



**Perigus Energy Ireland Midco Limited**

# **Greenhills Renewable Energy Park**

Land, Soils, Geology, Hydrology and Hydrogeology

605444 – R01

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## RSK GENERAL NOTES

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Ireland Ltd.

# CONTENTS

|          |                                                                   |          |
|----------|-------------------------------------------------------------------|----------|
| <b>1</b> | <b>LAND, SOILS, GEOLOGY, HYDROLOGY AND HYDROGEOLOGY .....</b>     | <b>1</b> |
| 1.1      | Introduction .....                                                | 1        |
| 1.1.1    | Objectives .....                                                  | 1        |
| 1.1.2    | Statement of Authority .....                                      | 1        |
| 1.2      | Methodology .....                                                 | 2        |
| 1.2.1    | Relevant EU Directive, Legislation and Guidance .....             | 2        |
| 1.2.2    | Study Area .....                                                  | 3        |
| 1.2.3    | Desk Study .....                                                  | 4        |
| 1.2.4    | Field Work .....                                                  | 4        |
| 1.2.5    | Evaluation of Potential Effects .....                             | 4        |
| 1.3      | Land Soils and Geology Existing Environment .....                 | 12       |
| 1.3.1    | Topography .....                                                  | 12       |
| 1.3.2    | Land .....                                                        | 12       |
| 1.3.3    | Soils and Subsoils .....                                          | 16       |
| 1.3.4    | Geology .....                                                     | 21       |
| 1.3.5    | Geohazards .....                                                  | 22       |
| 1.4      | Potential Impacts and Effects on Land Soils and Geology .....     | 27       |
| 1.4.1    | Construction Impacts and Effects .....                            | 27       |
| 1.4.2    | Operational Impacts and Effects .....                             | 29       |
| 1.4.3    | Decommissioning Impacts and Effects .....                         | 30       |
| 1.5      | Land, Soils and Geology Mitigation Measures .....                 | 31       |
| 1.6      | Residual Effects on Land, Soils and Geology .....                 | 35       |
| 1.6.1    | Land take .....                                                   | 36       |
| 1.6.2    | Soils and Geology .....                                           | 36       |
| 1.7      | Conclusion on Land, Soils and Geology .....                       | 36       |
| 1.8      | Hydrogeology and Hydrology Existing Environment .....             | 37       |
| 1.8.1    | Hydrogeology Existing Environment .....                           | 37       |
| 1.8.2    | Hydrology Existing Environment .....                              | 46       |
| 1.8.3    | Flood Risk .....                                                  | 48       |
| 1.8.4    | Water Framework Directive .....                                   | 51       |
| 1.8.5    | Sensitive and Designated Areas .....                              | 51       |
| 1.9      | Potential Impacts and Effects on Hydrology and Hydrogeology ..... | 58       |
| 1.9.1    | Construction Impacts and Effects .....                            | 58       |
| 1.9.2    | Operational Impacts and Effects .....                             | 61       |
| 1.9.3    | Decommissioning Impacts and Effects .....                         | 62       |
| 1.10     | Hydrology and Hydrogeology Mitigation Measures .....              | 62       |
| 1.10.1   | Design .....                                                      | 62       |
| 1.10.2   | Drainage .....                                                    | 64       |
| 1.10.3   | Sediment Control .....                                            | 65       |
| 1.10.4   | Dewatering .....                                                  | 67       |
| 1.10.5   | Abstraction .....                                                 | 67       |
| 1.10.6   | Flood Risk Management .....                                       | 68       |
| 1.10.7   | Fire Risk Management .....                                        | 68       |



|                                                  |    |
|--------------------------------------------------|----|
| 1.11 Monitoring .....                            | 68 |
| 1.11.1 Construction Phase .....                  | 68 |
| 1.11.2 Operational Phase .....                   | 69 |
| 1.11.3 Decommissioning Phase .....               | 69 |
| 1.12 Residual Effects .....                      | 71 |
| 1.12.1 Increase in Runoff .....                  | 71 |
| 1.12.2 Release of Suspended Sediments .....      | 71 |
| 1.12.3 Potential Pollution .....                 | 71 |
| 1.12.4 Flood Risk .....                          | 71 |
| 1.13 Cumulative Effects .....                    | 71 |
| 1.14 Conclusion Hydrology and Hydrogeology ..... | 73 |

## TABLES

|                                                                                                                               |    |
|-------------------------------------------------------------------------------------------------------------------------------|----|
| Table 1.1: Estimation of the Importance of soil and geological attributes .....                                               | 5  |
| Table 1.2: Estimation of the Importance of hydrology attributes .....                                                         | 6  |
| Table 1.3: Estimation of the Importance of hydrogeological attributes .....                                                   | 7  |
| Table 1.4: Describing the magnitude of effects, land, soils and geology .....                                                 | 7  |
| Table 1.5: Describing the magnitude of effects, hydrology .....                                                               | 9  |
| Table 1.6: Describing the magnitude of effects, hydrogeology .....                                                            | 9  |
| Table 1.7: Describing the significance of effects .....                                                                       | 11 |
| Table 1.8: Rating of significance of effects based on sensitivity and magnitude of effect .....                               | 11 |
| Table 1.9: Review of historical site use .....                                                                                | 12 |
| Table 1.10: Summary of land cover on site .....                                                                               | 13 |
| Table 1.11: Summary of soil types on site .....                                                                               | 16 |
| Table 1.12: Summary of subsoil types on site .....                                                                            | 17 |
| Table 1.13: Summary of bedrock geology on site .....                                                                          | 21 |
| Table 1.14: Summary of likely construction phase activities, potential impacts and effects in the absence of mitigation ..... | 29 |
| Table 1.15: Summary of likely operational phase activities, potential impacts and effects .....                               | 30 |
| Table 1.16: Groundwater vulnerability mapping guidelines (Lee et al. 2008) .....                                              | 38 |
| Table 1.17: Agricultural wells on site .....                                                                                  | 39 |
| Table 1.18: GSI boreholes and springs database within 2km of the site .....                                                   | 39 |
| Table 1.19: Summary of the catchment, sub catchment and sub basin at the site .....                                           | 46 |
| Table 1.20: Drain classifications .....                                                                                       | 46 |
| Table 1.21: EPA hydrochemistry on the surrounding river bodies .....                                                          | 47 |
| Table 1.22: Field surface water measurements taken using a HANNA on the 18/02/2025 .....                                      | 48 |
| Table 1.23: WFD status and risk .....                                                                                         | 51 |
| Table 1.24: Summary of downstream sensitive and designated areas .....                                                        | 51 |
| Table 1.25: EPA Drinking water rivers associated with the site .....                                                          | 53 |
| Table 1.26: Summary of likely construction phase activities, potential impacts and effects in the absence of mitigation ..... | 58 |
| Table 1.27: Existing, planned and proposed projects within 15km of the proposed development .....                             | 72 |

## FIGURES

|                                        |    |
|----------------------------------------|----|
| Figure 1.1: Slope and topography ..... | 14 |
| Figure 1.2: Land cover .....           | 15 |



|                                                                                                                  |    |
|------------------------------------------------------------------------------------------------------------------|----|
| Figure 1.3: Site soils.....                                                                                      | 18 |
| Figure 1.4: Site subsoils.....                                                                                   | 19 |
| Figure 1.5: Subsoil permeability.....                                                                            | 20 |
| Figure 1.6: Site bedrock geology .....                                                                           | 24 |
| Figure 1.7: GSI cross section 22 orientated north south approximately 2km east of the Proposed Development ..... | 25 |
| Figure 1.8: Site landslide susceptibility .....                                                                  | 26 |
| Figure 1.9: Site bedrock aquifer .....                                                                           | 42 |
| Figure 1.10: Groundwater vulnerability .....                                                                     | 43 |
| Figure 1.11: Groundwater recharge .....                                                                          | 44 |
| Figure 1.12: Groundwater abstractions .....                                                                      | 45 |
| Figure 1.13: Regional hydrology .....                                                                            | 49 |
| Figure 1.14: Site specific hydrology .....                                                                       | 50 |
| Figure 1.15: Water Framework Directive Status (2016-2021) .....                                                  | 54 |
| Figure 1.16: Water Framework Directive Risk, Cycle 3 .....                                                       | 55 |
| Figure 1.17: Designated sites .....                                                                              | 56 |
| Figure 1.18: Drinking water rivers .....                                                                         | 57 |
| Figure 1.19: Constraints map.....                                                                                | 63 |
| Figure 1.20: Proposed surface water monitoring during the construction phase of the Proposed Development .....   | 70 |

## APPENDICES

### APPENDIX A DRAINAGE SURVEY PHOTOGRAPHS

### APPENDIX B FLOOD RISK ASSESSMENT

# 1 LAND, SOILS, GEOLOGY, HYDROLOGY AND HYDROGEOLOGY

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## 1.1 Introduction

The Proposed Greenhills Renewable Energy Park (the Proposed Development) comprises a large scale solar array on an area of circa 320 hectares on a site located on agricultural lands in County Cork. It also comprises a battery energy storage system (BESS) and a proposed 220kV AIS substation to be connected to the national grid via a Loop-in connection to the existing 220kV OHL.

The Proposed Development will comprise the following:

- Solar array
- 33kV interconnector cabling between array areas and substation
- Inverter/transformer stations
- New site entrances and access tracks
- All ancillary development such as drainage infrastructure, security fencing, CCTV, weather stations and storage containers for spare parts.
- Temporary construction compound(s)
- Landscaping
- Biodiversity enhancement
- Battery energy storage system (BESS)
- 220kV substation & loop in grid connection.

### 1.1.1 Objectives

The objective of this report is to assess the potential effects of the Proposed Development to the land, soils, geology, hydrology and hydrogeology during the construction and operational phases of the Proposed Development. Where significant likely effects are predicted appropriate mitigation measures are presented. Following the implementation of the outlined mitigation the residual effects of the Proposed Development are considered along with the likely cumulative effects.

RSK has completed this assessment in accordance with the relevant legislation and guidance listed in section 1.2.1.

### 1.1.2 Statement of Authority

RSK (Ireland) Ltd., part of RSK Group, is a consultancy providing environmental services in hydrological, hydrogeological, geological and other environmental disciplines. The company and group provide consultancy to clients in both the public & private sectors. More information can be found at [www.rskgroup.com](http://www.rskgroup.com).

The principal members of the RSK team involved in this assessment include;

Nikolina Bozinovic, Senior Hydrogeologist: Nikolina is a qualified Hydrogeologist/Engineering Geologist with significant experience in hydrogeological assessments, water supply investigations, production of relevant EIAR chapters, supervision of ground investigations, technical report writing, field sampling of surface water and groundwater and collaboration with various specialists. Nikolina is a member of the International Association of Hydrogeologists (IAH) and currently working towards a chartership with the Institute of Geologist Ireland (IGI). Nikolina worked as Hydrogeologist for a large-scale national project in Ireland, namely the National Certificate of Authorisation Programme (NCAP) for Irish Water.

Matt Buchanan is a Principal Consultant at RSK with over 8 years professional experience across the range of Water, Flood Risk, Environmental and Construction Sectors in the UK and Ireland. Matt is a Chartered Water and Environmental Manager (C.WEM), a Chartered Scientist (C.Sci) and Chartered Environmentalist (CEnv) with the Chartered Institution of Water and Environmental Management. Matt has a strong technical background in flood risk, flood risk assessment and hydrological assessment and studies across the UK and Ireland. Matt has worked with a range of public bodies (OPW, EPA, EA & SEPA) on large-scale flood relief schemes to assess, quantify and optioneer sustainable solutions for the client and affected communities. Matt has also worked with a range of private sector developers aiding through planning and development stage to ensure timely and cost-effective construction programmes.

Dr. Paddy Kavanagh is a Lead Consultant with RSK Ireland. Paddy has over 44 years of experience in the environmental sector, both in Ireland and internationally, managing the delivery of and providing technical input to a wide range of projects since 1981. Since joining RSK Ireland Paddy has led the environmental impact assessment team and has fulfilled the role of Project Director on 3 Renewable energy projects. Prior to joining RSK Group in October 2022, Paddy was a lead consultant of the Generation Renewable Projects Delivery Team in ESB's Engineering and Major Projects (EMP), and previously led the Planning and Environment Team in ESB's Engineering and Major Projects.

## **1.2 Methodology**

### **1.2.1 Relevant EU Directive, Legislation and Guidance**

This assessment was undertaken in accordance with the following Irish legislation (transposition of the directive):

- SI No. 296 of 2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018.

In addition to this planning legislation, environmental legislation relevant to geological, geotechnical, hydrological, and hydrogeological aspects of the environment were referred to, such as:

- SI No. 30 of 2000: Planning and Development Act 2000 (e.g. sections 212 (1) f; Part IV, 6; Fifth Schedule Condition 21).
- SI No. 600 of 2001: Planning and Development Regulations 2001,
- SI No. 4 of 1995: The Heritage Act 1995,
- SI No. 33 of 2000: The Wildlife (Amendment) Act, 2000.



- SI No. 213 of 2003: European Communities (Protection of Waters Against Pollution from Agricultural Sources) Regulations, 2003.
- S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations, 2009.
- S.I. No. 9 of 2010: European Communities Environmental Objectives (Groundwater) Regulations, 2010.

This assessment has been prepared using, inter alia, the following guidance documents, which take account of the aforementioned legislation and policy:

- BSI (1999) Code of Practice for Site Investigations - BS 5930
- Department of Housing, Planning, Community and Local Government (DHPLG) (2017) Interim Guidelines for Planning Authorities on Statutory Plans, Renewable Energy and Climate Change
- European Commission (EC) (2021) EU Soil Strategy for 2030
- EC (2017) Guidance on the preparation of the Environmental Impact Assessment Report
- European Communities (Water Policy) Regulations, 2003-22.
- EPA (2022) Guidelines on the Information to be Contained in Environmental Effect Assessment Reports
- Institute of Geologists of Ireland (IGI) (2002) Geology in Environmental Effect Statements – A guide
- IGI (2013) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Effect Statements
- Fehily Timoney and Company (2023) Best Practice Planning Guidance Report for Large Scale Solar Energy Development in Ireland. Prepared with Irish Solar Energy Association (ISEA)
- National Roads Authority (NRA) (2008a) Guidelines on Procedures for the Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes
- NRA (2008b) Environmental Effect Assessment of National Road Schemes – A Practical Guide – Rev 1
- NRA (2014) Guidelines for the Management of Waste from National Road Construction Projects

### 1.2.2 Study Area

The study area or zone of influence for soils, geology, hydrology and hydrogeology is typically localised to the redline boundary and its immediate surrounds (minimum 2km as outlined in the Irish Geological Institute guidelines (IGI, 2013<sup>1</sup>)). This minimum distance is reviewed in more sensitive environments such as karst systems.

The study area for surface water extends further to the wider catchment area and includes downstream receptors such as designated sites and other sensitive and protected areas.

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<sup>1</sup> Irish Geological Institute (2013) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Effect Statements

### 1.2.3 Desk Study

Desktop assessments were undertaken before and after field investigations in order to determine the baseline conditions at the Proposed Development.

Study of geospatial data obtained from various sources including;

- Geohive Public Map Viewer. Available at: <https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx>, accessed July 2025.
- Geological Survey of Ireland - GSI (2025) Public Data Viewer Series. Available at: <https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx>, accessed July 2025.
- Environmental Protection Agency Map Viewer (2025) Environmental Protection Agency. Available at: <https://gis.epa.ie/EPAMaps/>, accessed July 2025.
- Irish Soil Information System (2025) Online Map Viewer. Available at: <http://gis.teagasc.ie/soils/map.php>, accessed July 2025.
- Office of Public Works (OPW) Flood maps. (2025) Available at: <https://www.floodinfo.ie/map/floodmaps/>, accessed July 2025.
- Met Éireann Meteorological Data (2025) <https://www.met.ie/climate/available-data/historical-data>, accessed July 2025
- Google Earth Aerial Photography. Accessed April 2025.
- National Parks & Wildlife (NPWS) Designations Viewer. Available at: <https://www.npws.ie/maps-and-data>, accessed July 2025.

Data was assessed at a regional, local and site-specific scale.

### 1.2.4 Field Work

Field inspections were carried out at the site of the Proposed Development during February 2025. Site walk overs were carried out to primarily assess the site drainage and general ground conditions including topographical, soil characteristics and to observe the baseline conditions at the site including visual assessment of the receiving environment in terms of impacts arising from the existing infrastructure and practices at the site. Photographs from the drainage survey are included in **Appendix A**.

As a result of the site survey and baseline assessment, constraints were determined for the development design, see section 11.3 and 11.8.

### 1.2.5 Evaluation of Potential Effects

While the development and project is not considered an Environmental Impact Assessment, the development will follow the principles of the guidelines set out in Annex III of the EIA Directive as best practice.

#### 1.2.5.1 Sensitivity of receptors

Sensitivity is defined as the potential for a receptor to be significantly affected by a proposed development (EPA, 2022). The sensitivity of the receiving geological environment is defined by the baseline quality, as well as its potential to absorb change or substitution.

To facilitate the qualification of geological attributes, receptors or features, as referenced in the IGI guidance (IGI, 2013), geological sensitivity criteria have been used as set out by the National Roads Authority (Table 1.1; Box 4.1, NRA, 2008).

**Table 1.1: Estimation of the Importance of soil and geological attributes**

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

Hydrological sensitivity criteria as set out by the National Roads Authority (**Table 1.2**; Box 4.2, NRA, 2008).

**Table 1.2: Estimation of the Importance of hydrology attributes**

| Importance / Sensitivity | Criteria                                                              | Typical Example                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Extremely High</b>    | Attribute has a high quality or value on an international scale       | River, wetland or surface water body ecosystem protected by EU legislation e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.                                                                                                               |
| <b>Very High</b>         | Attribute has a high quality or value on a regional or national scale | River, wetland or surface water body ecosystem protected by national legislation – NHA status<br>Regionally important potable water source supplying >2500 homes<br>Quality Class A (Biotic Index Q4, Q5)<br>Flood plain protecting more than 50 residential or commercial properties from flooding<br>Nationally important amenity site for wide range of leisure activities |
| <b>High</b>              | Attribute has a high quality or value on a local scale                | Salmon fishery<br>Locally important potable water source supplying >1000 homes<br>Quality Class B (Biotic Index Q3-4)<br>Flood plain protecting between 5 and 50 residential or commercial properties from flooding<br>Locally important amenity site for wide range of leisure activities                                                                                    |
| <b>Medium</b>            | Attribute has a medium quality or value on a local scale              | Coarse fishery<br>Local potable water source supplying >50 homes<br>Quality Class C (Biotic Index Q3, Q2-3)<br>Flood plain protecting between 1 and 5 residential or commercial properties from flooding                                                                                                                                                                      |
| <b>Low</b>               | Attribute has a low quality or value on a local scale                 | Locally important amenity site for small range of leisure activities<br>Local potable water source supplying <50 homes<br>Quality Class D (Biotic Index Q2, Q1)<br>Flood plain protecting 1 residential or commercial property from flooding<br>Amenity site used by small numbers of local people                                                                            |

Hydrogeological sensitivity criteria as set out by the National Roads Authority (**Table 1.3**; Box 4.2, NRA, 2008).

**Table 1.3: Estimation of the Importance of hydrogeological attributes**

| Importance / Sensitivity | Criteria                                                              | Typical Example                                                                                                                                                                                                                                                                                                      |
|--------------------------|-----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Extremely High</b>    | Attribute has a high quality or value on an international scale       | Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status                                                                                                                                                                                               |
| <b>Very High</b>         | Attribute has a high quality or value on a regional or national scale | Regionally Important Aquifer with multiple wellfields<br>Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – NHA status<br>Regionally important potable water source supplying >2500 homes<br>Inner source protection area for regionally important water source |
| <b>High</b>              | Attribute has a high quality or value on a local scale                | Regionally Important Aquifer<br>Groundwater provides large proportion of baseflow to local rivers<br>Locally important potable water source supplying >1000 homes<br>Outer source protection area for regionally important water source<br>Inner source protection area for locally important water source           |
| <b>Medium</b>            | Attribute has a medium quality or value on a local scale              | Locally Important Aquifer<br>Potable water source supplying >50 homes<br>Outer source protection area for locally important water source                                                                                                                                                                             |
| <b>Low</b>               | Attribute has a low quality or value on a local scale                 | Poor Bedrock Aquifer<br>Potable water source supplying <50 homes                                                                                                                                                                                                                                                     |

#### 1.2.5.2 Magnitude of potential effects

The potential effects may have an adverse, negligible or beneficial effect on the land, soils and geology as outlined below (**Table 1.4**; NRA, 2008; Box 5.1).

**Table 1.4: Describing the magnitude of effects, land, soils and geology**

| Magnitude of Effect  | Description                     | Example                                                                                                                                                                                                                                                  |
|----------------------|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Large Adverse</b> | Results in a loss of attribute. | Loss of high proportion of future quarry or pit reserves.<br>Irreversible loss of high proportion of local high fertility soils.<br>Removal of majority of geological heritage feature (>50%).<br>Requirement to excavate / remediate entire waste site. |



| Magnitude of Effect        | Description                                                                                        | Example                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            |                                                                                                    | Requirement to excavate and replace high proportion of peat, organic soils and/or soft mineral soils beneath alignment.                                                                                                                                                                                                                                                                                                                                                             |
| <b>Moderate Adverse</b>    | Results in effect on integrity of attribute or loss of part of attribute.                          | <p>Loss of moderate proportion of future quarry or pit reserves.</p> <p>Removal of part of geological heritage feature (15-50%).</p> <p>Irreversible loss of moderate proportion of local high fertility soils.</p> <p>Requirement to excavate / remediate significant proportion of waste site.</p> <p>Requirement to excavate and replace moderate proportion of peat, organic soils and/or soft mineral soils beneath alignment.</p>                                             |
| <b>Small Adverse</b>       | Results in minor effect on integrity of attribute or loss of small part of attribute.              | <p>Loss of small proportion of future quarry or pit reserves.</p> <p>Removal of small part of geological heritage feature (&lt;15%).</p> <p>Irreversible loss of small proportion of local high fertility soils and/or high proportion of local low fertility soils.</p> <p>Requirement to excavate / remediate small proportion of waste site.</p> <p>Requirement to excavate and replace small proportion of peat, organic soils and/or soft mineral soils beneath alignment.</p> |
| <b>Negligible</b>          | Results in an effect on attribute but of insufficient magnitude to affect either use or integrity. | No measurable changes in attributes.                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Minor Beneficial</b>    | Results in minor improvement of attribute quality.                                                 | <p>Minor enhancement of geological heritage feature.</p> <p>Remediation of a small, contaminated site (&lt;1ha)</p>                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Moderate Beneficial</b> | Results in moderate improvement of attribute quality.                                              | <p>Moderate enhancement of geological heritage feature.</p> <p>Remediation of a medium, contaminated site (&lt;2.5ha)</p>                                                                                                                                                                                                                                                                                                                                                           |
| <b>Major Beneficial</b>    | Results in major improvement of attribute quality.                                                 | <p>Major enhancement of geological heritage feature.</p> <p>Remediation of a large, contaminated site (&gt;2.5 ha)</p>                                                                                                                                                                                                                                                                                                                                                              |

The potential effects may have an adverse, negligible or beneficial effect on the surface water as outlined below (**Table 1.5**; NRA, 2008; Box 5.2).

