, such as GWDTEs and groundwater abstractions, the following mitigation measures will be implemented, prior to the commencement of, and throughout the duration of the Construction Phase to limit these impacts:

- Again, the CEMP will include good industry working practice and pollution prevention measures, with a particular focus on controlling runoff and suspended solids, preventing accidental spillages, excavated material stockpile management, and ensuring safe storage of materials and product in sealed areas;
- Uisce Éireann will be further consulted during the detailed design stage regarding the Dunboyne abstractions. This will include relevant aspects of the CEMP in addition to agreeing a method statement within the final CEMP for the works in the relevant location (potentially including monitoring and reporting requirements);
- Where trenching is carried out outside of existing roads, the methodology to backfill trenches will ensure that the backfill is not creating preferential subsurface flow pathway. Soil compaction will be undertaken, and where needed on off road sections, additional clay bunds will be installed within the trench in areas that are adjacent to or in proximity to potential GWDTEs:
    - Clay bunds are proposed to be installed along the proposed cable trench, with an increased frequency between approximate Chainages 2,200 to 2,650, 2,750 to 2,850, 26,200 to 26,250, and around Chainage 12,500 in proximity of the potential GWDTEs to prevent the formation of a drainage pathway.
- Should any unknown private supplies be identified in the vicinity of the proposed cable route, the supply will be monitored and, if required, an alternative supply will be provided.

11.5.2 Operational Phase

The following mitigation measures will be implemented during the Operational Phase:

- Risks to maintenance workers from ground gas when working within confined spaces will be mitigated by the development and adoption of safe system of work, including the use of PPE and RPE as a last resort; and
- In the event that ground works are required during the Operational Phase (it is currently assumed that no further ground works will be undertaken), appropriate health and safety and waste management procedures for working with potentially contaminated soils (including asbestos) and water will be established by the relevant appointed contractor, prior to such works commencing, such as the development and adoption of safe systems of work including the use of PPE as a last resort.

11.6 Residual Impacts

11.6.1 Construction Phase

The predicted residual impacts are expected to range from Imperceptible to Slight during the Construction Phase, following the implementation of the mitigation measures. A summary of the predicted residual impacts as a result of the Construction Phase is outlined in Table 11.34.

Table 11.34: Predicted Residual Impacts on Soil and Geological Receptors Post Mitigation – Construction Phase

Receptor	Impact Summary	Pre-Mitigation Summary			Post-Mitigation (Residual Impacts)	
		Importance	Magnitude	Significance	Magnitude of Impact	Significance
Soils	Loss of cover, sealing, compaction, erosion and degradation	Medium	Small Adverse	Moderate / Slight	Negligible	Slight
Geomorphology	Loss of features during construction	Low	Small Adverse	Imperceptible	Negligible	Imperceptible
Superficial Geology	Extraction of resources during shallow excavation	Low	Small Adverse	Imperceptible	Negligible	Imperceptible
Bedrock Geology	Potential for unmapped solution	Low	Small Adverse	Imperceptible	Negligible	Imperceptible
Granular and Crushed rock aggregate potential	Sterilisation of resources	Low	Small Adverse	Imperceptible	Negligible	Imperceptible
Contaminated Land and Ground Gas **(The method of assessment for these attributes varies from the standard impact assessment (as described in Section 11.2.4.1.4))**						
Attribute	**Impact Summary**	**Post-Mitigation Summary**				
		Importance	**Magnitude**	**Significance**		
Human Health (construction workers)	Dermal contact, ingestion and inhalation of impacted soil, dust fibres (asbestos) and waters.	Medium	Likely	Moderate Risk		
	Migration of ground gases and vapours to shallow pits or enclosed spaces.	Medium	Low Likelihood	Moderate / Low		
Human health (adjacent residents / workers, transient foot traffic)	Dermal contact, ingestion and inhalation of windblown soil, dust, fibres (asbestos) during construction.	Medium	Low Likelihood	Moderate / Low		
	Migration of ground gases into homes or workplaces via preferential pathways during construction.	Medium	Low Likelihood	Moderate / Low		