**Table 1.5: Describing the magnitude of effects, hydrology**

| Magnitude of Effect        | Description                                                                                        | Example                                                                                                                                                                                                                                                                          |
|----------------------------|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Large Adverse</b>       | Results in loss of attribute and /or quality and integrity of attribute                            | Loss or extensive change to a waterbody or water dependent habitat<br>Increase in predicted peak flood level >100mm <sup>1</sup><br>Extensive loss of fishery<br>Calculated risk of serious pollution incident >2% annually <sup>2</sup><br>Extensive reduction in amenity value |
| <b>Moderate Adverse</b>    | Results in impact on integrity of attribute or loss of part of attribute.                          | Increase in predicted peak flood level >50mm <sup>1</sup><br>Partial loss of fishery<br>Calculated risk of serious pollution incident >1% annually <sup>2</sup><br>Partial reduction in amenity value                                                                            |
| <b>Small Adverse</b>       | Results in minor impact on integrity of attribute or loss of small part of attribute.              | Increase in predicted peak flood level >10mm <sup>1</sup><br>Minor loss of fishery<br>Calculated risk of serious pollution incident >0.5% annually <sup>2</sup><br>Slight reduction in amenity value                                                                             |
| <b>Negligible</b>          | Results in an impact on attribute but of insufficient magnitude to affect either use or integrity. | Negligible change in predicted peak flood level<br>Calculated risk of serious pollution incident <0.5% annually <sup>2</sup>                                                                                                                                                     |
| <b>Minor Beneficial</b>    | Results in minor improvement of attribute quality.                                                 | Reduction in predicted peak flood level >10mm <sup>1</sup><br>Calculated reduction in pollution risk of 50% or more where existing risk is <1% annually <sup>2</sup>                                                                                                             |
| <b>Moderate Beneficial</b> | Results in moderate improvement of attribute quality.                                              | Reduction in predicted peak flood level >50mm <sup>1</sup><br>Calculated reduction in pollution risk of 50% or more where existing risk is >1% annually <sup>2</sup>                                                                                                             |
| <b>Major Beneficial</b>    | Results in major improvement of attribute quality.                                                 | Reduction in predicted peak flood level >100mm <sup>1</sup>                                                                                                                                                                                                                      |

<sup>1</sup> refer to Annex 1, Methods E and F, Annex 1 of HA216/06

<sup>2</sup> refer to Appendix B3 / Annex 1, Method D, Annex 1 of HA216/06

The potential effects may have an adverse, negligible or beneficial effect on the groundwater as outlined below (**Table 1.6**; NRA, 2008; Box 5.3).

**Table 1.6: Describing the magnitude of effects, hydrogeology**

| Magnitude of Effect  | Description                                                             | Example                                                                                                                                                                                                                                                                                                                                                 |
|----------------------|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Large Adverse</b> | Results in loss of attribute and /or quality and integrity of attribute | Removal of large proportion of aquifer<br>Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems<br>Potential high risk of pollution to groundwater from routine run-off <sup>1</sup><br>Calculated risk of serious pollution incident >2% annually <sup>2</sup> |

| Magnitude of Effect     | Description                                                                                        | Example                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Moderate Adverse</b> | Results in impact on integrity of attribute or loss of part of attribute.                          | Removal of moderate proportion of aquifer<br>Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems<br>Potential medium risk of pollution to groundwater from routine run-off <sup>1</sup><br>Calculated risk of serious pollution incident >1% annually <sup>2</sup> |
| <b>Small Adverse</b>    | Results in minor impact on integrity of attribute or loss of small part of attribute.              | Removal of small proportion of aquifer<br>Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems<br>Potential low risk of pollution to groundwater from routine run-off <sup>1</sup><br>Calculated risk of serious pollution incident >0.5% annually <sup>2</sup>                 |
| <b>Negligible</b>       | 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 <sup>2</sup>                                                                                                                                                                                                                                                                                   |

<sup>1</sup> refer to Annex 1, Methods E and F, Annex 1 of HA216/06

<sup>2</sup> refer to Appendix B3 / Annex 1, Method D, Annex 1 of HA216/06

### 1.2.5.3 The significance of potential effects

The significance of potential effects arising as a result of the Project are defined in accordance with the criteria provided by the EPA (2022). The description of the significance of effects as are presented in the following (**Table 1.7**). Only likely or possible potential effects are assessed.

**Table 1.7: Describing the significance of effects**

| Magnitude of Effect        | Description                                                                                                                             |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Imperceptible</b>       | An effect capable of measurement but without significant consequences.                                                                  |
| <b>Not Significant</b>     | An effect which causes noticeable changes in the character of the environment but without significant consequences.                     |
| <b>Slight Effects</b>      | An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.                      |
| <b>Moderate Effects</b>    | An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.       |
| <b>Significant Effects</b> | An effect which, by its character, magnitude, duration or intensity, alters a sensitive aspect of the environment.                      |
| <b>Very Significant</b>    | An effect which, by its character, magnitude, duration or intensity, significantly alters most of a sensitive aspect of the environment |
| <b>Profound Effects</b>    | An effect which obliterates sensitive characteristics.                                                                                  |

Considering the above definitions and rating structures associated with sensitivity and magnitude of potential effects, rating of significance of environmental effects is assigned in accordance with relevant guidance as presented in **Table B-8** (NRA, 2008; EPA, 2022) below and using professional judgement.

**Table 1.8: Rating of significance of effects based on sensitivity and magnitude of effect**

| Sensitivity<br>(Importance of Attribute) | Magnitude of Effect                |                                    |                                      |                                                  |
|------------------------------------------|------------------------------------|------------------------------------|--------------------------------------|--------------------------------------------------|
|                                          | Negligible<br>(Imperceptible)      | Small<br>Adverse<br>(Slight)       | Moderate<br>Adverse<br>(Moderate)    | Large<br>Adverse<br>(Significant to<br>Profound) |
| <b>Extremely High</b>                    | Imperceptible /<br>Not Significant | Significant                        | Profound                             | Profound                                         |
| <b>Very High</b>                         | Imperceptible /<br>Not Significant | Significant /<br>Moderate          | Very<br>Significant /<br>Significant | Profound                                         |
| <b>High</b>                              | Imperceptible /<br>Not Significant | Moderate /<br>Slight               | Significant /<br>Moderate            | Very<br>Significant /<br>Significant             |
| <b>Medium</b>                            | Imperceptible /<br>Not Significant | Slight                             | Moderate                             | Significant                                      |
| <b>Low</b>                               | Imperceptible                      | Imperceptible /<br>Not Significant | Slight                               | Slight /<br>Moderate                             |

## 1.3 Land Soils and Geology Existing Environment

### 1.3.1 Topography

A total land area of the proposed site is approximately 328 hectares and is characterised by relatively flat topography with associated elevations ranging between 23 and 166mAOD and slopes ranging from between 0.5 and 20° with an average slope of 4° as shown in **Figure 1.1**.

### 1.3.2 Land

#### 1.3.2.1 Historic Land Use

A review of the site and surrounding area history was undertaken by assessing the available historical maps and aerial photos available from the ordnance survey of Ireland (OSI) Geohive public viewer and Google Earth. **Table 1.9** below details the results of the review.

**Table 1.9: Review of historical site use**

| Year          | Source               | Land Use                                                                                                                            |
|---------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| 1829 – 1841   | 6 Inch First Edition | Majority of the red line boundary is made up of small fields, some small houses and farm buildings adjacent to the redline boundary |
| 1897 – 1913   | 25 Inch              | No significant changes                                                                                                              |
| 1910s – 1950s | 6 Inch Last Edition  | No significant changes                                                                                                              |
| 1995          | Aerial               | Some more bordering houses and agricultural buildings, some farm tracks on site                                                     |
| 2001 – 2006   | Aerial               | Some additional farm tracks added into the central area                                                                             |
| 2006 – 2012   | Aerial               | Some additional farm tracks added                                                                                                   |
| 2013 – 2018   | Aerial               | Some additional farm tracks added                                                                                                   |
| 2018          | Google Earth         | More farm tracks in the western portion of the redline boundary                                                                     |
| 2022          | Google Earth         | No significant changes                                                                                                              |
| 2024          | Google Earth         | No significant changes                                                                                                              |

#### 1.3.2.2 Land Cover

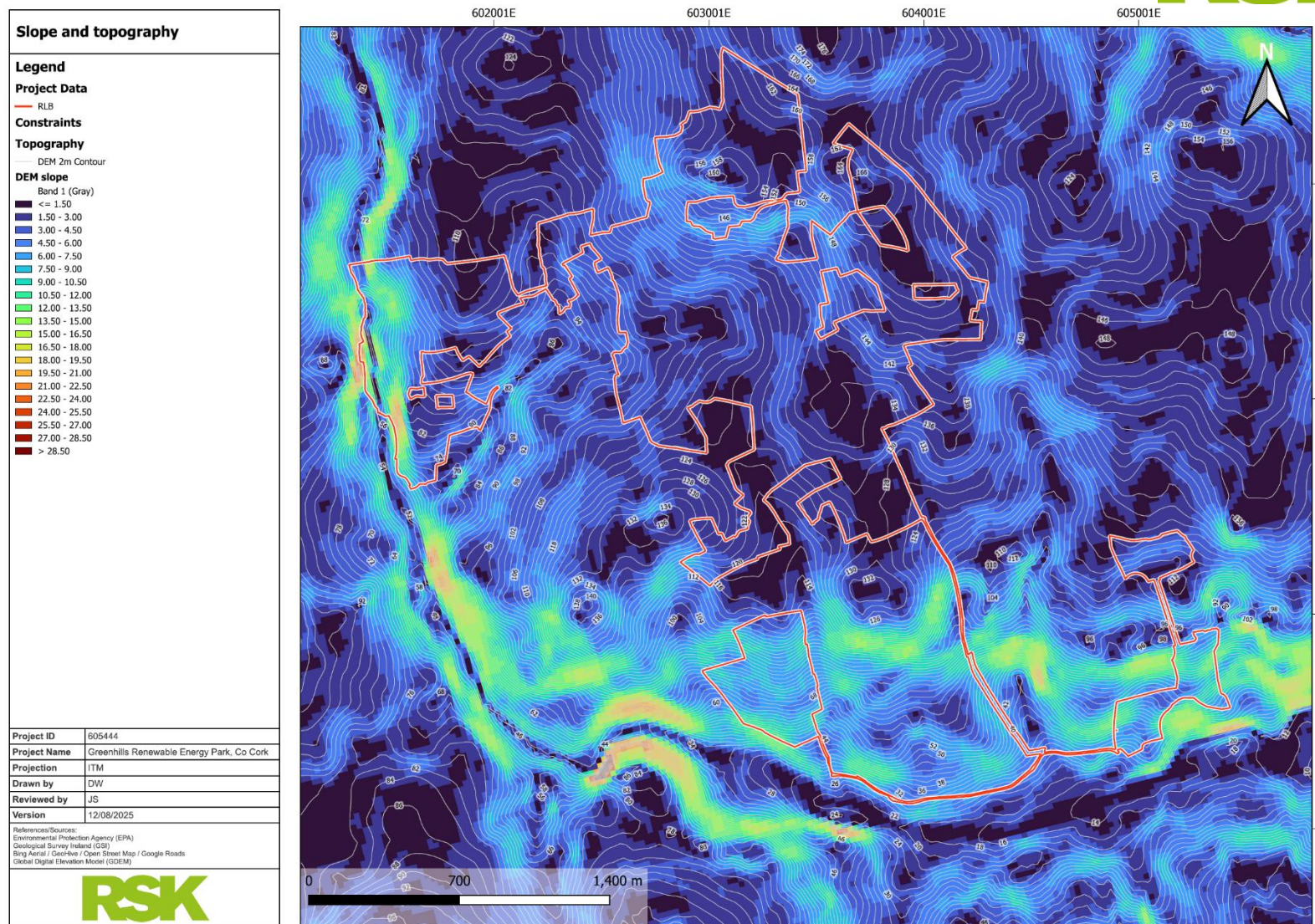
Consultation with Corine (2018)<sup>2</sup> Land Cover maps (EPA) indicates that the land use at the Proposed Development is agricultural, with much of the area classified as pastures (**Table 1.10** and **Figure 1.2**).

<sup>2</sup> CORINE Land Cover (2018). Online: <https://land.copernicus.eu/pan-european/corine-land-cover/clc2018>. [Accessed: July 2025]

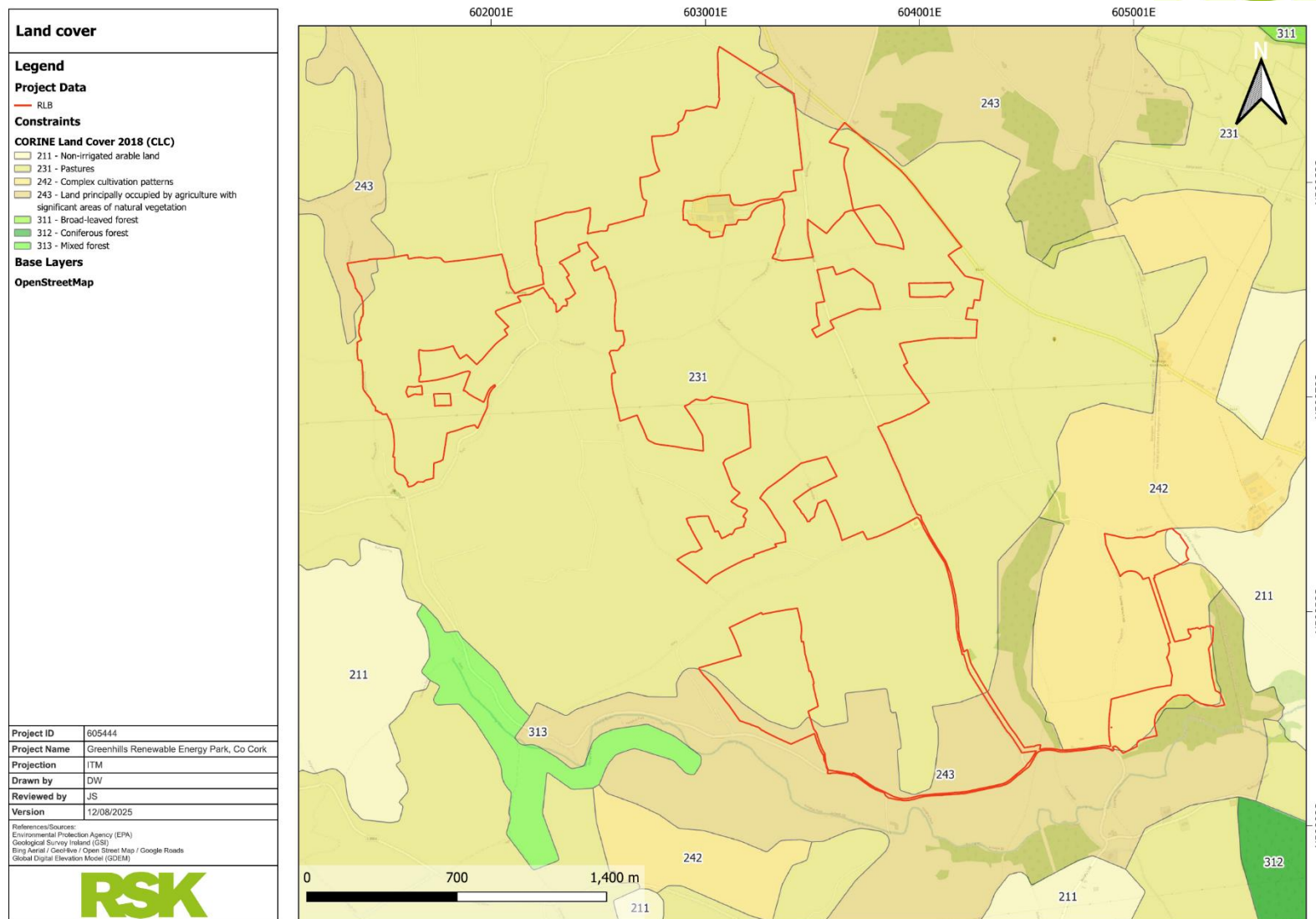


**Table 1.10: Summary of land cover on site**

| Code | Description                                                                            | Location                                                       |
|------|----------------------------------------------------------------------------------------|----------------------------------------------------------------|
| 231  | Pastures                                                                               | Most of redline boundary                                       |
| 242  | Complex cultivation patterns                                                           | Most eastern area of redline boundary                          |
| 243  | Land principally occupied by agriculture, with significant areas of natural vegetation | Some minor areas to the west and north of the redline boundary |
| 211  | Non-irrigated arable land                                                              | Very small area in the most eastern area of redline boundary   |



**Figure 1.1: Slope and topography**



Note: Data points presented are georeferenced using open source data and/or a handheld GPS. This drawing / map is considered a conceptual model with reasonable accuracy for the purposes of environmental assessment. This drawing should not be relied upon for detailed design purposes.

**Figure 1.2: Land cover**



### 1.3.3 Soils and Subsoils

#### 1.3.3.1 Soils

Consultation with the available National Soil Map (EPA map viewer<sup>3</sup>) indicates that most of the site is underlain by Acid Deep Well Drained Mineral (AminDW) with some minor pockets of AminSW, AminPD, AminSRPT and AlluvMIN (**Table 1.11, Figure 1.3**).

**Table 1.11: Summary of soil types on site**

| IFS soil | IFS description                                                                | IFS type                                                                                                                                                                                | Soil group                                                                             | IFS code | Parent material | National soils hydrology category |
|----------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|----------|-----------------|-----------------------------------|
| AminDW   | Acid Deep Well Drained Mineral                                                 | Deep well drained mineral - Derived from mainly non-calcareous parent materials                                                                                                         | Acid Brown Earths, Brown Podzolics                                                     | 11       | TDSs            | Well drained                      |
| AminSW   | Acid Shallow Well Drained Mineral                                              | Shallow well drained mineral - Derived from mainly non-calcareous parent materials                                                                                                      | Shallow Acid Brown, Earths/Brown Podzolics, Lithosols, Regosols, Some outcropping rock | 21       | RckNCA          | Well drained                      |
| AminPD   | Acid Deep Poorly Drained Mineral                                               | Deep poorly drained mineral - Derived from mainly non-calcareous parent materials                                                                                                       | Surface water Gleys / Ground water Gleys                                               | 31       | TDSs            | Poorly drained                    |
| AminSRPT | Acid Shallow, lithosolic or podzolic type soils potentially with peaty topsoil | Shallow, lithosolic or podzolic type soils potentially with peaty topsoil - Predominantly shallow soils derived from non-calcareous rock or gravels with/without peaty surface horizon" | Podzols (Peaty), Lithosols, Peats, Some outcropping rock                               | 43       | RckNCA          | Poorly drained                    |
| AlluvMIN | Mineral alluvium                                                               | Alluviums                                                                                                                                                                               | Variable                                                                               | 51       | A               | Alluvium                          |

<sup>3</sup> Environmental Protection Agency (EPA) (ND) EPA Map Viewer [Online], Layer SIS National Soils - Available at: <https://gis.epa.ie/EPAMaps/>

### 1.3.3.2 Subsoils

Consultation with the available subsoil maps (EPA map viewer) indicates that most of the Proposed Development site is underlain by sandstone till (TDSs). There are minor pockets of bedrock at or close to surface and Alluvium.

The subsoil types at site are summarised in **Table 1.12** and **Figure 1.4**.

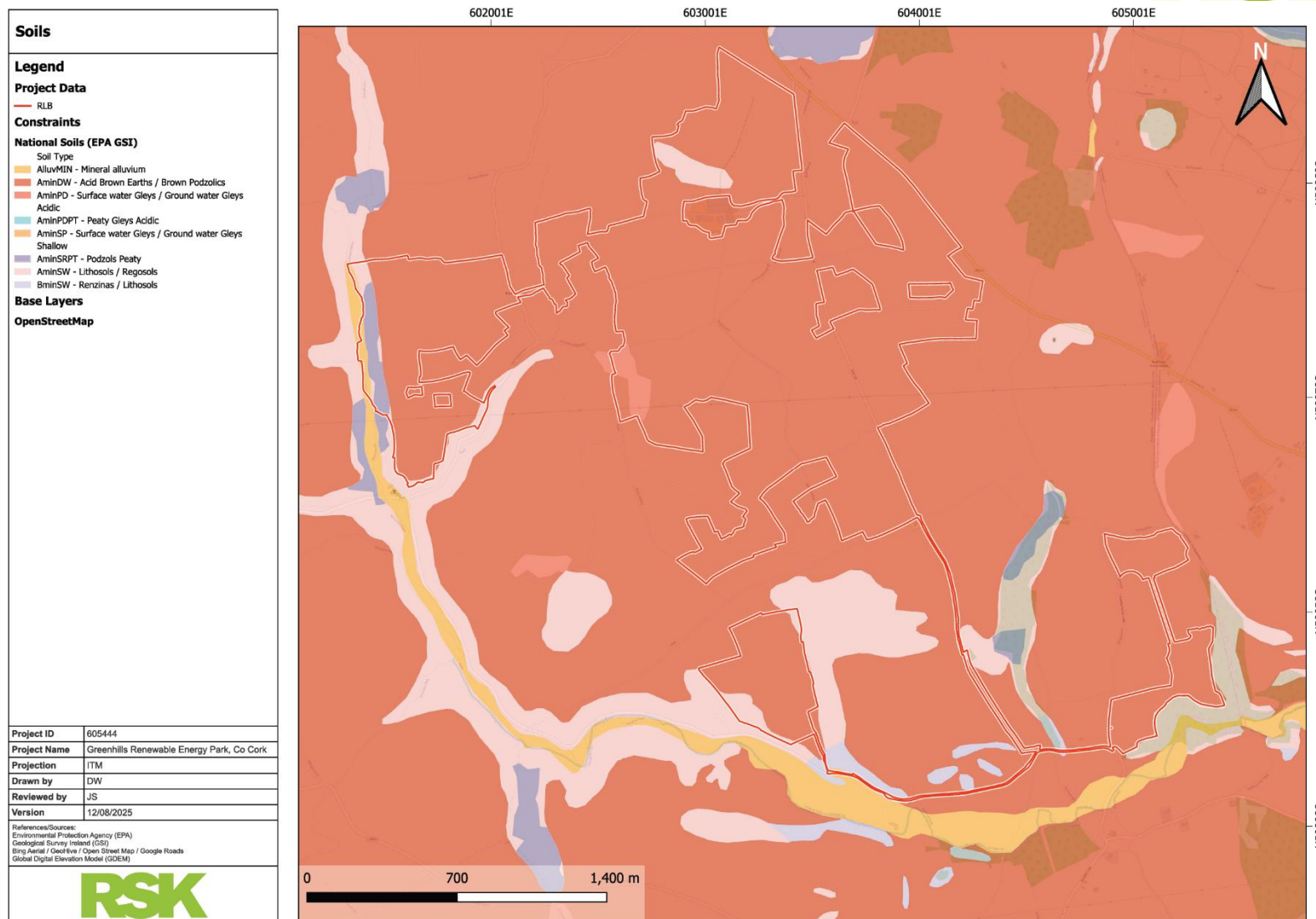
**Table 1.12: Summary of subsoil types on site**

| Subsoil Class                  | Parent material | Description               | Texture  | Location                                                                 |
|--------------------------------|-----------------|---------------------------|----------|--------------------------------------------------------------------------|
| Tills (diamictons)             | TDSs            | Sandstone till (Devonian) | Sandy    | Most of the site                                                         |
| Bedrock at or close to surface | Rck             | Bedrock at surface        | Na       | Adjacent to the rivers and towards the southwest of the redline boundary |
| Alluvium                       | A               | Alluvium undifferentiated | Variable | At the mapped rivers                                                     |

There is no mapped peat at the Proposed Development site and there was no evidence of peat during the site survey.

### 1.3.3.3 Subsoil Permeability

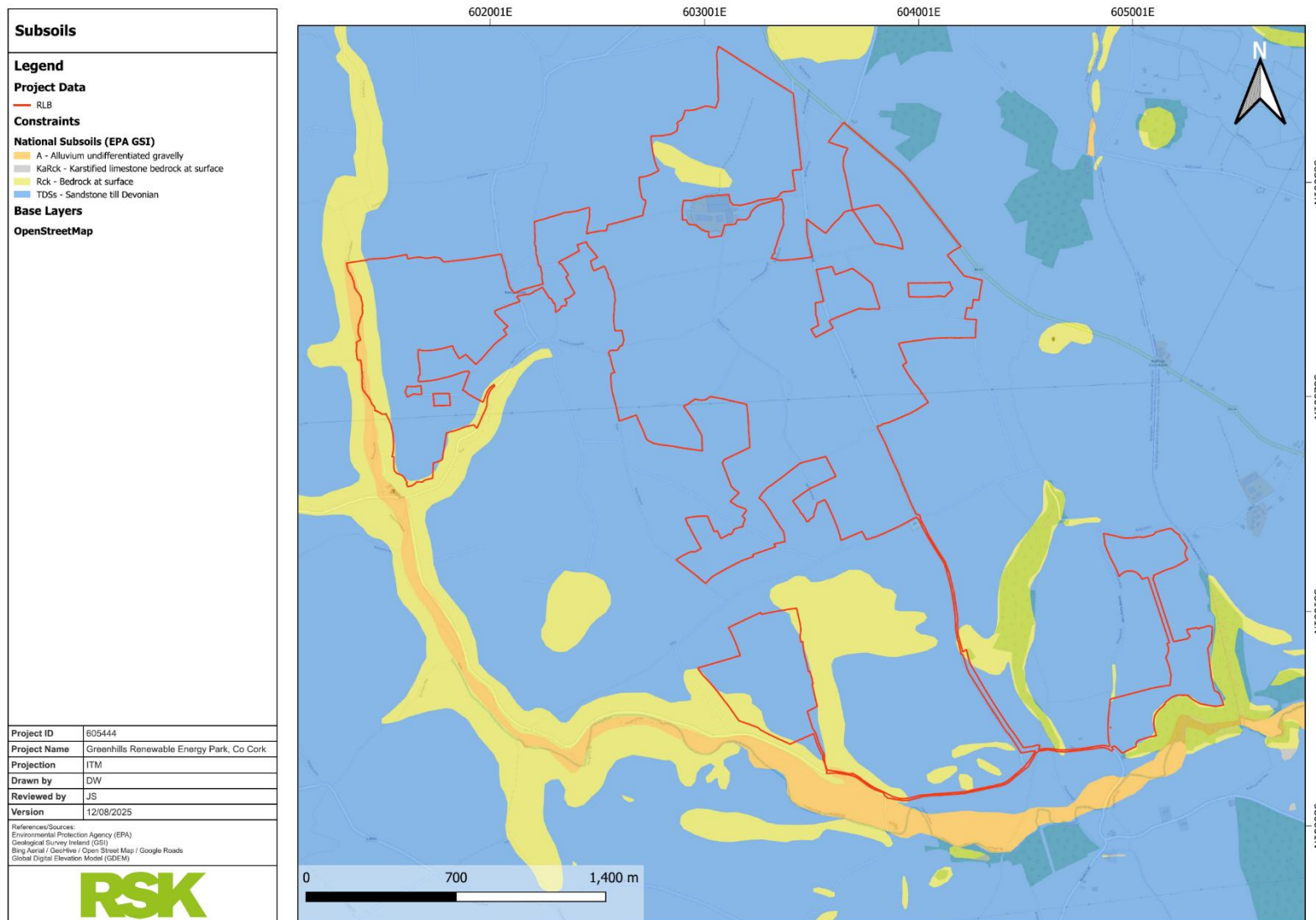
The subsoil permeability across the proposed development site is moderate or not mapped (**Figure 1.5**).



Note: Data points presented are georeferenced using open source data and/or a handheld GPS. This drawing / map is considered a conceptual model with reasonable accuracy for the purposes of environmental assessment. This drawing should not be relied upon for detailed design purposes.

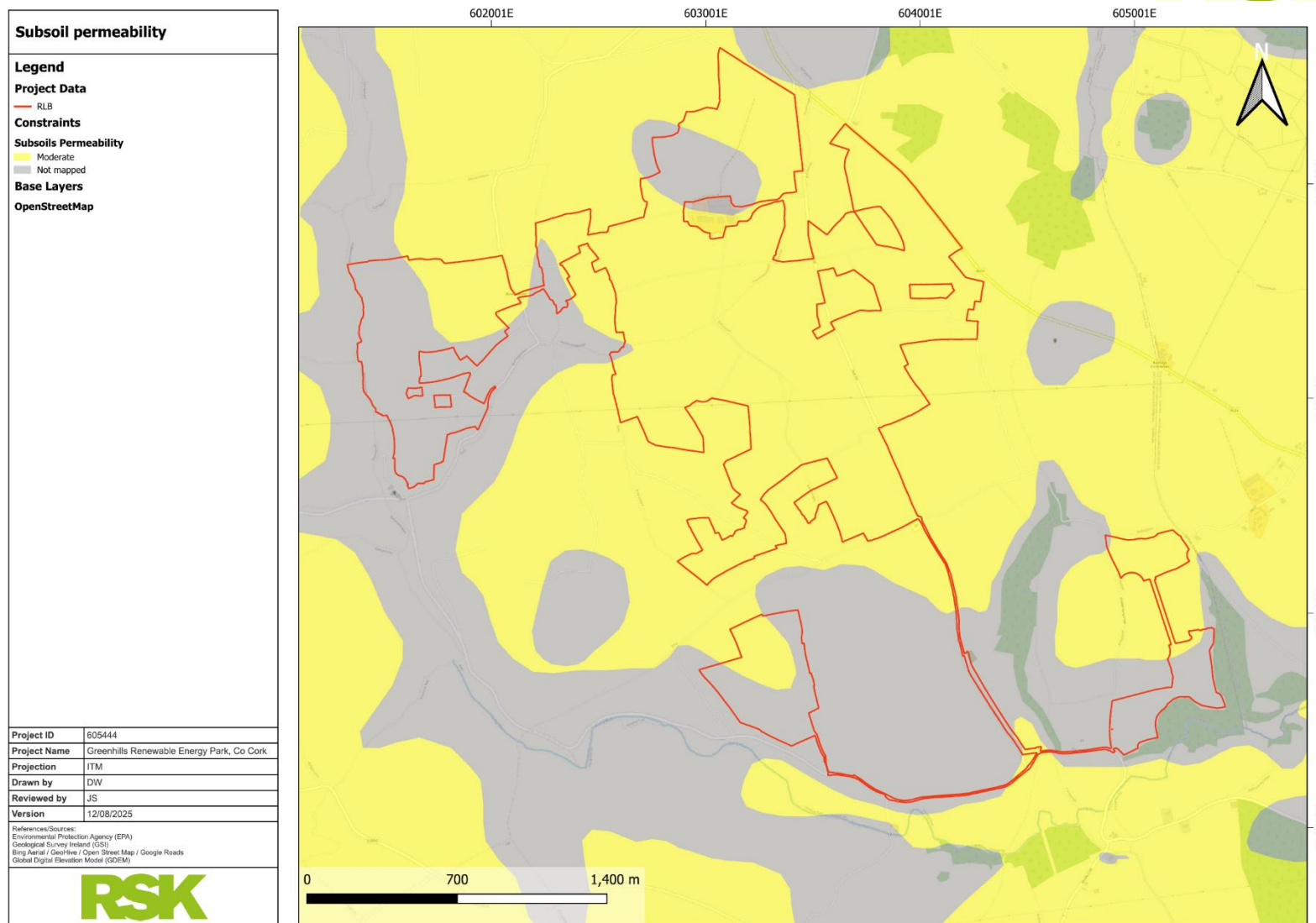
**Figure 1.3: Site soils**





Note: Data points presented are georeferenced using open source data and/or a handheld GPS. This drawing / map is considered a conceptual model with reasonable accuracy for the purposes of environmental assessment. This drawing should not be relied upon for detailed design purposes.

**Figure 1.4: Site subsoils**



**Figure 1.5: Subsoil permeability**

### 1.3.4 Geology

#### 1.3.4.1 Bedrock Geology

The Proposed Development is underlain by the Ballytrasna Formation (GSI, Bedrock 100k<sup>4</sup>). The Ballytrasna Formation is purple mudstone and pale red, fine to medium grained sandstone. Some of the most southern area is underlain by the Gyleen Formation (GY) which is described as sandstone with mudstone and siltstone. The lithologies are summarised in **Table 1.13** and **Figure 1.6**.

**Table 1.13: Summary of bedrock geology on site**

| Formation             | Description                                                                                                                                                                                                                                  | Label | Age            | Location                        |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------|---------------------------------|
| Ballytrasna Formation | In the type area some 90% of the formation is composed of dusky-red mudstone while the remainder comprises pale-red fine-medium grained sandstone. The member contains significant quartz-pebbly sandstones at Ballyvoyle and Helvick Heads. | BS    | Upper Devonian | Solar farm, substation and BESS |
| Gyleen Formation      | Fining upwards sequences of subsidiary red sandstone and dominant red sandstones with thinly bedded alternations of green and red sandstones, siltstones and mudstones towards the top.                                                      | GY    | Upper Devonian | Very south of solar farm        |

This area has undergone folding and faulting as a result of the north south compression associated with the Variscan Orogeny (**Figure 1.7**). The folds are orientated east west and the faults roughly north south. The solar farm site is in an anticline with some faults to the south.

According to the GSI bedrock mapping there are some outcrops along the western edge of the redline boundary where the Tourig\_020 river flows southward, however outcrops were not recorded during the site visit.

#### 1.3.4.2 Economic Geology

The GSI has areas mapped as Geological Resource Importance, such as active quarries and pits as well as mineral localities. Consultation with the GSI database shows that there is a mineral locality close to the most southern area of the redline boundary. Copper

<sup>4</sup> Geological Survey of Ireland (GSI) (ND) Geology [Online] - Available at: <https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=de7012a99d2748ea9106e7ee1b6ab8d5&scale=0> [Accessed: July 2025]

coloured shales were noted in the stream sections which were marked on GSI maps. No active quarries were found close to the Proposed Development.

The Aggregate Potential Mapping (APM, GSI<sup>5</sup>) shows the potential for crushed rocks and for sand and gravel is generally very low potential across the site, closer to areas mapped as rock at or close to surface has low to moderate potential. Areas underlain by the Gyleen Formation to the south of the solar farm have high to very high aggregate potential.

#### 1.3.4.3 *Geological Heritage*

Consultation with the GSI database for known Geological Heritage Sites in Ireland indicates that there are none at or close to the site.

### 1.3.5 **Geohazards**

#### 1.3.5.1 *Seismic Activity*

The island of Ireland does experience, monitor, and record seismic activity, although the magnitude of such occurrences is generally low and do not generally pose as a risk to infrastructure or human health. Although earthquakes are considered a triggering mechanism for landslides, given the low magnitude experienced in Ireland, earthquakes are not considered an important triggering factor in terms of stability risk<sup>6</sup>.

#### 1.3.5.2 *Soil Contamination*

Consultation with waste facility maps (EPA, Waste Facility) indicates that there are no licenced waste facilities or Integrated Pollution Prevention Control (IPPC) licenced facilities on or within the immediate surrounds of the Proposed Development site which could be a potential for contaminated soil.

There are no historic mines on or within the immediate surrounds of the Proposed Development site that could potentially have contaminated soil from tailings.

#### 1.3.5.3 *Karst Features*

Karst features form by the dissolution of rock. In Ireland most karst is found in Carboniferous Limestones. The GSI holds a database of mapped karst features which indicates there is no mapped karst in the study area and no evidence of dissolution features during the site walkover.

#### 1.3.5.4 *Landslide Susceptibility*

The Geological Survey of Ireland (GSI) has developed a Landslide Susceptibility map<sup>7</sup> of Ireland. The Proposed Development is considered to be of generally low risk in terms of

<sup>5</sup>Geological Survey of Ireland (GSI) (ND) Aggregate Potential Mapping [Online] - Available at: <https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=ee8c4c285a49413aa6f1344416dc9956> [Accessed: July 2025]

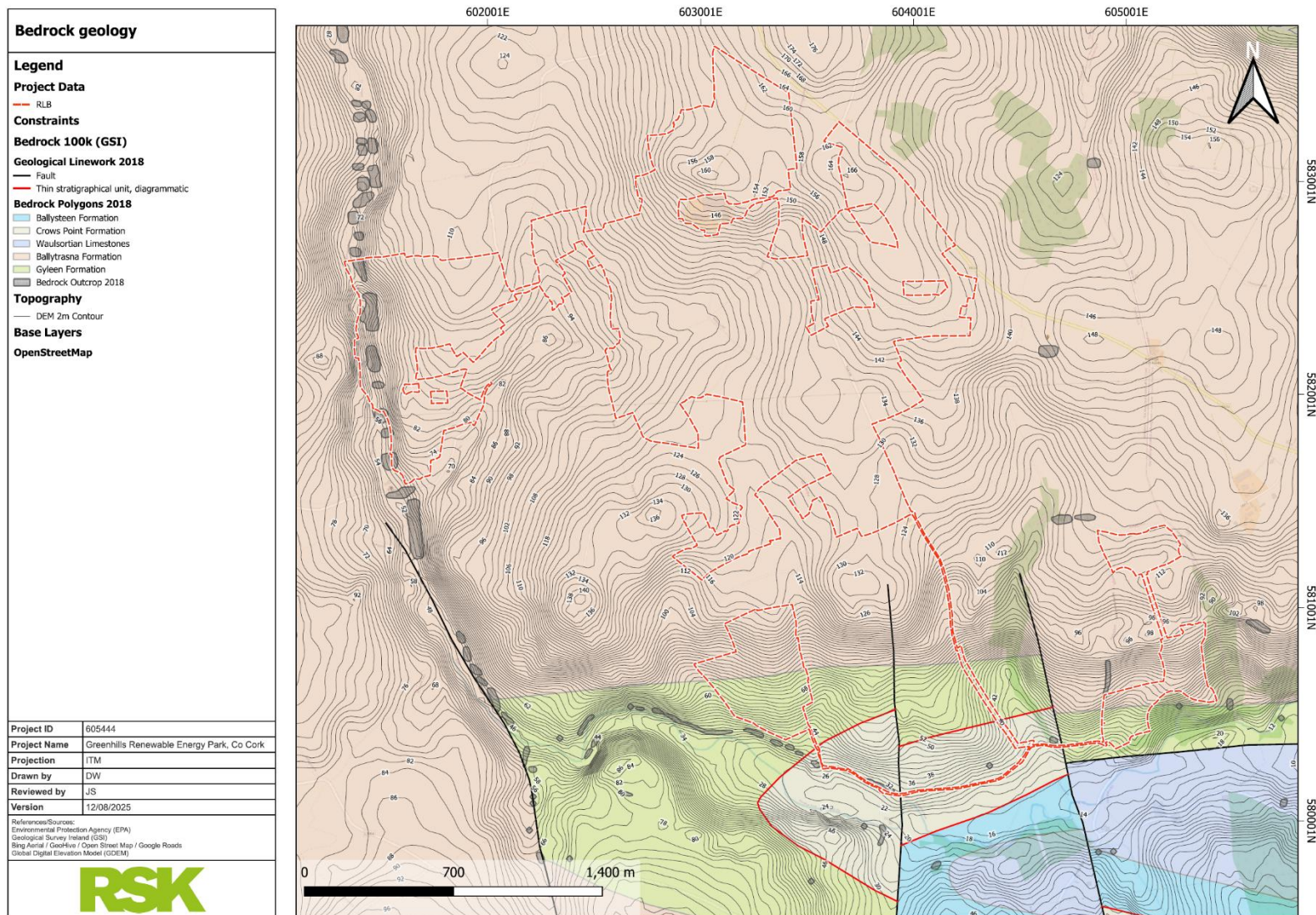
<sup>6</sup> Creighton, R., Doyle, A., Farrell, E. R., Fealy, R., Gavin, K., Henry, T., Johnston, T., Long, M., McKeown, C., Pellicer, X., Verbruggen, K. (2006) "Landslides in Ireland" Geological Survey Ireland: Irish Landslides Working Group.

<sup>7</sup> Geological Survey of Ireland (GSI) (ND) Geological Survey Ireland Spatial Resources [Online] - Available at: <http://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228> [Accessed: July 2025]

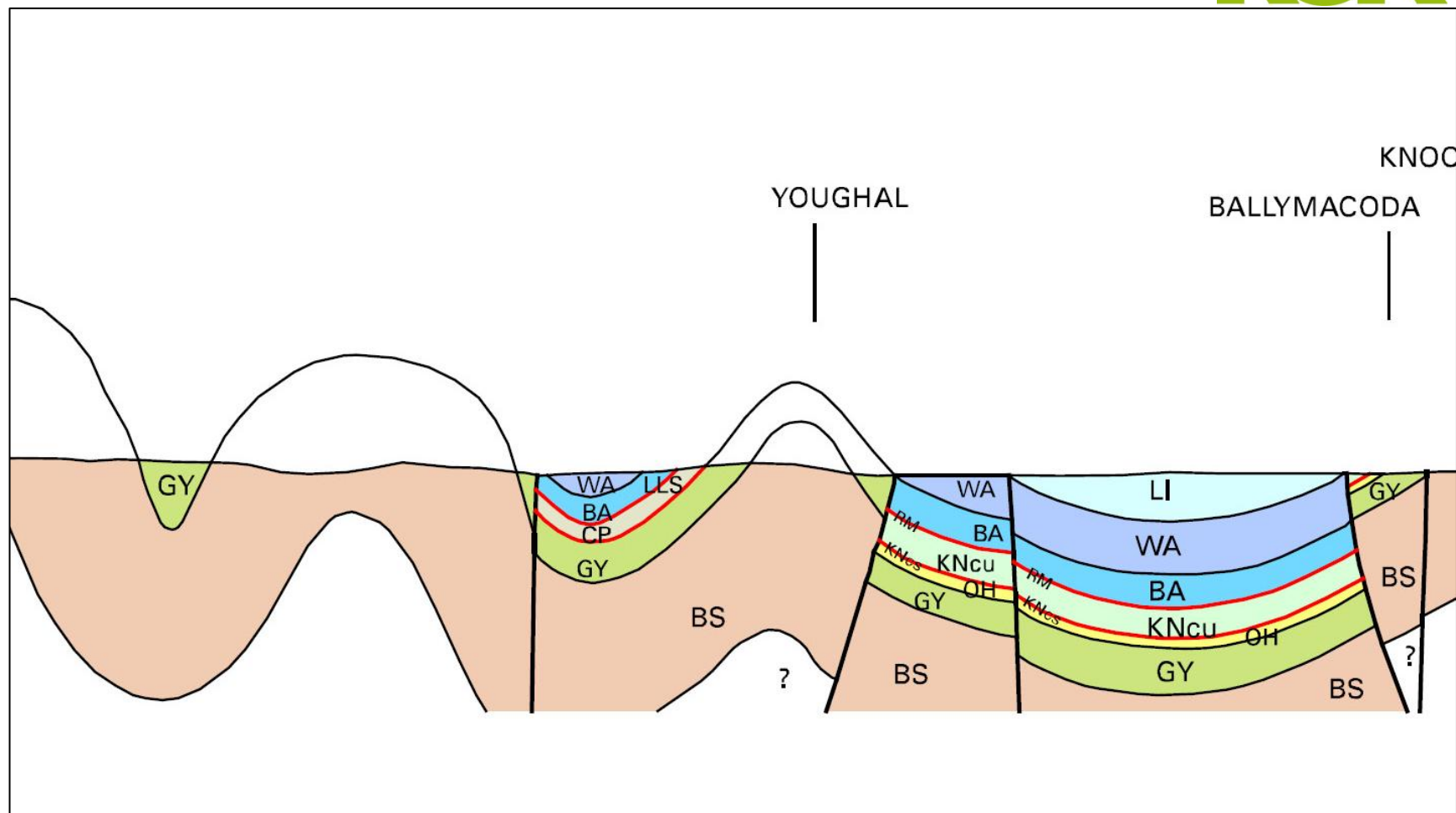
landslide susceptibility. There are some areas mapped as moderate to high close to the river along the western and southern edge of the redline boundary (**Figure 1.8**).

No mapped Landslide Event (GSI, Landslide Events) are recorded close to the study area.





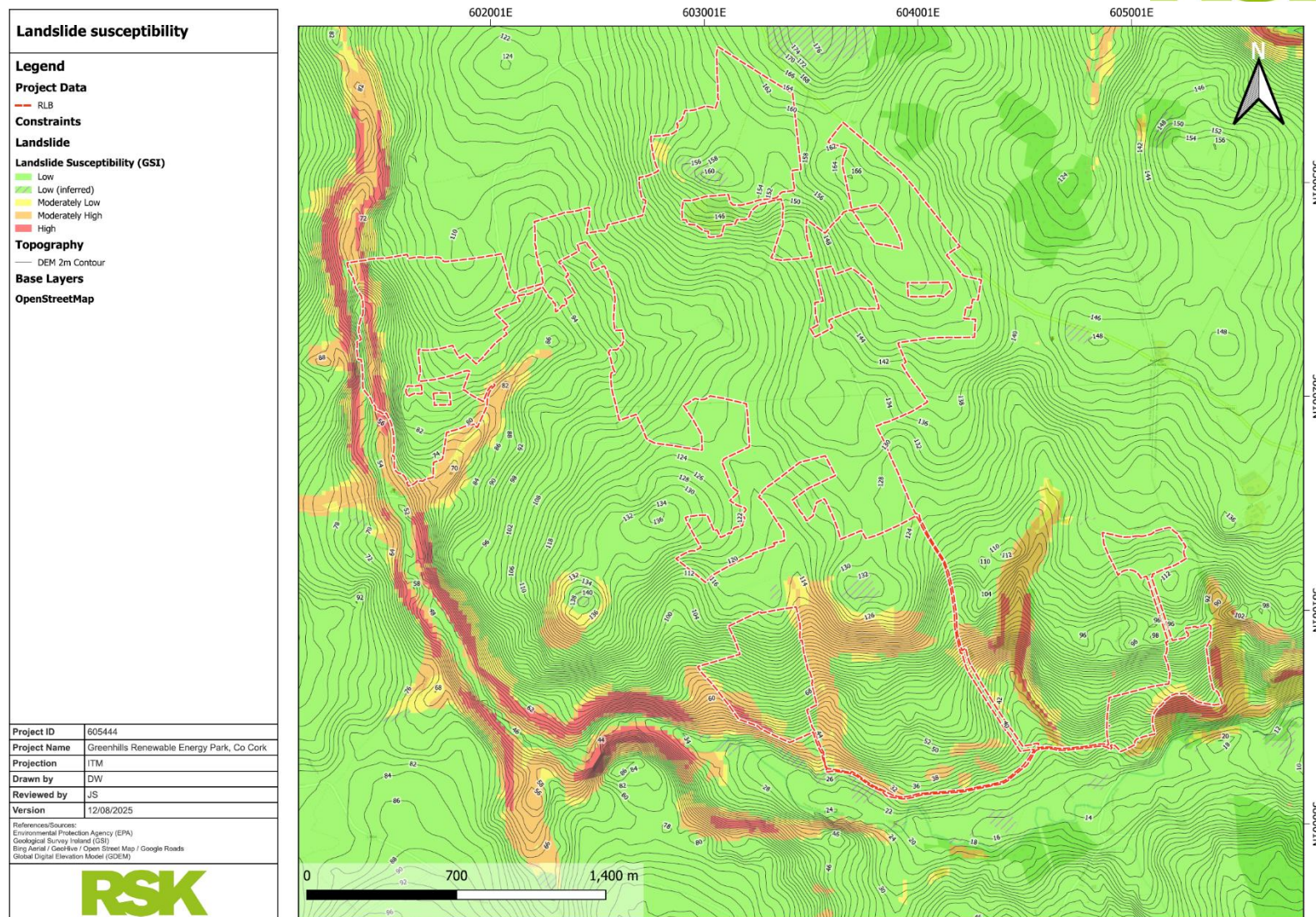
**Figure 1.6: Site bedrock geology**



**Figure 1.7: GSI cross section 22<sup>8</sup> orientated north south approximately 2km east of the Proposed Development**

<sup>8</sup> [https://secure.dccae.gov.ie/GSI\\_DOWNLOAD/Bedrock/Logs/GSI\\_Sections\\_2019/Sheet22CD.pdf](https://secure.dccae.gov.ie/GSI_DOWNLOAD/Bedrock/Logs/GSI_Sections_2019/Sheet22CD.pdf) [Accessed: July 2025]





**Figure 1.8: Site landslide susceptibility**

## 1.4 Potential Impacts and Effects on Land Soils and Geology

### 1.4.1 Construction Impacts and Effects

#### 1.4.1.1 'Do-nothing impact'

The "Do Nothing Impact" is the effect should the Proposed Development not be constructed. The existing land-use practices associated with agriculture will continue at the site. Additional tracks, recontouring of the land and excavation activities associated with the Proposed Development would not go ahead.