Attribute	Impact Summary	Post-Mitigation Summary		
		Importance	Magnitude	Significance
Property	Direct contact with sub-surface materials including made ground.	Mild	Likely	Moderate / Low
	Migration of ground gases into property through preferential pathways posing a potential explosion risk from ignition of explosive gases.	Mild	Unlikely	Negligible

Table 11.35: Predicted Residual Impacts on Hydrogeological Receptors Post Mitigation – Construction Phase

Receptor	Parameter	Impact Summary	Pre-Mitigation Summary			Post-Mitigation (Residual Impacts)	
			Importance	Magnitude	Significance	Magnitude of Impact	Significance
Private Water Supplies from GSI dataset	Groundwater Flow	N/A	Medium	Negligible	Imperceptible	Negligible	Imperceptible
	Groundwater Quality	N/A	Medium	Negligible	Imperceptible	Negligible	Imperceptible
Unknown Private Water Supplies	Groundwater Flow	Dewatering can alter groundwater level and flow locally, reducing water available to supplies.	Medium	Large Adverse	Significant	Small Adverse	Slight
	Groundwater Quality	Contamination may be introduced to groundwater through leaks and spills, impacting resources reliant on groundwater.	Medium	Large Adverse	Significant	Small Adverse	Slight
Uisce Éireann Public Supply Wells	Groundwater Flow	N/A	Extremely High	Negligible	Imperceptible	Negligible	Imperceptible
	Groundwater Quality	Excavation for cable route may mobilize contaminants and the pathway to the aquifer supporting the supplies is reduced, increasing its vulnerability to contamination	Extremely High	Small Adverse	Significant	Negligible	Imperceptible

Receptor	Parameter	Impact Summary	Pre-Mitigation Summary			Post-Mitigation (Residual Impacts)	
			Importance	Magnitude	Significance	Magnitude of Impact	Significance
Potential GWDTEs	Groundwater Flow	Small scale localized dewatering may reduce the quantity of groundwater available to support the vegetation resulting in drying up.	Medium	Moderate Adverse	Moderate	Small Adverse	Slight
	Groundwater Quality	Cable route trench crosses some GWDTEs, increasing suspended solids	Medium	Moderate Adverse	Moderate	Small Adverse	Slight
Tober Colleen Formation	Groundwater Flow	N/A	Low	Small Adverse	Imperceptible	Small Adverse	Imperceptible
	Groundwater Quality	N/A	Low	Small Adverse	Imperceptible	Small Adverse	Imperceptible
Malahide Formation	Groundwater Flow	Cable route trench may require dewatering, changing local groundwater levels and flows.	Medium	Small Adverse	Slight	Negligible	Imperceptible
	Groundwater Quality	Excavation and soil stripping for construction of cable route, HDD, and TCCs creates pathway to aquifer and can increase suspended solids. Exposed to leaks and spills from machinery.	Medium	Small Adverse	Slight	Negligible	Imperceptible
Waulsortian Limestone	Groundwater Flow	Cable route trench may require dewatering, changing local groundwater levels and flows.	Medium	Small Adverse	Slight	Negligible	Imperceptible
	Groundwater Quality	Excavation and soil stripping for construction of cable route, HDD, and TCCs creates pathway to aquifer and can increase suspended	Medium	Small Adverse	Slight	Negligible	Imperceptible

Receptor	Parameter	Impact Summary	Pre-Mitigation Summary			Post-Mitigation (Residual Impacts)	
			Importance	Magnitude	Significance	Magnitude of Impact	Significance
		solids. Exposed to leaks and spills from machinery.					
Lucan Formation	Groundwater Flow	Cable route trench may require dewatering, changing local groundwater levels and flows.	Medium	Small Adverse	Slight	Negligible	Imperceptible
	Groundwater Quality	Excavation and soil stripping for construction of cable route, HDD, and TCCs creates pathway to aquifer and can increase suspended solids. Exposed to leaks and spills from machinery.	Medium	Small Adverse	Slight	Negligible	Imperceptible
Rush Conglomerate	Groundwater Flow	Cable route trench may require dewatering, changing local groundwater levels and flows.	Medium	Small Adverse	Slight	Negligible	Imperceptible
	Groundwater Quality	Excavation and soil stripping for construction of cable route, HDD, and TCCs creates pathway to aquifer and can increase suspended solids. Exposed to leaks and spills from machinery.	Medium	Small Adverse	Slight	Negligible	Imperceptible
Boston Hill Formation	Groundwater Flow	Cable route trench may require dewatering, changing local groundwater levels and flows.	Medium	Small Adverse	Slight	Negligible	Imperceptible
	Groundwater Quality	Excavation and soil stripping for construction of cable route, HDD, and TCCs creates pathway to aquifer and	Medium	Small Adverse	Slight	Negligible	Imperceptible