#### 1.4.1.2 Land

Currently, most of the site is classified as pasture and is used for dairy farming. During the construction phase of the Proposed Development, the land use will temporarily change, as construction areas will be fenced off and soil stripping will occur where necessary (such as at the substation, access tracks, compounds, and cable trenches). This change in land use will be temporary and reversible, as the land beneath the solar array will be reseeded once construction is complete.

Land take is an unavoidable impact of the Proposed Development and the construction will result in both temporary and permanent land take. The activities associated with land take include localized soil stripping, construction of hardstands, access tracks, temporary infrastructure, excavation of the onsite drainage and the temporary storage of excavated materials.

During the construction phase land take of circa 210ha ha will be required for the solar array. The BESS footprint on a cut and fill area will be circa 0.8ha and the 220kV AIS substation footprint circa 1.8ha. Inverter hardstands will occupy circa 0.9ha and inverter pads circa 0.6ha. The development of a new site access track will lead to land use change from agricultural to access track of circa 2.1ha. Upgrading of existing site access tracks and drainage features will lead to marginal changes in land use. There will also be one main temporary construction compound of circa 0.5ha and 4 smaller temporary construction compounds. Hardstand areas such as the temporary construction compounds will be developed using hard core compacted over geogrid on existing ground.

At the end of the construction phase any temporary works, including temporary construction compounds will be reinstated.

In the absence of mitigation, the likely effects on the land at the proposed development, an attribute of medium sensitivity, are direct, short to long-term (whether reinstated following the construction phase or the decommission phase) for the elements excluding the substation and moderate adverse effect with a significance level of moderate.

For the lands occupied by the substation and new access track and the upgraded existing access tracks the effect will be moderate, adverse and permanent.

#### 1.4.1.3 Soils and Geology

To construct the proposed development, temporary compounds will be constructed on existing ground level and decommissioned as the development proceeds through the programme of works. There will be removal of soil and subsoil will be required in a number of places to facilitate tracks, the drainage system, trenches for cabling and the substation and BESS areas.

Removal of soil, an attribute with medium to high importance will be moderate in scale. When segregated and managed, topsoils and subsoils can be reinstated similar to baseline conditions. The likely effects of removal and replacement of topsoils and subsoil is considered, localised, direct, short to long-term (depending on if temporary or permanent infrastructure) and moderate adverse with a significance level of moderate to significant. These effects are reversible through reinstatement.

The excavations and construction works will not exceed depths of 1.2m for cable trenches and 3.6m at the substation, therefore it is not expected that there will be any impacts to the underlying bedrock geology.

The cut and fill volume for the substation and BESS is estimated to be 25,013 m<sup>3</sup>. Topsoil excavated on site (estimated at 8,307m<sup>3</sup>) will be reused on site for landscaping purposes.

In addition, circa 9,320m<sup>3</sup> of stone fill will be used to cap the substation site to a depth of 400mm. This will be imported from suitable licenced quarries.

The expected duration of works is circa 21 months.

Once all construction works are complete, the work areas will be reinstated with excavated soil and either seeded out with native species, allowed to vegetate naturally or reinstated with excavated grass turves and will be restored to their original condition. This work will be carried out in consultation with the landowner and in line with any relevant measures outlined in the planning application, CEMP and planning conditions.

Refuelling and storage of hydrocarbons and other hazardous chemicals on site have the potential to leak and cause soil contamination. The unmitigated likely effects to soil quality from an accidental spillage would be localised, direct, long-term, small to moderate adverse effect with a significance level of **slight to significant**. However, this likely effect is considered to be naturally reversible (natural attenuation over a relatively medium to long term period of time), or theoretically reversible (through remediation and reinstatement activities over a relatively short to medium term period of time). With appropriate environmental engineering controls and measures, this potential risk can be significantly reduced.

Consideration of likely significant effects includes:

- The activities likely to occur on-site during the construction phase of the development.
- The potential likely impacts or changes resulting from the activity or action.
- The potential likely effects which are the consequences of the potential impacts.

These are summarised in **Table 1.14** and discussed in the subsequent sections.



**Table 1.14: Summary of likely construction phase activities, potential impacts and effects in the absence of mitigation**

| Activities                                                                                                                                                                                                                                                                                                                           | Potential likely impacts                                                                                                                                                                                                                                                                                 | Potential likely effects                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Soil striping<br>Recontouring<br>Excavation (foundations, cable trenching, drainage works)<br>Stockpiling<br>Construction of infrastructure (temporary and permanent)<br>Use of cementitious material<br>Reuse / importation of materials<br>Vehicular movement<br>Storage of hydrocarbons / chemicals<br>Hedgerows and tree felling | Land take<br>Exposed soils<br>Compaction and subsidence<br>Soil sealing<br>Erosion and degradation<br>Subsoil / bedrock removal<br>Hydrocarbon / chemical spill<br>Release of wastewater<br>Release of cementitious material<br>Soil stability<br>Slope stability<br>Migration of solids to site run off | Loss of land / change of land use<br>Soil quality<br>Increased run off<br>Release of suspended solids<br>Surface water quality<br>Groundwater quality<br>Soil contamination<br>Loss of natural materials<br>Alteration of the natural soil profile |

## 1.4.2 Operational Impacts and Effects

### 1.4.2.1 Land

The solar panels, access tracks, substation and BESS will require land take during the operation of the Proposed Development. Any temporary infrastructure will be reinstated following the construction phase leaving land take, including upgraded existing tracks of circa 219 ha of which 210ha will be occupied by solar panels.

The land take required during the operational phase is circa 69% of the red line boundary.

### 1.4.2.2 Soils and Geology

Soils under the footprint of the solar farm, over time have the potential to be compacted, leading to subsidence. Soil quality is considered to have medium to high importance and the magnitude of potential compaction is small. The overall likely effects are considered to be localised, direct, permanent, small adverse effect with a significance level of **slight**.

Vehicular movements will be limited to small vans/jeeps for routine maintenance site inspections which are anticipated 2-4 times per month during the operation of the Proposed Development, therefore there will be limited effects to the underlying soils as a result of vehicular movement.

Minor accidental leaks or spills of fuels/ oils from maintenance vehicles can adversely affect the underlying soil. Bunded transformer and generators will be used. This inherently captures any potential risks of contamination from oil spills and leaks, with an in-built mitigation in design. The effect of a hydrocarbon spill is to reduce the soil quality.

Soil is considered to have medium to high importance and the magnitude of potential contamination is small. The unmitigated likely effects of soil contamination related to hydrocarbon or oil spills during the operational phase of the Project is considered to be localised, direct, small adverse effect with a significance level of **slight to moderate**, but reversible through remediation.

Consideration of likely significant effects includes:

- The activities likely to occur on-site during the operational phase of the development.
- The potential likely impacts or changes resulting from the activity or action.
- The potential likely effects which are the consequences of the potential impacts.

These are summarised in Table 1.15 and discussed in the subsequent sections.

**Table 1.15: Summary of likely operational phase activities, potential impacts and effects**

| Activities                                                                                                                          | Potential likely impacts                                                               | Potential likely effects                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operation of permanent infrastructure (solar panels, substation, BESS)<br>Vehicular movement<br>Storage of hydrocarbons / chemicals | Land take<br>Compaction and subsidence<br>Soil sealing<br>Hydrocarbon / chemical spill | Loss of land / change of land use<br>Soil quality<br>Erosion<br>Soil contamination<br>Groundwater quality<br>Surface water quality<br>Increased run off<br>Increased flooding |

### 1.4.3 Decommissioning Impacts and Effects

#### 1.4.3.1 Land, Soils and Geology

Post operation and at decommissioning stage, it is proposed that inverter pads and hardstands will be removed and the lands reinstated to agricultural use. It is also proposed that the BESS unit will be decommissioned and the site restored to agriculture use also.

It is proposed that the Greenhills 220kV AIS substation and Loop-in Grid connection will remain in-situ and will be handed over to EirGrid for future use, representing a permanent land use change. The new and upgraded access tracks will also remain in situ representing a permanent land use change.

The design life of the Proposed Development is approximately 40 years. At this point the Proposed Development will be decommissioned, and the site will be returned to agricultural usage or extended with a new planning application with more modern technology.

No new effects are anticipated during the decommissioning phase of the project in comparison to the construction phase. The potential effects are the same or less than those outlined above for the construction phase.

## **1.5 Land, Soils and Geology Mitigation Measures**

### **1.5.1 Design**

Mitigation by avoidance was incorporated into the solar farm layout design phase with a focus on use of existing trackways and site entrances to minimise the requirements for new infrastructure. Although some hedgerow length will be lost this was minimised through use of existing access points and access tracks also.

### **1.5.2 Construction Environmental Management Plan (CEMP)**

All construction works will be managed and carried out in accordance with the Construction Environmental Management Plan (CEMP) which will be updated by the civil engineering contractor and agreed prior to any works commencing on site. All management plans will be 'live' documents, so that lessons learned, and improvements

Best practice will be applied during construction which will minimise double handling of material which will help reduce the site traffic. Earthwork activities will not be scheduled to be carried out during severe weather conditions.

### **1.5.3 Engineering controls**

Confirmatory geotechnical testing will be carried out to tailor the engineering controls, such as use of geotextile membranes, required for each individual element.

A geotechnical risk register will be completed and maintained as part of the construction works. Ground settlement, horizontal movement and vibration monitoring will be implemented during construction activities to ensure that the construction does not exceed the design limitations.

### **1.5.4 Land take**

The solar array areas and infrastructure layout were dictated to a large degree by the existing infrastructure (farm access tracks), topography and constraints identification, including set back distances. Infrastructure has been designed such that the areas of land take are being located outside of buffer zones for sensitive receptors and constraints areas.

### **1.5.5 Ground or soil sealing**

There is potential for soil sealing due to the use of impermeable material in certain locations typical of most types of construction particularly in greenfield sites.

This effect will be mitigated by reducing the area where impermeable material is used and by the use of semi permeable gravel access tracks to allow water to pass through, therefore reducing runoff. The use of a geotextile membrane on top of soils will facilitate decommissioning of areas back to original land use. The use of semi permeable material will reduce changes to the geotechnical and hydrogeological attributes compared to impermeable material.

There are five temporary construction compounds associated with the proposed development. Four of these are in the solar array areas with the main construction compound located at the vicinity of substation. The temporary construction areas will have their granular fill material removed and reused as the construction demand arises. The underlying geotextile membrane will also be removed and the areas utilised as part

of the solar array. On final decommissioning all solar areas will be returned to their original agricultural use.

The mitigated residual effects associated with ground or soil sealing is considered to have a significance level of slight and therefore not significant.

#### **1.5.6 Erosion and degradation**

Erosion and degradation of exposed soils will occur primarily during the construction phase. Mitigation against the potential effects, includes:

- Limiting the amount of exposed soil at any one time.
- Limiting vehicular movement to established infrastructure as far as practicable.
- Ceasing construction activities during periods of sustained significant rainfall events, or directly after such events.
- Covering exposed temporary stockpiles with plastic sheeting during periods where works have temporarily ceased (e.g., weekends / overnight) and ahead of heavy rainfall / storm alerts.
- Reusing soils and subsoils as quickly as possible.
- Any areas not required for operation will be reinstated including drainage to minimise future erosion of the soils.

The mitigated residual effects associated with erosion and degradation of soils during construction have a significance level of slight and are therefore **not significant**.

#### **1.5.7 Subsoils and bedrock removal**

The effect on the land, soils and geology associated with the removal of subsoils during the cut and fill operations will be minimised using the following practices.

##### **Mitigation by avoidance**

Engineered cut and fill extents have been designed to minimise the volumes of subsoils to be removed.

##### **Mitigation by reuse**

Subsoil which is excavated as part of the construction phase will be reused onsite wherever possible, primarily in the cut and fill construction for the substation, BESS and new access track.

##### **Mitigation by remediation**

On completion of the construction phase, any areas not required for operation will be reinstated. Therefore, the effect of required excavation works will be remediated and limited to the extent of the actual proposed infrastructure. Granular material will be removed as required and reinstated with soils in keeping with the adjacent soils. Drainage will be reinstated as required to minimise future erosion of the soils. Mitigation measures outlined will ensure the effects arising from excavation activities are minimised to the footprint of the development.

The mitigated residual effects on soils and subsoil associated with excavations is considered to have a significance level of slight and is therefore **not significant**.

#### **1.5.8 Stockpiles**

Given that excavations are unavoidable, so too are temporary stockpiles. However, if managed appropriately, the potential effects associated with stockpiles can be minimised.

Mitigation measures for stockpiles related to construction of the proposed Development are as follows:

- Storage of excavated soils will be kept outside of any sensitive buffers
- Temporary stockpiles will be limited in height (1.5m for topsoil and 2m for subsoil) and shall have side slopes battered back to a safe angle of repose.
- Exposed temporary stockpiles will be covered in plastic sheeting during periods where works have temporarily ceased (e.g., weekends / overnight) and ahead of heavy rainfall / storm alerts.
- Excavated topsoil and subsoil will be re-used on the site as soon as possible, reducing double handling, the need for stockpiling, and reduce the potential for soil erosion.
- Materials will be managed by the contractor in accordance with the CEMP No stockpiles will remain on site following the construction phase of the development and are therefore both temporary and reversible.
- The mitigated residual effects on the soils associated with storage of stockpiles is considered to be **not significant**.

#### 1.5.9 Soil contamination

Soil contamination, or the potential for contamination, is an inherent risk associated with any development. To protect soils from contamination from construction materials such as hydrocarbon and other contaminants the following will be implemented.

- Construction activities will be restricted to the footprint of the development, therefore the potential for contaminants reaching soils is likely limited to the footprint of the development or construction area.
- Dedicated, bunded storage areas will be used for all fuels or hazardous substances.
- Spill kits will be maintained near to fuel storage areas
- Contaminants including any contaminated soil will be removed from the site in an appropriate manner if and when they should be produced or observed, and suitable remediation work undertaken.
- Should a significant contamination or pollution incident e.g., discharge or accidental release of hydrocarbons / fuel, contamination occurrences will be addressed immediately, this includes the cessation of works in the area of the spillage until the issue is resolved. If necessary, the relevant authorities will be notified as per the CEMP Emergency Response Plan, and stakeholders will also be promptly informed.

##### 1.5.9.1 Imported aggregate

Only verified clean, inert material will be used and will be locally sourced and conform to relevant standards to prevent changes to the baseline conditions.



#### 1.5.9.2 *Invasive species*

Areas which have been identified as containing non-native invasive species will be avoided and fenced off.

Should the need arise, the removal, treatment and disposal of any identified invasive non-native plants including contaminated soils will be undertaken in accordance with the latest guidance by the Appointed Contractor to prevent further growth or spread beyond the site.

The mitigated residual effects on soil quality associated with soil contamination is considered to have a significance level of slight and therefore **not significant**.

#### 1.5.10 **Material and waste management**

A Resource and Waste Management Plan has been prepared as part of the CEMP. All excavated earth materials, wherever possible, will either be re-used in an environmentally appropriate and safe manner (e.g., reinstatement, landscaping) or removed from the Proposed Development site at the end of the construction phase.

The mitigated residual effects associated with materials and waste management is considered to be **not significant**.

##### 1.5.10.1 *Ground stability*

A geotechnical engineer / engineering geologist will be employed during the construction phase to monitor excavation activities, to verify that safety standards are being met and monitor for any potential stability issues, particularly in areas of deeper excavations or tree felling.

With a view to applying the precautionary principle, the following procedures will be adopted as best practice mitigation measures at the Proposed Development to mitigate against potential ground stability effects:

- The Contractor's methodology statement and risk assessment will be in line with the CEMP and will be reviewed and approved by a suitably qualified geotechnical engineer/engineering geologist prior to site operations.
- Particular attention and pre-construction assessment (developer / sub-contractor site specific risk assessment and method statement (RAMS) and on-site toolbox talks etc.)
- An emergency response system will be developed for the construction phase of the Project, particularly during the early excavation phase.
- Construction activities will not occur during periods of sustained significant rainfall events, or directly after such events to allow time for work areas to drain.
- Vehicular movements will be restricted to the footprint of the proposed development.
- Temporary stockpiles will be restricted to the footprint of the proposed development and adhere to mitigation measures outlined in section 11.5.8.
- In the event that soil stability issues arise during construction activities, all ongoing construction activities at the particular area of the site will cease

immediately, the assigned geotechnical supervisor will inspect and characterise the issue at hand, corrective measures will be prescribed.

Adhering to the mitigation measures described will minimise the adverse effects posed by stability issues.

The mitigated residual effects associated with ground stability on the land, soils and geology are considered to have a significance level of slight and therefore not significant.

## **1.6 Residual Effects on Land, Soils and Geology**

Mitigation measures outlined in this report lay down the framework to reduce all potential effects of the proposed development on geological receptors. The mitigation laid out in this chapter provides mitigation by avoidance measures for land, soils and geology. The mitigated potential effects lay down the achievable benchmarks provided measures are considered and implemented adequately.

The unavoidable residual effects on the soils and geology environment as a function of the proposed development, is that there will be a change in ground conditions at some locations within the proposed development site with natural materials such as soil, subsoil and bedrock being replaced by concrete, subgrade and surfacing materials.

The residual effects after implementation of all mitigation measures for the construction phase of the proposed development on the land, soils and geology are considered to be generally short-term (length of construction) to long-term, localised to the footprint of the development and partially reversible through reinstatement. The mitigated residual effects are considered to have a significance level of slight and therefore are not significant.

No further effects are anticipated during the operational phase of the proposed development on the geological, geomorphological and geotechnical environment therefore no additional mitigation measures are required.

Maintenance and monitoring during the operational phase of the proposed development pose similar potential effects associated with the construction phase but to a far lesser extent. The operational team will carry out maintenance works (to site tracks, onsite substation, solar panels and associated infrastructure) and will put in place control measures to mitigate the risk of hydrocarbon or oil spills during the operational phase of the solar farm. Any vehicles utilised during the operational phase will be maintained on a weekly basis and checked daily to ensure any damage or leakages are corrected.

The likely effects on the land, soil and geology during the operational phase of the proposed development will be mitigated through good site practice, management of vehicular movements, hydrocarbon controls. The mitigated residual effects from the operational phase are considered to have a significance level of slight and are therefore not significant.

On completion of reinstatement works following the construction phase, it is expected that the solar farm will be returned as close to its present condition. With the passage of time the site will be reinstated and left to revegetate naturally over and revert to a more natural drainage regime. It is expected that the long-term residual effects associated with the development will therefore have a significance level of slight and therefore not significant.

#### **1.6.1 Land take**

Land take is an unavoidable effect of the proposed Development, careful design reduces the land take. The residual effects of land take on the land have a significance level of **slight**.

#### **1.6.2 Soils and Geology**

It is expected that the residual effects associated with the construction phase of the proposed development on the land soils and geology will have a significance level of **slight**.

### **1.7 Conclusion on Land, Soils and Geology**

From the baseline study and impact assessment it is considered that with the implementation of the mitigation measures outlined in this report the potential impacts of the proposed development on the identified receptors will not result in any likely significant effects on the land, soils, and geology.

## 1.8 Hydrogeology and Hydrology Existing Environment

### 1.8.1 Hydrogeology Existing Environment

#### 1.8.1.1 Aquifer Characteristics

The site is underlain by a Locally Important Aquifer (LI) which describes bedrock which is moderately productive only in local zones (**Figure 1.9**).

From the WFD Working Group on Groundwater Guidance Document No. 5 (2004), a groundwater body is at risk of failing its WFD objectives if the *Abstraction: Recharge* ratio is greater than:

- 5% for groundwater bodies that are supporting a GWDTE;
- 20% for bedrock groundwater bodies; and
- 30% for gravel groundwater bodies.

The Proposed Development overlies the Glenville Groundwater Body which covers an area of 1,107 km<sup>2</sup>.

The Glenville Groundwater Body has assigned the latest status 2019-2024 as Good, as well as the river water bodies within the Tourig\_SC\_10 Sub Catchment, meaning that the quantitative assessments, including tests for saline (or other) intrusions, impacts of groundwater on surface waters, Groundwater Dependent Ecosystems and water balance tests are met.

There are no karst features close to the site. Historic maps have indicated previous mapped 'springs' or 'rises' in the area.

#### 1.8.1.2 Groundwater Vulnerability

Groundwater vulnerability is a measure of the inherent geological and hydrogeological characteristics which determine the ease at which groundwater may potentially become contaminated via human activities at the surface. The vulnerability of groundwater is dependent upon multiple factors including the type and quantity of contaminants and the rate they can flow to the groundwater and the attenuating capacity of the geological deposits through which the water travels. These factors are controlled by the types of subsoil that overlie the groundwater, the way in which the contaminants recharge the geological deposits (point or diffuse source) and the unsaturated thickness of geological deposits from the point of contaminant discharge.

The GSI vulnerability mapping guidelines (**Table 1.16**) allow for the assignment of vulnerability ratings from "extreme" to "low", depending upon the subsoil type and thickness. An additional extreme "X" category is used to denote areas of bedrock outcrop or subcrop, or within 30m of a location of point recharge such as a karst feature.

**Table 1.16: Groundwater vulnerability mapping guidelines (Lee et al. 2008<sup>9</sup>)**

| Depth to rock                                                                                                                                                                                                                                                                                                                                                                                                         | Hydrogeological requirements for vulnerability categories |                                      |                                               |                                 |                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|--------------------------------------|-----------------------------------------------|---------------------------------|-------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                       | Diffuse recharge                                          |                                      |                                               | Point recharge                  | Unsaturated zone              |
|                                                                                                                                                                                                                                                                                                                                                                                                                       | High permeability (sand / gravel)                         | moderate permeability (sand subsoil) | low permeability (clayey subsoil, clay, peat) | (swallow holes, losing streams) | (sand & gravel aquifers only) |
| 0-3m                                                                                                                                                                                                                                                                                                                                                                                                                  | Extreme                                                   | Extreme                              | Extreme                                       | Extreme (30m radius)            | Extreme                       |
| 3-5m                                                                                                                                                                                                                                                                                                                                                                                                                  | High                                                      | High                                 | High                                          | N/A                             | High                          |
| 5-10m                                                                                                                                                                                                                                                                                                                                                                                                                 | High                                                      | High                                 | Moderate                                      | N/A                             | High                          |
| >10m                                                                                                                                                                                                                                                                                                                                                                                                                  | High                                                      | Moderate                             | Low                                           | N/A                             | High                          |
| <p>i. N/A = not applicable<br/> ii. Release point of contaminants is assumed to be 1-2m below ground surface.<br/> iii. Permeability classifications relate to the engineering behaviours as described by BS5930.<br/> iv. Outcrop and shallow subsoil (i.e. generally &lt;1.0m) areas are shown as a sub-category of extreme vulnerability.</p> <p>(amended from Deakin and Daly (1999) and DELG/EPA/GSI (1999))</p> |                                                           |                                      |                                               |                                 |                               |

The groundwater vulnerability on site varies from moderate (M) to rock at or near surface (X). Most of the site is classed at high (H), with more extreme ground water vulnerability mapped close to the rivers and towards the south of the redline boundary (**Figure 1.10**).

Based on the mapped subsoil permeability (section 1.3.3.3) the depth to bedrock on site ranges from 0 – 10m with shallower bedrock found closer to the mapped rivers. In the small area mapped as moderate vulnerability the depth to bedrock is deeper (>10m).

#### 1.8.1.3 Groundwater Recharge

The groundwater recharge map is generated from the GSI online Geohive dataset which provides Effective Rainfall, Average Recharge and Average Recharge Range.<sup>10</sup>

The volume of effective rainfall likely to reach groundwater (i.e., recharge) is estimated from recharge coefficients compiled by the Irish Working Group on Groundwater<sup>11</sup>, which are based on soil drainage, subsoil permeability, vulnerability and aquifer type. The effective rainfall (total rainfall – actual evapotranspiration) ranges from 806-881mm/yr at the Proposed Development.

Most of the site is assigned a recharge coefficient of 60% with some areas close to rivers assigned 85%. The Average Recharge is indicated as being 200mm/yr with an estimated recharge ranges from 151-200mm/yr (**Figure 1.11**).

#### 1.8.1.4 Groundwater Resources

##### Groundwater Abstractions and Wells

There are four private/agricultural wells located within the red line boundary these are summarized in **Table 1.17** below and shown in **Figure 1.12**.

<sup>9</sup> Lee, M., Hunter Williams, N., Meehan, R., Kelly, R., Kabza, M., Murphy, O and Spillane, M (2008) Groundwater Vulnerability Mapping. Irish National Hydrology Conference.

<sup>10</sup> <https://gsi.geodata.gov.ie/portal/apps/webappviewer/index.html?id=d333a8a9b6ab44378411fc0d973db4ef>

<sup>11</sup> Working Group on Groundwater, 2005. Guidance on the Assessment of the Impact of Groundwater Abstractions.



**Table 1.17: Agricultural wells on site**

| ID | X (ITM) | Y (ITM) |
|----|---------|---------|
| 1  | 603166  | 582653  |
| 2  | 603246  | 582657  |
| 3  | 603244  | 582880  |
| 4  | 603383  | 582563  |

Regionally there is the water supply zone for Youghal-Lands, Youghal Regional. Youghal Regional falls within the South West Regional water supply zone

It is assumed as a worst-case scenario that all dwellings possess their own private well as there is no updated database in existence for private wells.

The GSI Groundwater well, borehole and spring database contains records of boreholes, dug wells, springs, and ground site investigations derived from GSI drilling, fieldwork and surveys, Local Authorities and other state bodies, Private Well Grants, Drillers, Consultants, Group Water Schemes and Academia (GSI, Wells and Springs). The locations of records have different accuracies depending on the source data. It should be noted that it is not a comprehensive database. **Table 1.18** contains abstraction boreholes within 2km of the site. Two off these boreholes (2007NWW040, 2007NWW061) are located within the redline boundary however their location accuracy is within 1km.

Any historically mapped springs within the redline boundary were investigated during the site survey however no evidence of these features were found.

**Table 1.18: GSI boreholes and springs database within 2km of the site**

| ID         | Date | Location accuracy | Distance       | Type     | Depth to bedrock | Yield class                      | Use                 |
|------------|------|-------------------|----------------|----------|------------------|----------------------------------|---------------------|
| 2007NWW040 | 1969 | to within 1km     | Within the RLB | Borehole | 6.1              | Moderate (65.5m <sup>3</sup> /d) | NA                  |
| 2007NWW061 | NA   | to 1km            | Within the RLB | Borehole | 1.5              | NA                               | Unknown             |
| 2007NWW071 | 1999 | to 50m            | 3m             | Borehole | 3.1              | Poor (30m <sup>3</sup> /d)       | Unknown             |
| 2007NWW116 | 2000 | to 50m            | 92m            | Borehole | 0.9m             | Moderate (87.3m <sup>3</sup> /d) | Agri & domestic use |
| 2007NWW060 | NA   | to 20m            | 100m           | Unknown  | 3.5m             | NA                               | Other               |
| 2007NWW072 | 2000 | to 100m           | 133m           | Borehole | 4.6m             | Moderate (87.2m <sup>3</sup> /d) | Domestic use only   |
| 2007NWW076 | NA   | to 10m            | 209m           | Borehole | NA               | NA                               | NA                  |
| 2007NWW062 | 1957 | to 1km            | 268m           | Borehole | 3.1m             | NA                               | Unknown             |
| 2007SWW056 | NA   | to 20m            | 361m           | Borehole | NA               | NA                               | Other               |
| 2007NWW070 | 1998 | to 20m            | 444m           | Borehole | 6.1m             | Moderate (54.5m <sup>3</sup> /d) | Domestic use only   |

| ID         | Date | Location accuracy | Distance | Type     | Depth to bedrock | Yield class                      | Use                   |
|------------|------|-------------------|----------|----------|------------------|----------------------------------|-----------------------|
| 2007SWW042 | 1982 | to 50m            | 512m     | Borehole | 25.3m            | Excellent (979m <sup>3</sup> /d) | Public supply (Co Co) |
| 2007NWW035 | 1973 | to within 1km     | 623m     | Borehole | 5.5m             | Poor (21.8m <sup>3</sup> /d)     | NA                    |
| 2007NWW042 | NA   | to within 1km     | 641m     | Borehole | 1.8m             | Good (109m <sup>3</sup> /d)      | Public supply (Co Co) |
| 2007NWW115 | 2002 | to 50m            | 700m     | Borehole | 3.1m             | Moderate (65.5m <sup>3</sup> /d) | Agri & domestic use   |
| 2007SWW014 | 1970 | to 1km            | 833m     | Borehole | 3m               | Poor (38.2m <sup>3</sup> /d)     | Unknown               |
| 2007NWW038 | 1971 | to within 1km     | 903m     | Borehole | 6.1m             | Poor (22m <sup>3</sup> /d)       | NA                    |
| 2007NWW063 | 1961 | to 1km            | 1039m    | Borehole | 2m               | Good (109m <sup>3</sup> /d)      | Unknown               |
| 2007NWW064 | NA   | to 1km            | 1060m    | Borehole | 1.8m             | NA                               | Unknown               |
| 2007NWW032 | 1963 | to within 1km     | 1088m    | Borehole | 10.7m            | Poor (8.7m <sup>3</sup> /d)      | NA                    |
| 2007SWW017 | 1961 | to 1km            | 1253m    | Borehole | 2m               | Poor (27.3m <sup>3</sup> /d)     | Unknown               |
| 2007NWW054 | NA   | to within 10m     | 1261m    | Borehole | NA               | Poor (14m <sup>3</sup> /d)       | NA                    |
| 2007SWW100 | NA   | to 10m            | 1338m    | Borehole | 4m               | NA                               | NA                    |
| 2007SWW071 | 1998 | to 50m            | 1509m    | Borehole | 6.7m             | Moderate (65.5m <sup>3</sup> /d) | Domestic use only     |
| 2007SWW061 | 1972 | to 1km            | 1519m    | Borehole | 1.5m             | Poor (10.9m <sup>3</sup> /d)     | Unknown               |
| 2007NWW073 | 1999 | to 200m           | 1539m    | Borehole | 3.7m             | Poor (38.15m <sup>3</sup> /d)    | Domestic use only     |
| 2007SWW070 | 1998 | to 50m            | 1586m    | Borehole | 2.7m             | Moderate (52.2m <sup>3</sup> /d) | Domestic use only     |
| 2007NWW041 | 1970 | to within 1km     | 1653m    | Borehole | 5.5m             | Poor (28m <sup>3</sup> /d)       | NA                    |
| 2007NWW117 | NA   | to 50m            | 1655m    | Borehole | 2.4m             | Good (163.6m <sup>3</sup> /d)    | Agri & domestic use   |
| 2007NWW031 | 1964 | to within 1km     | 1902m    | Borehole | 3.1m             | Poor (10.9m <sup>3</sup> /d)     | NA                    |
| 2007SWW020 | 1961 | to 1km            | 1922m    | Borehole | 12.2m            | Good (109.1m <sup>3</sup> /d)    | Unknown               |
| 2007NWW021 | 1970 | to within 1km     | 1942m    | Borehole | 4.6m             | Poor (38.2m <sup>3</sup> /d)     | NA                    |
| 2007SWW055 | 1970 | to 1km            | 1965m    | Borehole | 2.4m             | Moderate (54.5m <sup>3</sup> /d) | Unknown               |
| 2007SWW021 | 1971 | to 1km            | 1972m    | Borehole | 7.6m             | NA                               | Unknown               |

### **Group Water Schemes**

Group Water Schemes (GWSs) are community-run water supply schemes and GSI holds a register publicly available through GSI map viewer.

According to the review of GSI map, there are no group water schemes located at or close to the site.

### **Public Water Schemes**

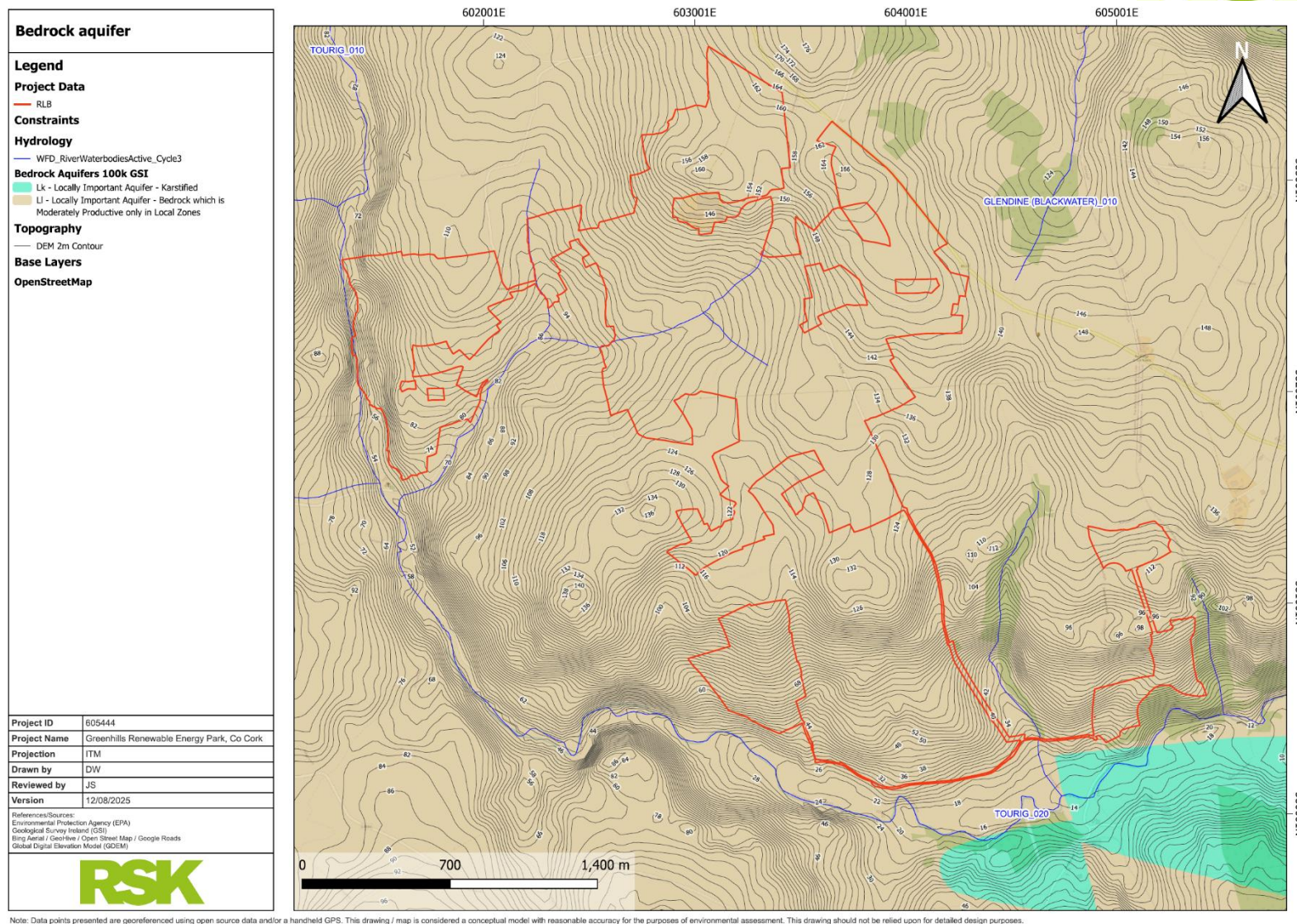
Also, there are no public water schemes located at or close to the site based on GSI mapping review.

#### **1.8.1.5 Groundwater Flow Direction**

Groundwater flow in the Glenville Groundwater Body (GWB) occurs in faults and joints as the rocks have no intergranular permeability<sup>12</sup>. The flow most likely occurs in an upper shallow weathered zone with flow towards the rivers and streams. Therefore, groundwater flow directions in the bedrock aquifer underlying at the Site are presumed to follow the topography of the area. The flow paths are generally less than a few 100 meters in length.

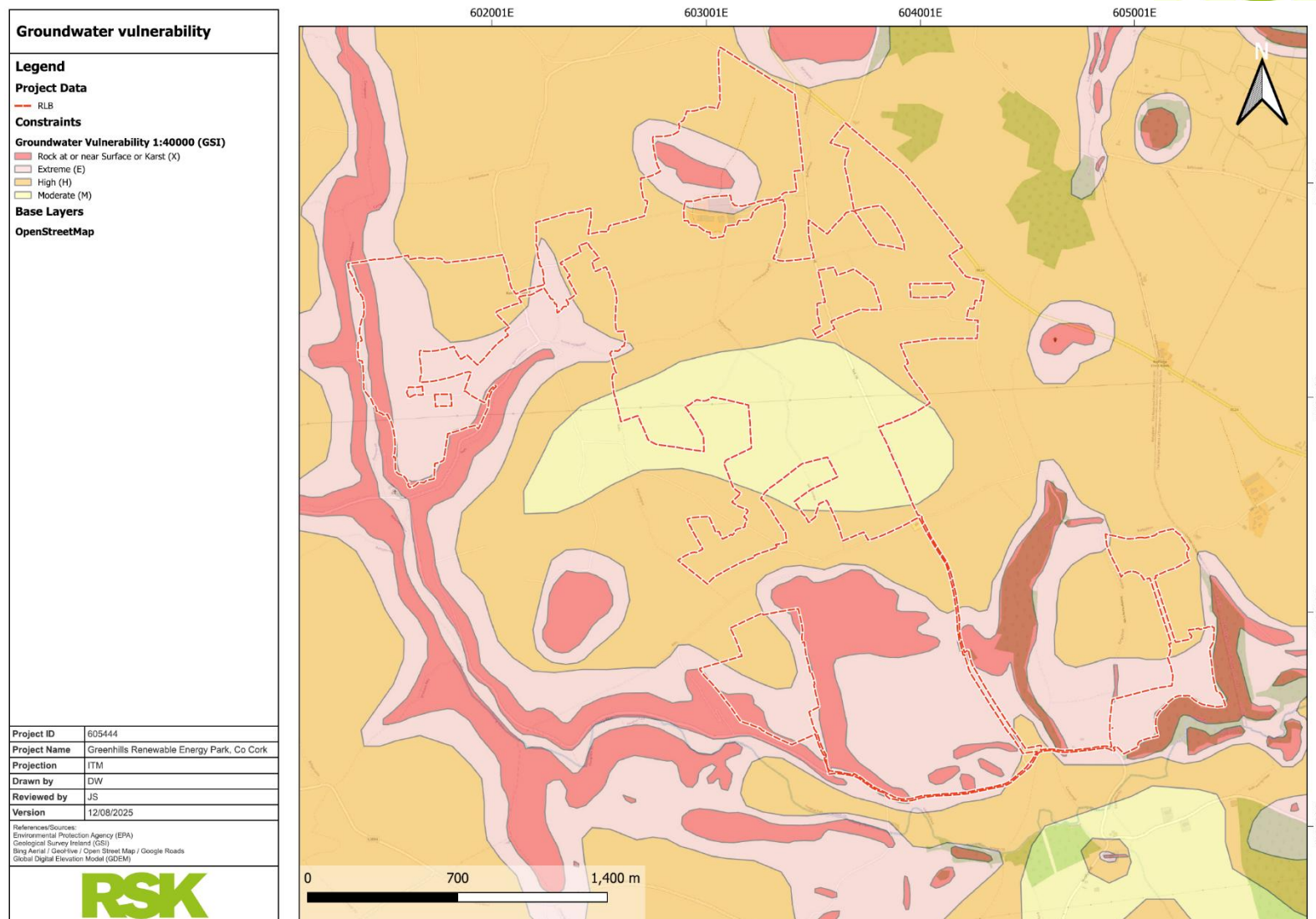
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<sup>12</sup> Geological Survey of Ireland (2004) Glenville GWB: Summary of Initial Characterisation. Available at: <https://gsi.geodata.gov.ie/downloads/Groundwater/Reports/GWB/GlenvilleGWB.pdf>



**Figure 1.9: Site bedrock aquifer**

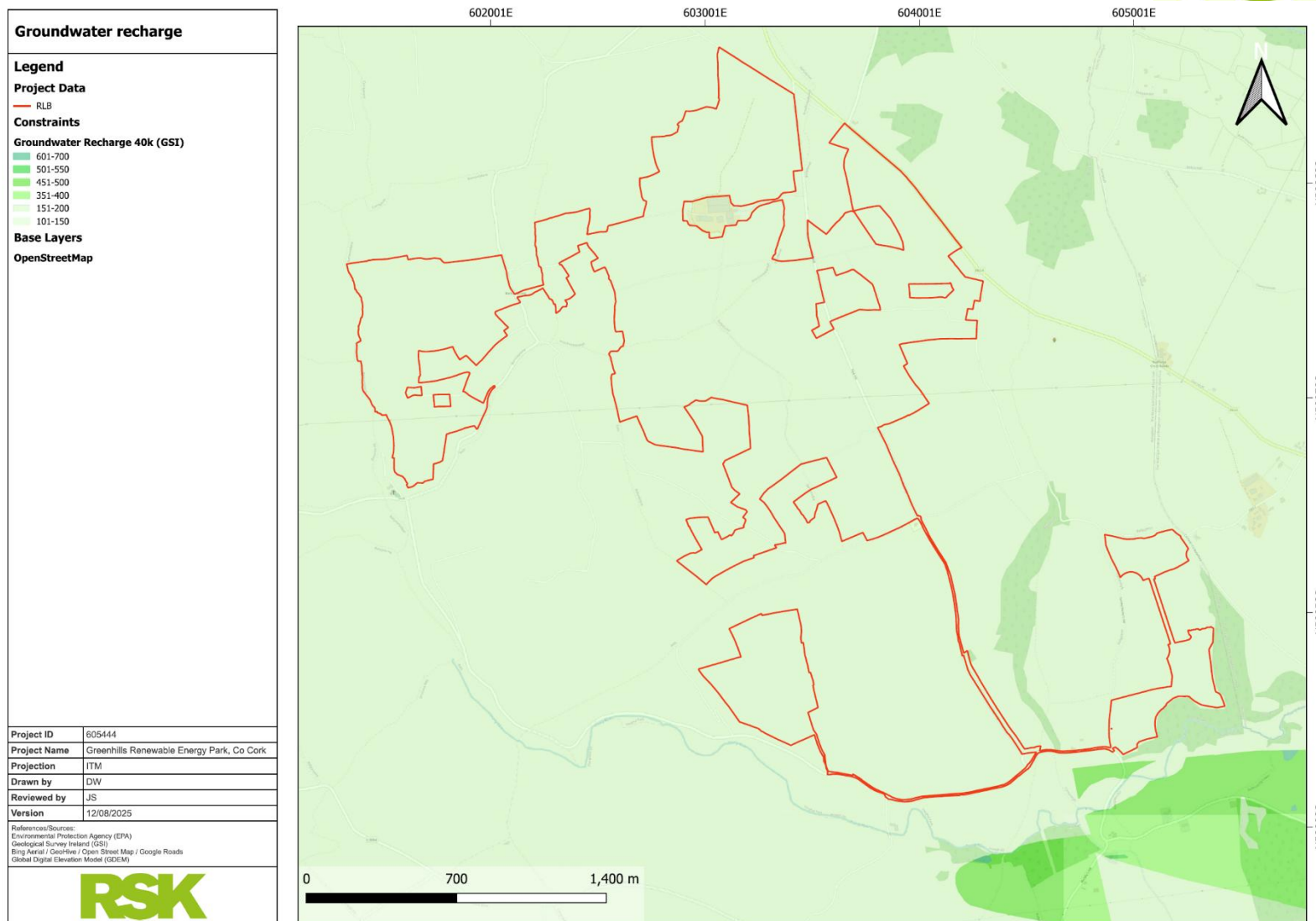




Note: Data points presented are georeferenced using open source data and/or a handheld GPS. This drawing / map is considered a conceptual model with reasonable accuracy for the purposes of environmental assessment. This drawing should not be relied upon for detailed design purposes.

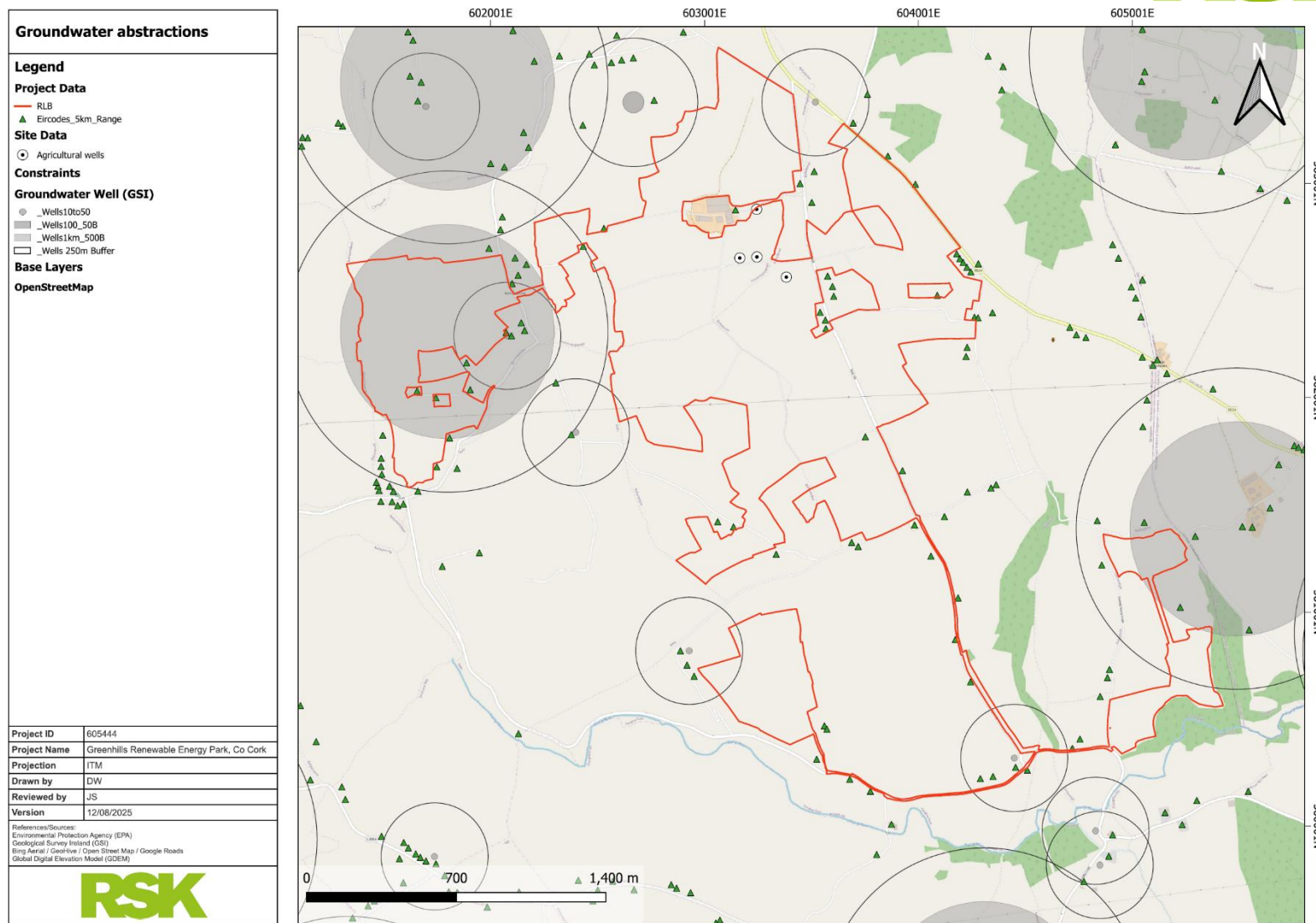
**Figure 1.10: Groundwater vulnerability**





Note: Data points presented are georeferenced using open source data and/or a handheld GPS. This drawing / map is considered a conceptual model with reasonable accuracy for the purposes of environmental assessment. This drawing should not be relied upon for detailed design purposes.