Receptor	Parameter	Impact Summary	Pre-Mitigation Summary			Post-Mitigation (Residual Impacts)	
			Importance	Magnitude	Significance	Magnitude of Impact	Significance
		can increase suspended solids. Exposed to leaks and spills from machinery.					
Till derived from Namurian sandstones and shales	Groundwater Flow	N/A	Low	Small Adverse	Imperceptible	Small Adverse	Imperceptible
	Groundwater Quality	Excavation and soil stripping for construction of cable route, HDD, and TCCs creates pathway to aquifer and can increase suspended solids. Exposed to leaks and spills from machinery.	Low	Moderate Adverse	Slight	Negligible	Imperceptible
Gravels derived from limestones	Groundwater Flow	N/A	Low	Small Adverse	Imperceptible	Small Adverse	Imperceptible
	Groundwater Quality	Excavation and soil stripping for construction of cable route, HDD, and TCCs creates pathway to aquifer and can increase suspended solids. Exposed to leaks and spills from machinery.	Low	Moderate Adverse	Slight	Negligible	Imperceptible
Alluvium	Groundwater Flow	N/A	Low	Small Adverse	Imperceptible	Small Adverse	Imperceptible
	Groundwater Quality	Excavation and soil stripping for construction of cable route, HDD, and TCCs creates pathway to aquifer and can increase suspended solids. Exposed to leaks and spills from machinery.	Low	Moderate Adverse	Slight	Negligible	Imperceptible
	Groundwater Flow	N/A	Low	Small Adverse	Imperceptible	Small Adverse	Imperceptible

Receptor	Parameter	Impact Summary	Pre-Mitigation Summary			Post-Mitigation (Residual Impacts)	
			Importance	Magnitude	Significance	Magnitude of Impact	Significance
Till derived from limestone	Groundwater Quality	Excavation and soil stripping for construction of cable route, HDD, and TCCs creates pathway to aquifer and can increase suspended solids. Exposed to leaks and spills from machinery.	Low	Moderate Adverse	Slight	Negligible	Imperceptible
Lacustrine Sediments	Groundwater Flow	N/A	Low	Small Adverse	Imperceptible	Small Adverse	Imperceptible
	Groundwater Quality	Excavation and soil stripping for construction of cable route, HDD, and TCCs creates pathway to aquifer and can increase suspended solids. Exposed to leaks and spills from machinery.	Low	Moderate Adverse	Slight	Negligible	Imperceptible

11.6.2 Operational Phase

The predicted residual impacts are expected to range from Imperceptible to Slight during the Operational Phase, following the implementation of the mitigation measures. A summary of the predicted residual impacts as a result of the Operational Phase is outlined in Table 11.36 and Table 11.37.

Table 11.36: Predicted Residual Impacts on Soil and Geological Receptors Post Mitigation – Operational Phase

Attribute	Impact Summary	Post-Mitigation Summary		
		Importance	Magnitude	Significance
Contaminated Land and Ground Gas* * The method of assessment for these attributes varies from the standard impact assessment (as described in SectionAssessment of Land Contamination 11.2.4.1.4)				
Human health (maintenance workers)	Dermal contact, ingestion and inhalation of soil, dust, fibres (asbestos) and waters during routine maintenance	Medium	Unlikely	Low
	Migration of ground gases and vapours to enclosed spaces	Medium	Low Likelihood	Moderate / Low
Human health (end users, adjacent	Dermal contact, ingestion and inhalation of windblown soil, dust, fibres	Medium	Unlikely	Low

Attribute	Impact Summary	Post-Mitigation Summary		
		Importance	Magnitude	Significance
residents workers)	(asbestos) from retained surface soils			
	Migration and accumulation of ground gases into homes or workplaces via preferential pathways created during construction	Medium	Unlikely	Low
Property	Direct contact with sub-surface materials including made ground.	Mild	Unlikely	Negligible
	Migration of ground gases into property through preferential pathways posing a potential explosion risk from ignition of explosive gases	Mild	Unlikely	Negligible

Table 11.37: Predicted Residual Impacts on Hydrogeological Receptors Post Mitigation – Operational Phase

Attribute	Parameter	Impact Summary	Pre-Mitigation Summary			Post-Mitigation (Residual Impacts)	
			Importance	Magnitude	Significance	Magnitude of Impact	Significance
Private Water Supplies from GSI dataset	Groundwater Flow	N/A	Medium	Negligible	Imperceptible	Negligible	Imperceptible
	Groundwater Quality	N/A	Medium	Negligible	Imperceptible	Negligible	Imperceptible
Unknown Private Water Supplies	Groundwater Flow	Change in shallow groundwater level and flow direction due to presence of subsurface features – Joint Bays and cable	Medium	Large Adverse	Significant	Small Adverse	Slight
	Groundwater Quality	Chance of leaks and spills from access tracks into the groundwater supporting the supplies	Medium	Large Adverse	Significant	Small Adverse	Slight
Uisce Éireann Public Supply Wells	Groundwater Flow	N/A	Extremely High	Negligible	Imperceptible	Negligible	Imperceptible
	Groundwater Quality	N/A	Extremely High	Negligible	Imperceptible	Negligible	Imperceptible
Potential GWDTEs	Groundwater Flow	During excavation for the cable	Medium	Moderate Adverse	Moderate	Small adverse	Slight

Attribute	Parameter	Impact Summary	Pre-Mitigation Summary			Post-Mitigation (Residual Impacts)	
			Importance	Magnitude	Significance	Magnitude of Impact	Significance
		route, the open trench will provide a flow path / drain for shallow groundwater supporting the area to drain away, resulting in potential drying up of the wet grassland					
	Groundwater Quality	N/A	Medium	Negligible	Imperceptible	Negligible	Imperceptible
Tober Colleen Formation	Groundwater Flow	N/A	Low	None	N/A	N/A	N/A
	Groundwater Quality	N/A	Low	None	N/A	N/A	N/A
Malahide Formation	Groundwater Flow	N/A	Medium	None	N/A	N/A	N/A
	Groundwater Quality	N/A	Medium	None	N/A	N/A	N/A
Waulsortian Limestone	Groundwater Flow	N/A	Medium	None	N/A	N/A	N/A
	Groundwater Quality	N/A	Medium	None	N/A	N/A	N/A
Lucan Formation	Groundwater Flow	N/A	Medium	None	N/A	N/A	N/A
	Groundwater Quality	N/A	Medium	None	N/A	N/A	N/A
Rush Conglomerate	Groundwater Flow	N/A	Medium	None	N/A	N/A	N/A
	Groundwater Quality	N/A	Medium	None	N/A	N/A	N/A
Boston Hill Formation	Groundwater Flow	N/A	Medium	None	N/A	N/A	N/A
	Groundwater Quality	N/A	Medium	None	N/A	N/A	N/A
Till derived from Namurian sandstones and shales	Groundwater Flow	N/A	Low	Small Adverse	Imperceptible	Negligible	Imperceptible
	Groundwater Quality	N/A	Low	Small Adverse	Imperceptible	Negligible	Imperceptible
	Groundwater Flow	N/A	Low	Small Adverse	Imperceptible	Negligible	Imperceptible