**Figure 1.11: Groundwater recharge**



**Figure 1.12: Groundwater abstractions**

## 1.8.2 Hydrology Existing Environment

### 1.8.2.1 Regional and Local Hydrology

The site is situated within the Blackwater (Munster) WFD Catchment (Hydrometric area (HA) 18) draining a total area of 3311km<sup>2</sup>. This catchment is subdivided into 28 catchments with the site falling into the Tourig\_SC\_010. The regional and local hydrology of the site are summarised below in **Table 1.19** and **Figure 1.13**.

**Table 1.19: Summary of the catchment, sub catchment and sub basin at the site**

| WFD Catchment                | WFD SubCatchment     | WFD River Sub Basin                         | River Waterbody                             |
|------------------------------|----------------------|---------------------------------------------|---------------------------------------------|
| Blackwater (Munster) [HA_18] | Tourig_SC_010 [18-8] | Tourig_020 [IE_SW_18T030700]                | Tourig_020 [IE_SW_18T030700]                |
|                              |                      | Glendine (Blackwater)_010 [IE_SW_18G070300] | Glendine (Blackwater)_010 [IE_SW_18G070300] |

### 1.8.2.2 Site Specific Hydrology

The Site is characterised by a relatively extensive network of historic drains, with occasional non-mapped natural and artificial drainage channels (**Figure 1.14**). The drainage classifications are summarised in **Table 1.20**.

**Table 1.20: Drain classifications**

| Drain classification              | Description                                                  |
|-----------------------------------|--------------------------------------------------------------|
| Historically Mapped Surface Water | 25-inch maps located on GeoHive maps (Not mapped by EPA/WFD) |
| Primary Drainage                  | Main artery of drains on site                                |
| Secondary Drainage                | Connection to primary drains                                 |
| Tertiary Drainage                 | Connection to secondary drains                               |

### 1.8.2.3 Surface Water Hydrochemistry

Hydrochemistry data for the monitoring stations is continuously being monitored as part of the WFD Cycle 3 sub catchment assessments, this data is then used to assign WFD status. **Table 1.11** outlines the most recent hydrochemistry data available for the Glendine (Blackwater)\_010 and Lower Blackwater M Estuary / Youghal Harbour. No hydrochemistry data is available for the Tourig\_020.

**Table 1.21: EPA hydrochemistry on the surrounding river bodies**

| Parameter                                | Unit         | Glendine (Blackwater)_010 <sup>13</sup><br>Station ID – RS18G070300<br>Monitoring date: 07/07/2025 | Lower Blackwater M Estuary /<br>Youghal Harbour <sup>14</sup><br>Station ID – TW31003144BR2012<br>Monitoring date: 03/07/2025 |
|------------------------------------------|--------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Dissolved Oxygen                         | % Saturation | 95                                                                                                 | 112                                                                                                                           |
| True Colour                              | mg/l Pt Co   | <5                                                                                                 | -                                                                                                                             |
| Chloride                                 | mg/l         | 18.2                                                                                               | -                                                                                                                             |
| Total Hardness (as CaCO <sub>3</sub> )   | mg/l         | 70                                                                                                 | -                                                                                                                             |
| ortho-Phosphate (as P) - unspecified     | mg/l         | <0.01                                                                                              | <0.005                                                                                                                        |
| pH                                       | pH units     | 7.6                                                                                                | 8                                                                                                                             |
| Temperature                              | °C           | 12.7                                                                                               | 14.6                                                                                                                          |
| Total Oxidised Nitrogen (as N)           | mg/l         | 3.5                                                                                                | 0.03                                                                                                                          |
| Dissolved Oxygen                         | mg/l         | 9.9                                                                                                | -                                                                                                                             |
| Conductivity @25°C                       | µS/cm        | 200                                                                                                | -                                                                                                                             |
| Ammonia-Total (as N)                     | mg/l         | <0.02                                                                                              | 0.028                                                                                                                         |
| Alkalinity-total (as CaCO <sub>3</sub> ) | mg/l         | 49                                                                                                 | -                                                                                                                             |
| BOD - 5 days (Total)                     | mg/l         | <1                                                                                                 | <1                                                                                                                            |
| Chlorophyll a (Fluorescence)             | µg/l         | -                                                                                                  | 1.6                                                                                                                           |
| Salinity                                 | PSU          | -                                                                                                  | 33.7                                                                                                                          |

#### 1.8.2.4 Site Specific Hydrochemistry

No surface water sampling was conducted during site surveys however some field measurements were collected (SW1-SW6) and are summarised below in **Table 1.12**.

<sup>13</sup> [https://www.catchments.ie/data/#/waterbody/IE\\_SW\\_18G070300?\\_k=1zobge](https://www.catchments.ie/data/#/waterbody/IE_SW_18G070300?_k=1zobge)

<sup>14</sup> [https://www.catchments.ie/data/#/waterbody/IE\\_SW\\_020\\_0100?\\_k=4pljq7](https://www.catchments.ie/data/#/waterbody/IE_SW_020_0100?_k=4pljq7)

**Table 1.22: Field surface water measurements taken using a HANNA on the 18/02/2025**

| SW location | X (ITM)   | Y (ITM)   | PH   | Temperature (C) | Conductivity (µS/cm) | Total dissolved solids (ppm) |
|-------------|-----------|-----------|------|-----------------|----------------------|------------------------------|
| SW1         | 603033.03 | 582367.87 | 6    | 9.7             | 232                  | 119                          |
| SW2         | 602212.42 | 582783.39 | 5.93 | 8.9             | 156                  | 79                           |
| SW3         | 606367.57 | 580275.65 | 6.62 | 9.9             | 164                  | 84                           |
| SW4         | 604629.85 | 581570.72 | 6.35 | 10.2            | 224                  | 116                          |
| SW5         | 603845.64 | 579982.71 | 6.48 | 10.7            | 149                  | 75                           |
| SW6         | 603419.65 | 581283.84 | 6.11 | 9.4             | 244                  | 124                          |

### 1.8.3 Flood Risk

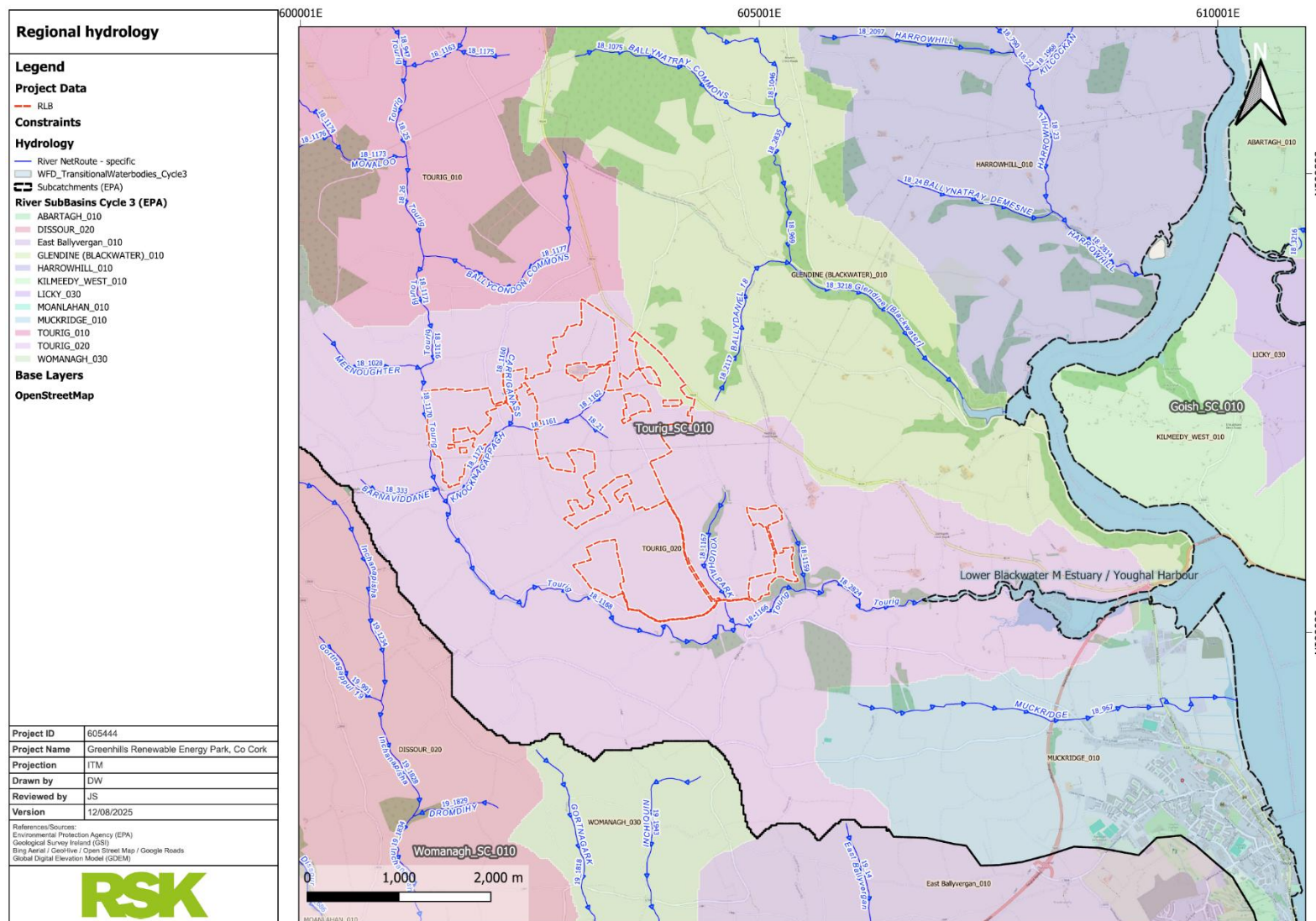
The Office of Public works (OPW) interactive flood maps were consulted to assess flood the risk of flooding at the site. The full flood risk assessment is attached as **Appendix B**.

No past flood events, as mapped by the OPW, are shown in proximity to the site. Historic maps on the GSI website were assessed and no historic flooding has been indicated on site. Catchment Risk Assessment and Management (CFRAM) “predictive” maps were also consulted. These maps show areas predicted to be inundated during a theoretical or ‘design’ flood event with an estimated probability of occurrence. The site does not fall within any low, medium or high probability flood zones. However, the Tourig\_20 and Glendine\_010 which run adjacent to the site have been mapped as having National indicative flooding in present day, in low and medium probability flood zones. Local knowledge has also indicated that local flooding is occurring within the same river sub-basin of the site.

The CFRAM do not take into account potential changes due to climate change and were consequently prepared using various climate projections. The Mid-Range Future Scenario (MRFS) extent were generated taking in the potential effects of climate change using an increase in rainfall of 20% and sea level rise of 500mm. The High-End Future Scenario (HRFS) extent were generated taking in in the potential effects of climate change using an increase in rainfall of 30% and sea level rise of 1,000 mm. Under both the MRFS and HRFS scenarios the site does not fall within any low, medium or high probability flood zones. Similarly to above, the National Indicative Fluvial Flooding in MRFS and HRFS are mapped along the Tourig\_20 and Glendine\_10 running adjacent to the site.

The flood risk on site is likely low but there is some flooding downstream therefore mitigation measures to reduce surface water runoff will be implemented.





**Figure 1.13: Regional hydrology**



**Figure 1.14: Site specific hydrology**



#### 1.8.4 Water Framework Directive

The WFD status of river water bodies associated with the Tourig\_SC\_10 Sub Catchment ranges from “Good” to “Moderate”. However, there are noted significant pressures on water quality from Agriculture<sup>15</sup>. A summary of WFD status of relevant surface water bodies hydrologically connected to the Site is presented in **Table 1.23** and **Figure 1.15**. The WFD risk (cycle 3) for the river water bodies is shown in **Figure 1.16** and shows the Lower Blackwater M Estuary / Youghal Harbour is at risk with significant pressures from Agriculture.

**Table 1.23: WFD status and risk**

| Name                                         | Overall status (2010-2015) | Overall status (2013-2018) | Overall status (2016-2021) | Risk Status | WFD pressures |
|----------------------------------------------|----------------------------|----------------------------|----------------------------|-------------|---------------|
| Glenville GWB                                | Good                       | Good                       | Good                       | Not at risk | N/A           |
| Tourig_020                                   | Good                       | Good                       | Good                       | Not at risk | N/A           |
| Lower Blackwater M Estuary / Youghal Harbour | Moderate                   | Moderate                   | Moderate                   | At risk     | Agriculture   |

#### 1.8.5 Sensitive and Designated Areas

There are no designated sites within the redline boundary. However, there are some downstream designated sites which are hydrologically linked to the site and summarised in **Table 1.24** and **Figure 1.17**.

There are designated drinking water rivers on site, mapped by the EPA and are sensitive receptors under Article 7 Abstraction for Drinking Water .

No other sensitive receptors have been found on site such as nutrient sensitive rivers, salmonid rivers, or freshwater pearl mussel catchments. The nearest designated area for shellfish is located in Youghal Bay, east of the Womanagh Estuary.

**Table 1.24: Summary of downstream sensitive and designated areas**

| Name       | Code            | Type                                     | Hydrological connectivity                                      | Hydrogeological connectivity  |
|------------|-----------------|------------------------------------------|----------------------------------------------------------------|-------------------------------|
| Tourig_020 | IE_SW_18T030700 | Article 7 Abstraction for Drinking Water | Likely Directly via the Tourig River and other onsite drainage | Possible Via groundwater flow |

<sup>15</sup> [https://catchments.ie/wp-content/files/catchmentassessments/18%20Blackwater%20\(Munster\)%20Catchment%20Summary%20WFD%20Cycle%203.pdf](https://catchments.ie/wp-content/files/catchmentassessments/18%20Blackwater%20(Munster)%20Catchment%20Summary%20WFD%20Cycle%203.pdf) [Accessed: 11/07/2025]

| Name                                  | Code           | Type                                                 | Hydrological connectivity                                 | Hydrogeological connectivity                                                   |
|---------------------------------------|----------------|------------------------------------------------------|-----------------------------------------------------------|--------------------------------------------------------------------------------|
| Blackwater River (Cork/Waterford) SAC | 002170         | Special Area of Conservation                         | Likely Downstream via onsite drainage to the Tourig River | Unlikely Adjacent to GWB but >2km from site and flow paths are generally 100ms |
| Blackwater Estuary SPA                | 004028         | Special Protection Area                              | Likely Downstream via onsite drainage to the Tourig River | Unlikely Adjacent to GWB but >2km from site and flow paths are generally 100ms |
| Blackwater River And Estuary pNHA     | 000072         | Proposed Natural Heritage Area                       | Likely Downstream via onsite drainage to the Tourig River | Unlikely Adjacent to GWB but >2km from site and flow paths are generally 100ms |
| Blackwater Estuary Lower              | IE_SW_020_0100 | Urban Waste Water Treatment Directive Sensitive Area | Likely Downstream via onsite drainage to the Tourig River | Unlikely Adjacent to GWB but >2km from site and flow paths are generally 100ms |

#### 1.8.5.1 Drinking Water Rivers

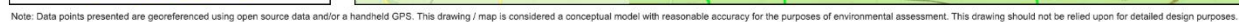
The rivers on site (sections of the Tourig\_20) have been mapped by the EPA as drinking water rivers under the river waterbody code; IE\_SW\_18T030700, they are listed below in **Table 1.25** and shown in **Figure 1.18**.

**Table 1.25: EPA Drinking water rivers associated with the site**

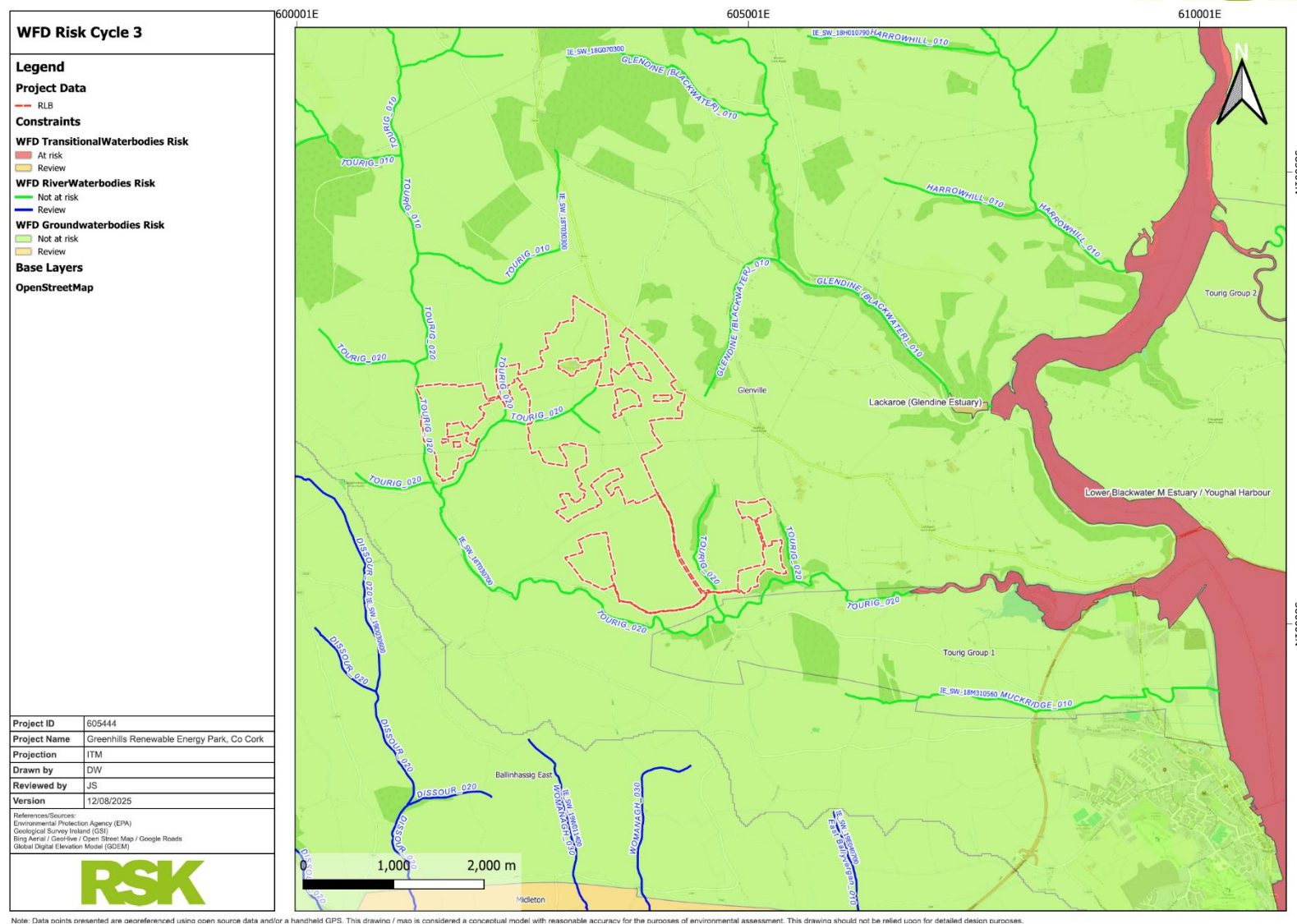
| River Name                | Location          | Local Name, river section | Segment code | Location           |
|---------------------------|-------------------|---------------------------|--------------|--------------------|
| Tourig_20                 | South Western RBD | Ballyneague               | 18B47        | On site            |
| Tourig_20                 | South Western RBD | Knocknagappagh            | 18K42        | On site            |
| Tourig_20                 | South Western RBD | Carriganass               | 18C30        | On site            |
| Tourig_20                 | South Western RBD | Tourig                    | 18T03        | Adjacent to site   |
| Tourig_20                 | South Western RBD | Youghal Park              | 18Y01        | Adjacent to site   |
| Tourig_20                 | South Western RBD | Ballyglavin               | 18B67        | Adjacent to site   |
| Glendine (Blackwater)_010 | South Western RBD | Ballydaniel 18            | 18B53        | Downstream of site |
| Glendine (Blackwater)_010 | South Western RBD | Glendine [Blackwater]     | 18G07        | Downstream of site |