Attribute	Parameter	Impact Summary	Pre-Mitigation Summary			Post-Mitigation (Residual Impacts)	
			Importance	Magnitude	Significance	Magnitude of Impact	Significance
Gravels derived from limestones	Groundwater Quality	N/A	Low	Small Adverse	Imperceptible	Negligible	Imperceptible
Alluvium	Groundwater Flow	N/A	Low	Small Adverse	Imperceptible	Negligible	Imperceptible
	Groundwater Quality	N/A	Low	Small Adverse	Imperceptible	Negligible	Imperceptible
Till derived from limestone	Groundwater Flow	N/A	Low	Small Adverse	Imperceptible	Negligible	Imperceptible
	Groundwater Quality	N/A	Low	Small Adverse	Imperceptible	Negligible	Imperceptible
Lacustrine Sediments	Groundwater Flow	N/A	Low	Small Adverse	Imperceptible	Negligible	Imperceptible
	Groundwater Quality	N/A	Low	Small Adverse	Imperceptible	Negligible	Imperceptible

11.7 Conclusion

Following the implementation of the mitigation measures outlined in Section 11.5, no significant impacts on soils and geology are predicted as a result of the Proposed Development. Similarly, no significant impacts are expected on hydrogeological receptors. There will be a short-term impact on the four potential GWDTEs along the proposed cable route during construction and operation which are assessed to have a Slight significance residual impact on their ecosystem.

There will be temporary adverse impacts to the ground surface due to the disruption associated with trenching for the proposed cable installation, temporary storage of excavated materials and change of land use at TCCs and HDD Compounds. However, given the minimal extent of the directly impacted land use areas compared to the land use of the wider study area, these impacts are deemed to be of Slight significance. In addition, following the installation of the proposed cable, restoration works will be carried out to restore the land back to pre-construction condition, excluding the permanent access tracks and Joint Bay locations. Therefore, any impacts will be temporary, for the duration of the Construction Phase, and overall this will result in an impact of Slight significance.

The proposed cable route will cross multiple economic deposits comprising very high / high potential aggregate and crushed rock and sands and gravels. However, the areas directly impacted by the construction activities and proposed construction depths will be small relative to the size of the economic deposits as a whole across the study area. Therefore, potential losses in economic deposits across the study area are deemed to be low, and assessed as resulting in an Imperceptible significance of impact.

There could be temporary adverse impacts to groundwater bodies, protection areas, potential GWDTE, abstractions, and aquifers due to trench works, HDD activities, and any dewatering required. However, the scale of the Proposed Development relative to the size of the groundwater bodies as a whole is very small. For the majority, the works are unlikely to intersect groundwater (groundwater on average being 2m bgl and trenching to extend not further than 1.8m bgl) except at the final chainage of the proposed cable route where excavations will locally be up to 4m. Any dewatering will be minor, short term, mitigated, and with a

negligible magnitude of impact to identified receptors. Therefore, significance of impact is assessed as Imperceptible.

Uisce Éireann will be further consulted during the detailed design stage regarding the Dunboyne abstractions, on relevant aspects of the CEMP and agreeing a method statement within the final CEMP for the works in the relevant location (potentially including monitoring and reporting requirements). The risk of encountering unrecorded Private Water Supplies is low, and with the implementation of the mitigation measures for private supplies, there will be no significant residual impacts.

Risks to groundwater quality and associated receptors will be mitigated with the adoption of a CEMP. Long term shallow groundwater flow disruptions in the backfilled trench will be mitigated by the use of clay bunds within the trench along the proposed cable route, in particular in areas where potential GWDTEs are intercepted.

A review of GSI records on private abstractions has been undertaken and the known supplies have been assessed. There is also the possibility of currently unknown abstractions and supplies that could be affected by the Proposed Development. Albeit the risks being low, as proposed trenching will be <1.8m deep by 1.5m wide and short-lived. With the implementation of the mitigation measures for private supplies, there will be no significant impacts, as the impact is assessed as Imperceptible to Slight.

In addition, no significant impacts are anticipated to the WFD groundwater bodies, protection areas, aquifers, or abstractions. As a result, the Proposed Development is not expected to cause deterioration in the status of any groundwater body either quantitatively or qualitatively.

11.8 References

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