*RBD – River Basin District*



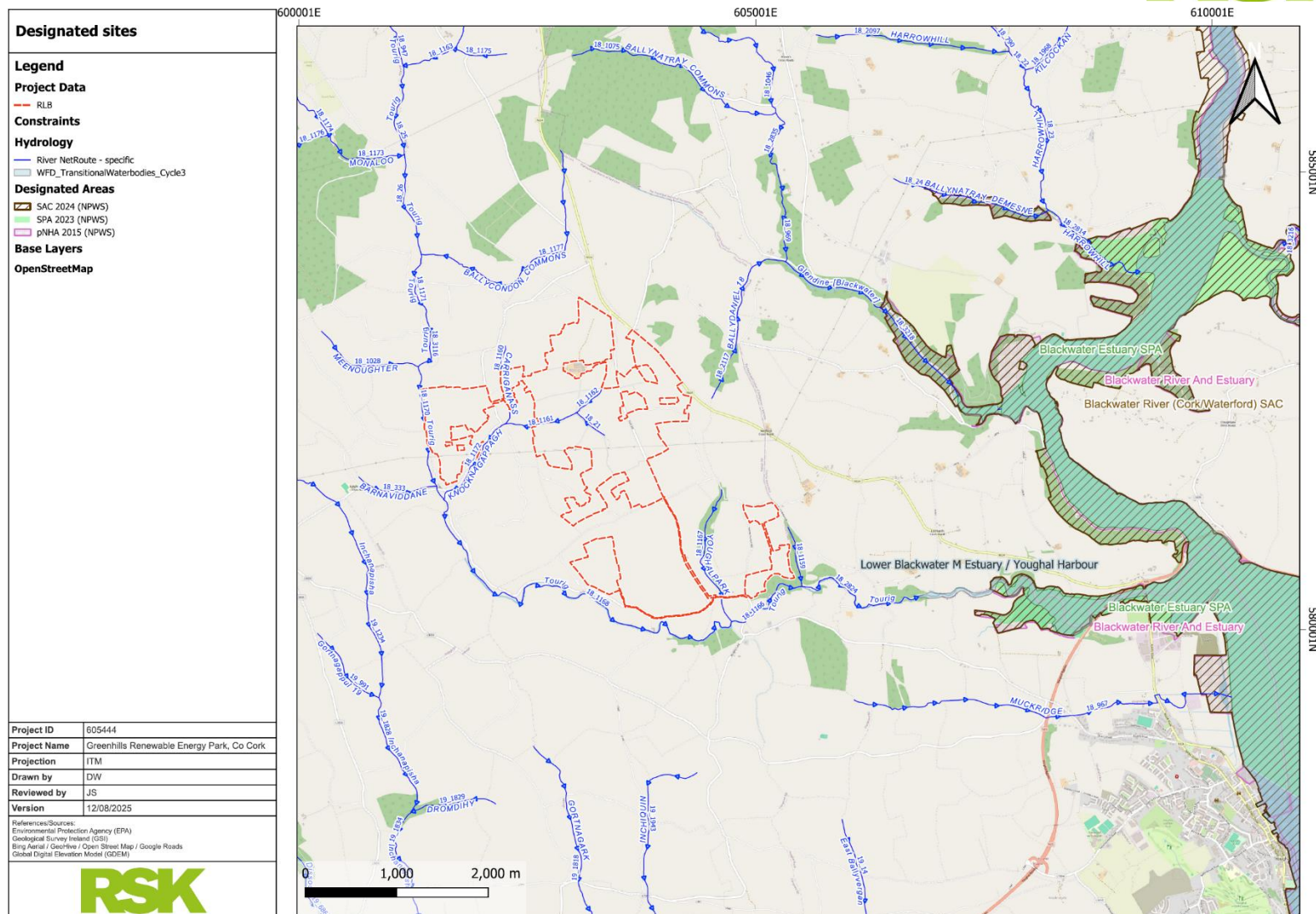


**Figure 1.15: Water Framework Directive Status (2016-2021)**

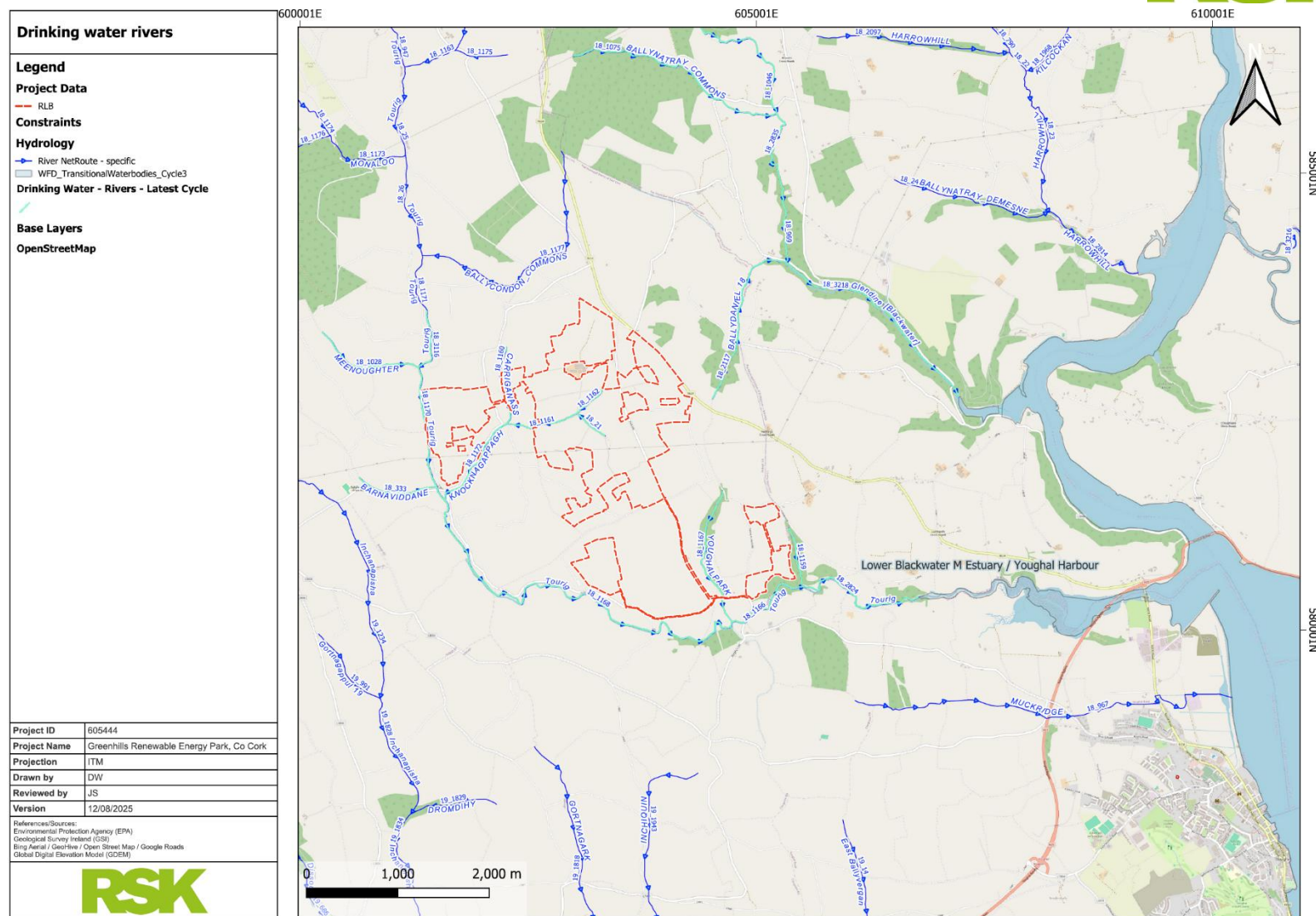


**Figure 1.16: Water Framework Directive Risk, Cycle 3**





**Figure 1.17: Designated sites**



Note: Data points presented are georeferenced using open source data and/or a handheld GPS. This drawing / map is considered a conceptual model with reasonable accuracy for the purposes of environmental assessment. This drawing should not be relied upon for detailed design purposes.

**Figure 1.18: Drinking water rivers**

## 1.9 Potential Impacts and Effects on Hydrology and Hydrogeology

### 1.9.1 Construction Impacts and Effects

Construction activities have the potential to directly or indirectly effect the surface water and or groundwater at the site and hydrologically and hydrogeological connected. The surface water receptors have high to very high sensitivity as they are designated drinking water and connected to downstream designated sites. The underlying groundwater body has moderate sensitivity due to the aquifer type.

Consideration of likely significant effects includes:

- The activities likely to occur on-site during the construction phase of the development.
- The potential likely impacts or changes resulting from the activity or action.
- The potential likely effects which are the consequences of the potential impacts.

These are summarised in **Table 1.26** and discussed in the subsequent sections.

**Table 1.26: Summary of likely construction phase activities, potential impacts and effects in the absence of mitigation**

| Activities                                                                                                                                                                                                                                                                                                                          | Potential likely impacts                                                                                                                          | Potential likely effects                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Soil striping<br>Recontouring<br>Excavation (foundations, cable trenching, drainage works)<br>Stockpiling<br>Construction of infrastructure (temporary and permanent)<br>Use of cementitious material<br>Reuse / importation of materials<br>Vehicular movement<br>Storage of hydrocarbons / chemicals<br>Dewatering<br>Abstraction | Erosion and degradation<br>Subsoil / bedrock removal<br>Hydrocarbon / chemical spill<br>Release of wastewater<br>Release of cementitious material | Increased run off<br>Release of suspended solids<br>Surface water quality<br>Groundwater quality<br>Surface water contamination<br>Groundwater contamination<br>Alteration of the hydrological regime<br>Changes to local surface water supplies<br>Increased flooding |

#### Increase in runoff

The construction of the Proposed Development has the potential to result in increased rates of runoff relative to baseline conditions due to increased hydraulic loading, progressive excavation and removal of vegetation cover and replacement with hardstanding surfaces, reducing the potential recharge. Poorly designed infrastructure



and recontouring of the land could result in a change or obstruction to overland flow on site.

Such an increase in surface water runoff, or an increased hydrological response to rainfall, has the potential to exacerbate flooding events and impact on hydro morphology of waterbodies downstream of the development, and/or to exacerbate flooding and erosion within the redline boundary.

Without mitigation the likely effects on the receiving surface water, an attribute of high sensitivity, are unavoidable, direct, short to long-term, localised to regional and large adverse effect with a significance level of **moderate to profound**. Mitigation measures and engineering controls can reduce the potential effects.

### **Release of suspended sediments**

A number of construction activities can directly or indirectly lead to the release of suspended solids included soil stripping, excavation, stockpiling, vehicular movement and other construction activities. The release of elevated suspended solids and nutrients to watercourses, drainage channels and discharge routes would adversely affect water quality and potentially adversely affect aquatic habitats downstream if not mitigated against. The most vulnerable construction areas where surface water quality deterioration is likely to occur includes works close to existing drainage features (excavation activities, spoil storage areas) and water course crossings.

Runoff contaminated with suspended solids will add turbidity to the receiving surface water body, can block fish gills and smother spawning grounds, reduce light penetration for flora growth, and promote bacteria and algae production. Nutrients that are associated with the solids can lead to eutrophication of the water environment and eventually to fish-kills due to lowering of oxygen supply.

Release of runoff containing suspended solids will potentially impact on the WFD status and objectives associated with the surface water networks both within and downstream of the Proposed Development including designated SPA and SAC.

In the absence of mitigation the potential likely effects from the release of elevated suspended solids and nutrients to surface waters, are considered both direct and indirect, long-term to permanent, small to moderate adverse effects, with a significance level of **moderate to significant**. Mitigation measures and engineering controls can reduce the potential effects.

The potential effects of suspended solids to groundwater, an attribute of medium sensitivity, are considered to be unlikely due to the limited deeper excavation activities and moderate soil permeability providing natural filtration. If foundation excavations or cable trenches were to reach the bedrock the effects would likely be small adverse due to the aquifer classification and short flow lines. Therefore the significance level of potential effects **not significant to slight**.

### **Potential Pollution**

Temporary storage and onsite use of chemicals, fuels and oils associated with construction activities, may enter the surface or groundwater environment via accidental spillages, improper transport and refuelling, or inappropriate storage and disposal

procedures, thus adversely affecting surface and groundwater quality, with associated effects to potable supplies, fish and aquatic ecology.

Temporary sanitation facilities for site personnel will be required during the construction phase of the Proposed Development. Permanent sanitation facilities are included in the substation design and will be in situ for the duration of the operational phase. There is a potential for wastewater or sanitation chemicals to spill or leak into the receiving surface water or groundwater. Accidental release of wastewater to surface waters would likely result in an increase in biochemical oxygen demand (BOD) which in turn would lower the dissolved oxygen concentration and adversely impact on aquatic life. Wastewater sanitation chemicals are also pollutant risks due to their inherent toxicity to aquatic flora and fauna and their potential to adversely impact on the productivity or status of surface water systems. The risk is dependant on the location of the facilities relative to sensitive receptors, the condition of the facilities and the chemicals used.

At the substation concrete pouring and curing will be required. The accidental leaching of cementitious wastes such as concrete, lean mix or cement can result in an adverse change to the water hydrochemistry which can adversely impact on sensitive aquatic flora fauna, as they are highly alkaline and can significantly elevate the pH concentration above the tolerance range of fish such as cyprinid and salmonid species.

During the construction phase there is a potential for surface water and or groundwater to become contaminated with pollutants such as hydrocarbons, waste water and cementitious material as a result of the construction activities. The accidental release of contaminants into the receiving surface water or groundwater and effect the quality and potentially the WFD status.

In the absence of mitigation the likely effects to surface water quality, an attribute of high sensitivity, could be localised to regional (downstream and/or downgradient), direct and indirect, temporary to long-term, small adverse effect with a significance level of **slight to significant** depending on the scale and type of contamination.

The effect on groundwater, an attribute of moderate sensitivity, could be direct and indirect, localised to potentially regional, temporary to long-term but reversible and small adverse with a significance level of **slight to moderate**.

#### 1.9.1.1 *Flood Risk Downstream*

During the construction of the Proposed Development various activities will lead to an increase in runoff from site and without mitigation measure this could lead to flooding on site or further downstream.

The site does not lie within probable flood zones and has no on site risks, however downstream fluvial flooding has been identified.

A 1 in 100 year storm event scenario results in a net increase of surface water runoff associated with the Development, calculated to be 0.016-0.185m<sup>3</sup>/s, (or 0.01-4.15% relative to the associated micro catchment) see **Appendix B**.

Poorly designed drainage has the potential to adversely effect the baseline hydrological regime including new preferential pathways, erosion and soil degradation particularly during and immediately after construction phase whereby unvegetated soils are exposed.

In the absence of mitigation measures during the design and construction of the Proposed Development, the effects of flooding could be localised to potentially regional (downstream), direct or indirect, short term, small to moderate adverse with a significance level of **slight to very significant**.

### 1.9.2 Operational Impacts and Effects

Operation of the Proposed Development is likely to result in increased volumes of runoff relative to baseline conditions due to permanent infrastructure on hardstanding surfaces which are effectively or assumed impermeable.

During prolonged heavy rainfall events, additional surface water runoff at increased flow velocity could increase hydraulic loading potentially exacerbating flooding events and the hydromorphology of waterbodies on site or downstream of the Development.

Without mitigation the likely effects on the receiving surface water, an attribute of high sensitivity, are unavoidable, direct, short to long-term, localised to regional and moderate adverse effect with a significance level of **slight to significant**.

With appropriate environmental engineering controls and mitigation measures, including attenuation features, these potential effects can be significantly reduced. Furthermore, if considered adequately, mitigation measures have the potential to reduce the discharge rates from the site compared to baseline runoff rates, resulting in **beneficial** effect on the hydrological response to rainfall at the Proposed Development and mitigate against potential flood events downstream.

Occasional access necessary for maintenance during the operational phase could result in minor accidental leaks or spills of fuels/ oils. There is potential for spills and leaks of oils from the transformers and generator. There is a potential for a hydrocarbon spill to enter the surface water network via overland flow or leach through the soils to the underlying bedrock aquifer and effect the surface or groundwater quality. Surface water and groundwater are considered to have medium to high importance and the magnitude of potential contamination is small.

Permanent sanitation facilities are located at the substation, there is a potential for wastewater or sanitation chemicals to spill or leak into the receiving surface water or groundwater.

There is a fire risk from the BESS site operations which can result in chemical leaks to underlying soils which could potentially leach into the underlying aquifer.

The unmitigated likely effects of contamination during the operational phase of the proposed development is considered to be localised to regional, direct or indirect, small adverse effect with a significance level of **slight to significant**.

Water will be required for the toilet and canteen facilities throughout the operational phase.

#### 1.9.2.1 Flood Risk Downstream

Once operational, drainage and attenuation features will be in place reducing the potential for downstream flooding, providing a **beneficial** effect of the Proposed Development.

### **1.9.3 Decommissioning Impacts and Effects**

No new impacts or effects are anticipated during the decommissioning phase of the project in comparison to the construction phase. The potential effects are the same or less than those outlined above for the construction phase.

## **1.10 Hydrology and Hydrogeology Mitigation Measures**

### **1.10.1 Design**

As part of the design sensitive receptors, drains and drinking water rivers have been avoided and appropriate buffers applied;

- 20m surface water buffer zone – mapped surface water features. i.e. EPA mapped streams, rivers, lakes
- 10m drainage buffer zone – non-mapped drainage features i.e., non-mapped streams, significant natural and artificial drainage features identified during the desk and from field observations.

The drainage has been designed to reduce the potential effects on surface water quality and quantity and potential for flooding on site and downstream.

Nature Based Solutions (NBS) will be adopted at the Proposed Development in constructed drainage. NBS include Sustainable Drainage Systems (SuDS), which will be employed to attenuate runoff and reduce the hydrological response to rainfall at the site. Extending or maximising this approach sufficiently has the potential to attain a net reduction in runoff rates at the site, resulting in beneficial effects to water quality and reducing downstream flood risk.

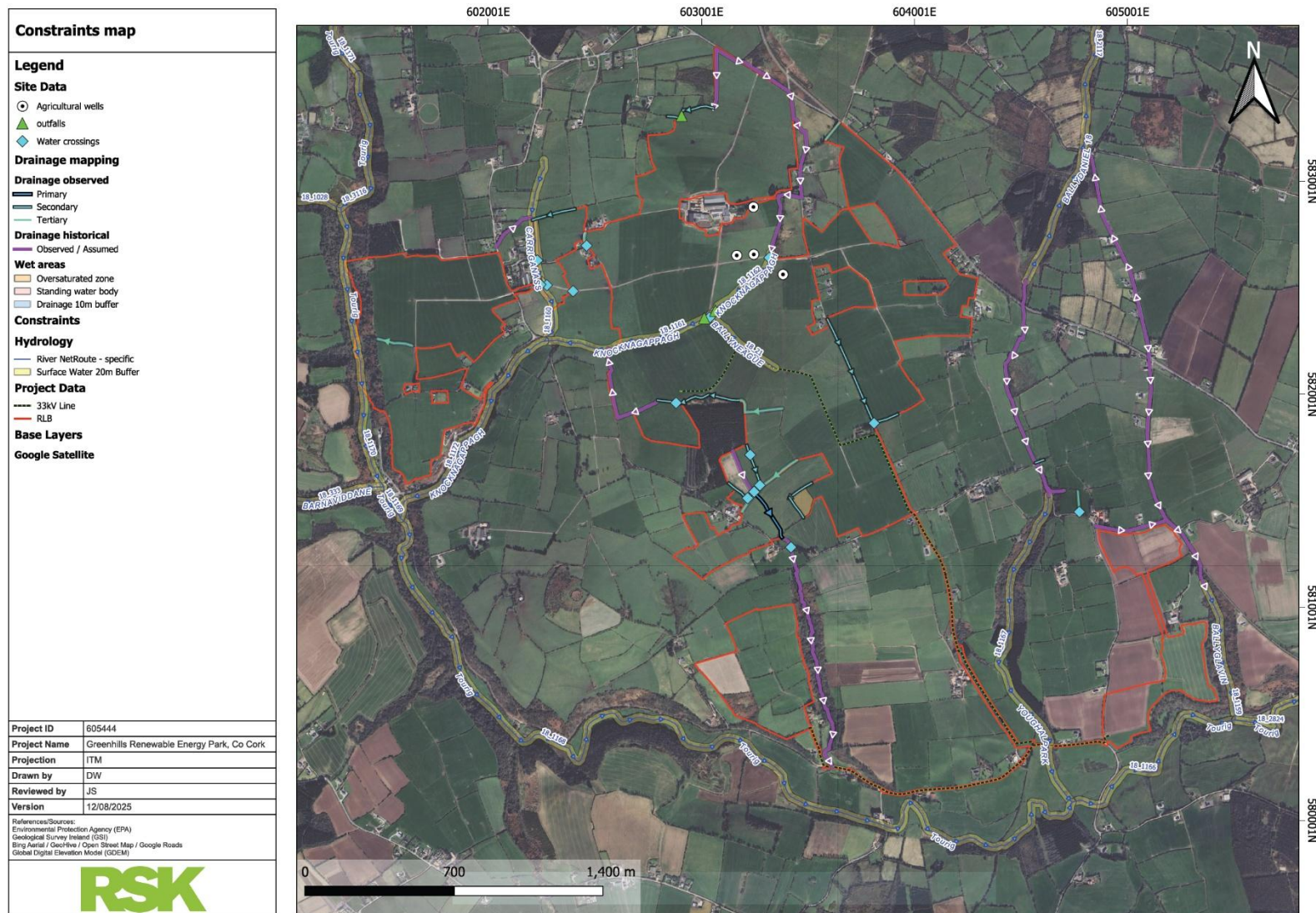
The design of the Proposed Development uses as little concrete as possible, minimising the potential effects on surface and groundwater receptors.

The overall design and soil management have aimed to reduce land take and soil disturbance helping to reduce potential direct and indirect impacts on land, soils and water.

The panels will be mounted on galvanized steel frames mainly anchored by shallow driven piles causing minimal disturbance to the land.

Any surplus excavated materials, such as a topsoil and subsoil, will be re-used on-site for landscaping and backfilling cable trenches.





Note: Data points presented are georeferenced using open source data and/or a handheld GPS. This drawing / map is considered a conceptual model with reasonable accuracy for the purposes of environmental assessment. This drawing should not be relied upon for detailed design purposes.

**Figure 1.19: Constraints map**



### 1.10.2 Drainage

Existing drains and watercourses have been accounted for during the design phase of the Proposed development. Construction activities avoid these buffer zones.

The drainage, attenuation and other surface water runoff management systems will be installed concurrent with the main construction activities to control increased runoff and associated suspended solids loads in runoff during intensive construction activities. Erosion controls will be incorporated into the design to minimise exposed soil in existing and newly established drainage channels.

During the construction phase of the Proposed Development any surface water run off from the construction areas will be collected and managed, in a way that settlement ponds and check dams will be maintained (deslugged/settle solids removed) on regular basis by using a vector (suction tanker) and disposing of the contents at a licenced facility. It is important to minimise the agitation of solids during these works, otherwise it will likely lead to an acute significant loading of suspended solids in the drainage network.

Permanent site drainage will adopt a Sustainable Drainage (SuDS) nature-based approach to manage surface water runoff. This approach to drainage ensures that existing site hydrology is maintained, including runoff rates and volumes.

A handheld turbidity meter is recommended to accurately measure the quality of water discharging from the site. The meter should be maintained and calibrated frequently. It is recommended that quality thresholds are established for the purposes of escalating water quality issues as/if they arise.

Temporary mitigation measures such as silt fences will be erected in areas where risk of pollution to watercourses has been identified e.g., watercourse crossing locations and areas where development (such as felling) unavoidably lie within watercourse buffer zones.

Upslope cut-off drainage channels approximately parallel to the proposed track alignment installed in advance of any excavated cuttings for the track. This will prevent washout by surface flows of exposed clays in excavations and fine sediments in track makeup, and increase efficiency of silt removal in future trackside drainage swales.

Minor drains, other flow paths and cut-off drain outlet locations will be identified and charted, to ensure that piped crossings can be installed in advance of or adjacent to the track construction.

Trackside drainage swales and silt/attenuation ponds will be installed in parallel with track construction. Note that this may require that drainage swales are reformed on an ongoing basis as temporary track alignments are modified to their eventual finished design level.

Drainage swales and silt ponds will be provided in 46 locations as per the Greenhills Renewable Energy Project Drainage Plan, see Appendix B to the PER. A swale is a shallow linear vegetated channel feature which is designed to collect and transfer runoff during rainfall events. The vegetation helps to filter out any potential contaminants from reaching the surface water or groundwater network. Swales help to promote infiltration and can help to mitigate against flooding and reduce erosion. Check dams and berms can be installed across the flow path of a swale to increase attenuation and infiltration.

At the 11 site entrances, soakaway and interceptor drains will be added to prevent surface water runoff from discharging onto the public road.

No surface water runoff will be discharged onto public roads, foul sewers, or adjacent property.

### **1.10.3 Sediment Control**

Excavated material will be temporarily stockpiled onsite for re-use during reinstatement. Stockpiles will be restricted to less than 2m in height. Stockpiles will be located a minimum of 50m from surface water features, and all stockpiling locations will be subject to approval by the Site Manager and Project Ecological Clerk of Works (ECoW). No material will be stored other than in the areas selected for stockpiling.

In order to mitigate the effects posed by release of suspended solids and associated nutrient loading to the surface water environment:

- Best practice will be in place for construction works, including avoiding constraints, excavations battered back to a safe angle of repose, segregation of topsoil and subsoil, reuse of material as soon as possible and low angles of stockpiling ensuring stability.
- The drainage, attenuation and other surface water runoff management systems will be installed concurrent with the main construction activities to control increased runoff and associated suspended solids loads in runoff during intensive construction activities.
- Sediment / silt fencing will be erected along the perimeter of source areas e.g., stockpiles to reduce the potential for sediment laden run-off to reach sensitive receptors. No direct flow paths between stockpiles and watercourses will be permitted at the site.
- Earthworks will not occur during sustained or intense rainfall events.
- Vehicle movement will be restricted to the footprint on the development where practicable.

Following completion of construction the temporary works/assembly areas needed for the construction period will be reinstated using the original spoil material removed and stockpiled close to the location from where it was excavated.

Soil management measures will include regular checking of sediment accumulation at check dams and settlement ponds locations and subsequent desludging and cleaning as required. Any accumulated sediment will be disposed at a licenced facility.

#### **1.10.3.1 Refuelling and storage of chemicals**

All machinery will be checked regularly for any leaks or signs of wear and tear. Where possible off-site refuelling will take place off-site. Fuel stored onsite will be bunded to at least 110% volume capacity of fuels stored at the site. On-site refuelling of machinery will be carried out at dedicated refuelling locations a minimum distance of 50m from watercourses using a mobile double skinned fuel bowser. Drip tray, spill kits and fuel absorbent pads will be available during refuelling in case of any accidental spillages. Only designated competent operatives will be authorised to refuel plant on site.

Containers will be properly secured to prevent unauthorised access and misuse. An effective spillage procedure will be put in place with all staff properly briefed. Any waste fuel/ oil will be collected, stored in appropriate containers and will be reused, recycled or disposed of offsite in an authorized facility .

#### *1.10.3.2 Concrete*

Ready-mixed concrete will be used as required during the construction phase except for parts of the substation where hollow core concrete will be used.

All concrete will be delivered from local batching plants in sealed concrete delivery trucks, as required. Vehicles transporting cement or concrete will be visually inspected for signs of excess cementitious material prior to being granted access to the site.

Only the chute of the concrete delivery truck will be cleaned on site in a dedicated bunded area, using the least volume of water required. The contents will be allowed to settle and the supernatant will be removed off site by licenced generator to a licenced wastewater treatment plant. Designated washout of concrete trucks will not be located within the vicinity of watercourses or drainage channels.

Concrete will be poured during metrological dry periods/seasons in so far as practical and reasonably foreseeable. This will reduce the potential for surface water run off being significantly affected by freshly poured concrete. No surplus concrete will be stored or deposited on site.

#### *1.10.3.3 Wastewater*

Staff welfare facilities are required for the duration of the construction and operational phases (substation) of the Proposed Development. Wastewater/sewerage generated by the welfare facilities will be collected and held in a sealed storage holding tank, fitted with a high-level alarm, which is a device installed in the storage tank that is capable of sounding an alarm during a filling operation when the liquid level nears the top of the tank.

All wastewaters will be emptied periodically and tankered off-site by a licensed waste collector to an authorised wastewater sanitation plant for treatment. There will be no onsite treatment of wastewater. A wastewater or sewerage leakage is not anticipated in a properly managed site.

Routine inspection of the temporary facilities will be carried out to ensure no overloading and no leakages are occurring. In line with the approach laid out in section 9.2.1, mitigation measures have been designed to reduce Project specific residual effects to neutral or slight and not significant.

#### *Operational phase*

No refuelling will take place on site during the operational phase. The Inverter Combiner Kiosk/Transformer units will contain oil that will be bunded to prevent leaks, no emissions will occur during normal operation as the oil is maintained within the system. These will be monitored and maintained regularly to prevent leaks.

Welfare provisions (toilets, sink, etc.) will be in place in the substation throughout the operational phase.

#### 1.10.4 Dewatering

Groundwater was not encountered during the site investigation works carried out at the substation location in July 2025. Groundwater is not expected to be encountered during the construction of the Proposed Development.

Should dewatering be required during the installation of underground cabling, the excavated trench will be dewatered from a sump installed within the low section of the opened trench. Where dewatering is required, dirty water will be fully and appropriately attenuated through silt bags before being appropriately discharged to vegetation or surface water drainage features.

#### 1.10.5 Abstraction

A production well will be installed on the site. The volumes of abstraction will be small for the solar farm requirements. Registration of well with EPA is required if the abstraction volume of the well is greater than 25 m<sup>3</sup>/d.

Small private supplies (SPS) are drinking water supplies serving commercial or public activity. Delineation of catchments for SPSs may be carried out by GSI or a third party, but remains the responsibility of the water supplier, who must arrange to have the delineation carried out. Most SPS abstract groundwater from wells and springs. Simple delineation methods are proposed for SPS, based on GSI's desk-based water balance method, governed by the following simple equation:

$$\text{Abstraction (m}^3\text{/d)} = \text{Recharge (m/day)} \times \text{Area (m}^2\text{)}$$

In this method, abstraction and recharge rates are used to define an area, which is required to sustain the abstraction. The area reflects the size of the zone of contribution (ZOC), but the shape of the ZOC has to be adjusted to account for the likely groundwater flow field, guided by topography.

For instance, if the production well of Proposed Development will require abstraction of 10 m<sup>3</sup>/d, then the area to sustain abstraction will be calculated as:

$$\begin{aligned} \text{Area (m}^2\text{)} &= \frac{\text{Abstraction (m}^3\text{/d)}}{\text{Recharge (m/day)}} \\ &= \frac{10 \text{ m}^3\text{/d}}{0.2 \text{ m/day}} \\ &= 50 \text{ m}^2 \end{aligned}$$

The area surrounding a supply (i.e. within 10 meters of it) should be, grassed, fenced (to avoid animal access), and kept free of debris. Supplies should be located as far as possible from potential sources of contamination, in accordance with minimum setback distances, this is to primarily prevent from E.Coli and nitrate contamination.

Supplies should be in a mounded area, with ground sloping away from it.

The production well should be constructed according to accepted standards in relation to the following:



- equipment, materials and techniques used in the construction of the well
- Verticality and straightness of the well
- Sanitary security and disinfection of the well
- Wellhead should be constructed so as to ensure that surface water and shallow groundwater, which are likely to be polluted, cannot enter the well. Wells must be cased and grouted to an adequate depth, the casing and grout must meet certain minimum standards, and the placing of the casing and grout must be meet a certain specification
- Water well should be cleaned and disinfected before being brought into use. The methods and materials should meet certain minimum standards.
- Water well should be tested for yield and quality. A mandatory list of tested chemical and bacteriological parameters should be specified.

The adoption of these should protect the environment and public health by reducing groundwater contamination via poor well construction and cross-contamination between aquifers.

#### **1.10.6 Flood Risk Management**

The drainage systems for the Proposed Development have been designed for 1 in 100 year rainfall storm events, including an additional 20% to account for climate change, to mitigate against flooding at the site and to adjacent areas (Appendix B).

Attenuation features including swales will help to mitigate against potential flooding on site and downstream of the Proposed Development.

#### **1.10.7 Fire Risk Management**

Fire prevention and spread are part of the BESS design. The proposed system will incorporate multi-layer protection systems designed to meet or exceed industry safety standards. The safety features will include fire testing certification and multi-layer protection systems to prevent and manage thermal events. These features will mitigate the risks to surface and groundwater receptors.

### **1.11 Monitoring**

#### **1.11.1 Construction Phase**

Daily visual inspection of silt fencing, drainage channels, swales and other surface water runoff control infrastructure. Any blockages or damages should be repaired or cleared as soon as possible.

Weather monitoring in the form of 24-hour advance meteorological forecasting (downloadable from Met Éireann) linked to a trigger-response system. When a pre-determined rainfall trigger levels is exceeded and/or any yellow or greater rainfall warning (>25mm/hour) issued by Met Éireann, planned responses will be undertaken including stopping construction work and inspecting construction areas and drainage features prior to recommencing works.

Routine surface water monitoring will be conducted on site and at locations downstream during the construction phase of the Proposed Development at a frequency agreed with the planning authority.

Monitoring throughout the construction phase of the development is to be undertaken as per the Construction Environmental Management Plan (CEMP) under the supervision of the appointed Environmental Manager / Clerk of Works. In the event of any limit exceedances, potential contamination events or other environmental incidences works are to be stopped until corrective measures are implemented and adverse environmental effects are minimised if not avoided.

Environmental incidents including accidental spillages (e.g., fuel), breaches of licence limits if applicable, and significant environmental incidents will be reported to the Local Authority as part of the emergency response. Incident notification will be escalated to relevant third parties where relevant e.g., Inland Fisheries Ireland (IFI) if surface water receptors are intercepted.

### **1.11.2 Operational Phase**

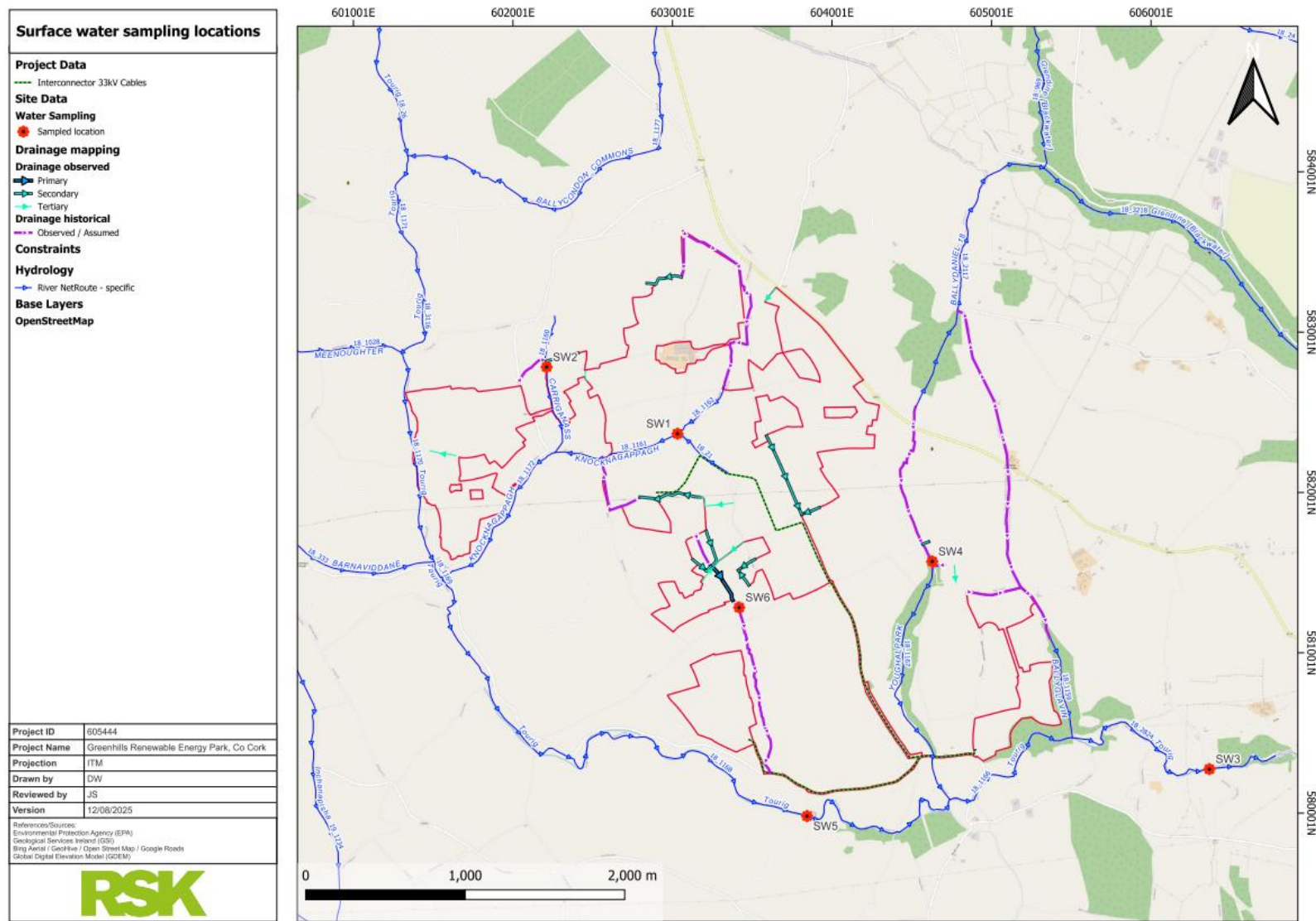
Following the construction phase of the Proposed Development drainage features will be routinely monitored and maintained where required.

Surface water sampling at selected water monitoring locations at the site will be carried out at a reasonable frequency and gradually reduced based on observed stability of conditions and will also be scheduled following extreme meteorological events.

### **1.11.3 Decommissioning Phase**

Similar to the construction phase daily visual inspection of silt fencing, drainage channels, swales and other surface water runoff control infrastructure. Any blockages or damages should be repaired or cleared as soon as possible.

Routine surface water monitoring will be conducted on site and at locations downstream of the Proposed Development at a frequency outlined in the Decommissioning Plan and agreed with the planning authority.



**Figure 1.20: Proposed surface water monitoring during the construction phase of the Proposed Development**

## 1.12 Residual Effects

The unavoidable residual effects on the hydrology and hydrogeology environment as a function of the Proposed Development is that there will be a change in the hydrological regime at the site with changes in flow, drainage, increase in runoff and potential release of suspended solids as a result of construction activities, and the introduction of concrete, subgrade and surfacing materials.

Mitigation by avoidance and the implementation of physical control and mitigation measures will ensure that contaminant concentrations, particularly elevated suspended solids entrained in run-off are reduced to below the relevant legislative screening criteria. The overall residual effects are anticipated to have no likely significant adverse effects. The residual effects following the construction phase are summarised below from **1.12.1**.

### 1.12.1 Increase in Runoff

Mitigation measures ensure that the potential effects to surface water receptors from the increased runoff is reduced to a significance level of **slight**.

### 1.12.2 Release of Suspended Sediments

Proposed mitigation measures will ensure that, the risk of elevated suspended solids to surface waters is reduced to a significance level of **slight**.

### 1.12.3 Potential Pollution

Mitigation measures outlined above will ensure the effect arising from a potential hydrocarbon / hazardous substance spill to the surrounding receptors are minimised to a significance level of **slight**.

### 1.12.4 Flood Risk

Mitigation measures including drainage and attenuation features will help reduce the potential for downstream flooding, a residual, **beneficial** effect of the Proposed Development.

## 1.13 Cumulative Effects

The following projects are within 15km of the proposed development are summarised in **Table 1.27**.

The Proposed Development falls in the Tourig\_SC\_010 sub catchment and two sub basins, most of the site falls in the Tourig\_020 with the most northwestern portion in the Glendine (Blackwater)\_010. Only one project falls into the same sub catchment and lies further upstream the Glendine (Blackwater)\_010. This project has no significant residual effects on hydrological receptors and therefore no significant cumulative effects are anticipated from other projects during the construction or operational of this project.

While some projects overlay the same GWB, hydrogeological connectivity is unlikely due to the type of aquifer. There are no significant effects on groundwater associated with this development to add to a cumulative impact.

**Table 1.27: Existing, planned and proposed projects within 15km of the proposed development**

| Project                                                                                                                     | Planning / Project Ref               | Distance   | Hydrological connectivity                                                                                                                                                         | Hydrogeological connectivity                                              |
|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| <b>Solar Farms</b>                                                                                                          |                                      |            |                                                                                                                                                                                   |                                                                           |
| Youghal Mudlands, Youghal, Co. Cork,                                                                                        | CCC 175245                           | 4.32km SE  | This project is in a different sub catchment (Muckridge_010).                                                                                                                     | >2km from site and flow paths are generally 100ms.                        |
| Youghal Mudlands, Muckridge Demesne, Foxhole, Youghal, Co. Cork                                                             | CCC 204407 (EXTENSION TO CCC 175245) | 3.75km SE  | This project is in a different sub catchment (Muckridge_010).                                                                                                                     | In a different GWB and >2km from site and flow paths are generally 100ms. |
| Ballyspillane West, Midleton, Co. Cork                                                                                      | CCC 175498                           | 13.13km SW | This project is in a different catchment                                                                                                                                          | In a different GWB and some distance from site.                           |
| Tead More, Ballynacorra, Midleton, Co. Cork                                                                                 | CCC 166302                           | 14.57km SW | This project is in a different catchment                                                                                                                                          | In a different GWB and some distance from site.                           |
| <b>Wind Farm</b>                                                                                                            |                                      |            |                                                                                                                                                                                   |                                                                           |
| Knocknaglogh Lower/ Barranastook Upper/ Knocknamona/ Woodhouse or Tinakilly/ Monageela/ Killatoor, Dungarvan, Co. Waterford | WCC 14600109                         | 14.27km NE | This project is in a different subcatchment                                                                                                                                       | Some distance from site.                                                  |
| Lyrenacarriga, Co. Waterford and the townlands of Lyremountain, Co. Cork.                                                   | ACP 309121                           | 1.36km N   | In the same subcatchment as the proposed development, it is in the same subbasin (Glendine (Blackwater)_010 as the very northwest of the RLB. A very small portion of the site is | >1km from site and flow paths are generally 100ms.                        |



| Project | Planning / Project Ref | Distance | Hydrological connectivity                                             | Hydrogeological connectivity |
|---------|------------------------|----------|-----------------------------------------------------------------------|------------------------------|
|         |                        |          | hydrologically connected further downstream the Glendine [Blackwater] |                              |

CCC = Cork County Council, WCC = Waterford County Council, ACP = An Coimisiún Pleanála

## 1.14 Conclusion Hydrology and Hydrogeology

From the baseline study and impact assessment undertaken the following hydrology and hydrogeology environment sensitive receptors have been identified in the receiving environment:

- Surface water features: Tourig\_020, Glendine (Blackwater)\_010 and Blackwater Estuary
- The Glenville Groundwater Body and a Locally Important Aquifer (LI)
- Potential private supply wells in area

It is considered that with the implementation of the mitigation measures outlined in this report the potential impacts of the proposed development on the identified receptors will not result in any likely significant effects on the hydrology and hydrogeology.



## **APPENDIX A**

### **DRAINAGE SURVEY PHOTOGRAPHS**

---



## **APPENDIX B**

# **FLOOD RISK ASSESSMENT**

---

# **Greenhill Solar Farm – Drainage Survey**

## **Site Photographs**



# Drainage Survey

## Constraints Maps

Tile 1

Drainage assessment

Legend

Site Data

outfalls

water\_crossings

Drainage mapping

Drainage observed

Primary

Secondary

Tertiary

Drainage historical

Observed / Assumed

Wet areas

Oversaturated zone

Standing water body

Drainage 10m buffer

Constraints

Hydrology

River NetRoute - specific

Surface Water 50m Buffer

Project Data

16/10/2025

RLB

Base Layers

Google Satellite

|              |                                  |
|--------------|----------------------------------|
| Project ID   | 605444                           |
| Project Name | Greenhills Renewable Energy Park |
| Projection   | ITM                              |
| Drawn by     | DW                               |
| Version      | November 2025                    |

RSK



Note: Data points presented are georeferenced using open source data and/or a handheld GPS. This drawing / map is considered a conceptual model with reasonable accuracy for the purposes of environmental assessment. This drawing should not be relied upon for detailed design purposes.

SW sampling locations

Legend

Site Data

Water Sampling

Sampled location

Drainage mapping

Drainage observed

Primary

Secondary

Tertiary

Drainage historical

Observed / Assumed

Wet areas

Oversaturated zone

Standing water body

Drainage 15m buffer

Constraints

Hydrology

River NetRoute - specific

Lake Segment (EPA)

WFD\_TransitionalWaterbodies\_Cycle3

Subcatchments (EPA)

River SubBasins Cycle 3 (EPA)

Bride [Waterford]\_010

DISSOUR\_010

DISSOUR\_020

East Ballyvergan\_010

GLENABOY\_010

GLENLINE (BLACKWATER)\_010

HARROWHILL\_010

KILMEEDY\_WEST\_010

LICKY\_030

MOANLAHAN\_010

MUCKRIDGE\_010

TOURIG\_010

TOURIG\_020

WOMANAGH\_020

WOMANAGH\_030

Project Data

16/10/2025

RLB

Topography

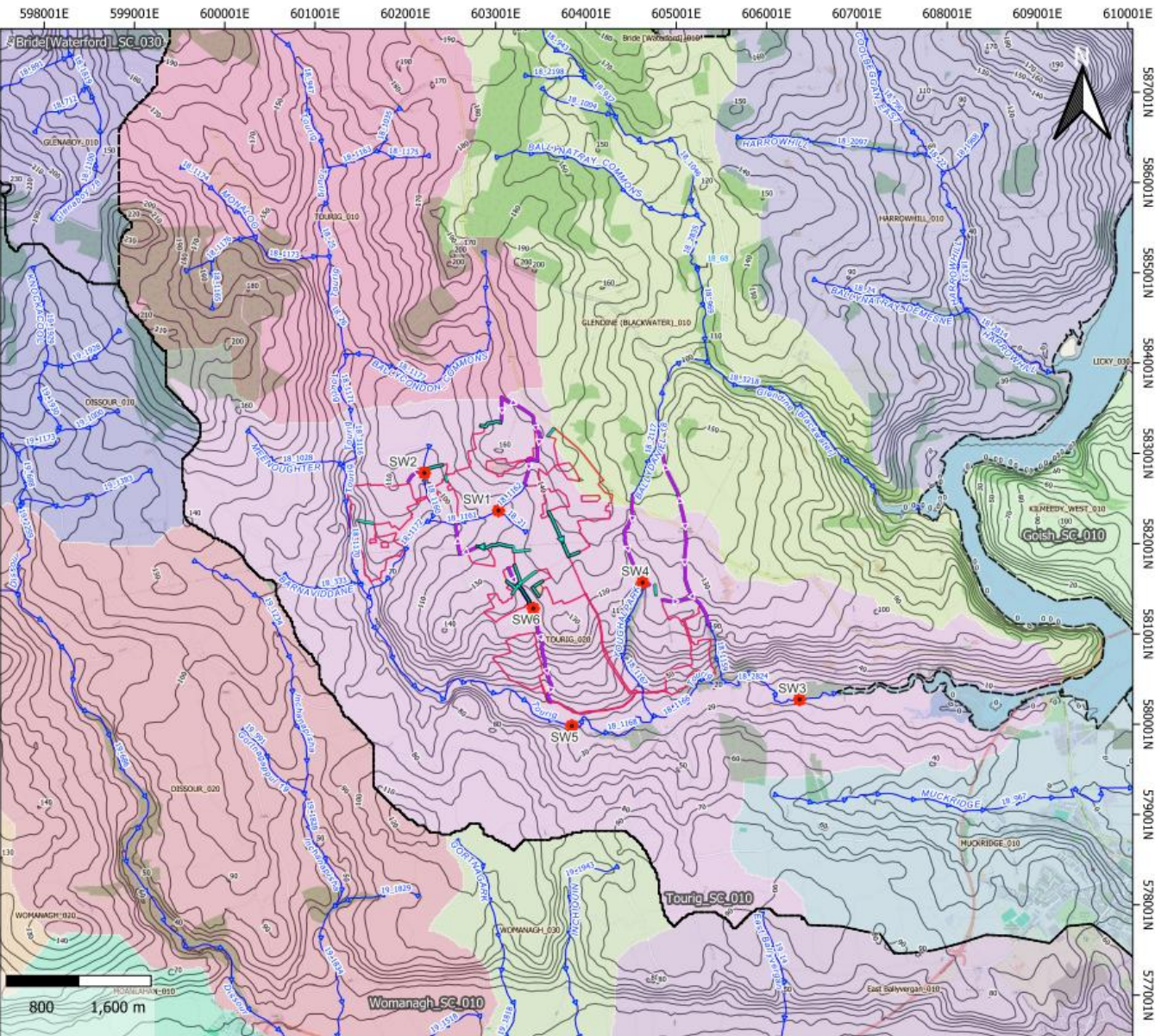
Elevation 10m Contour

Base Layers

OpenStreetMap

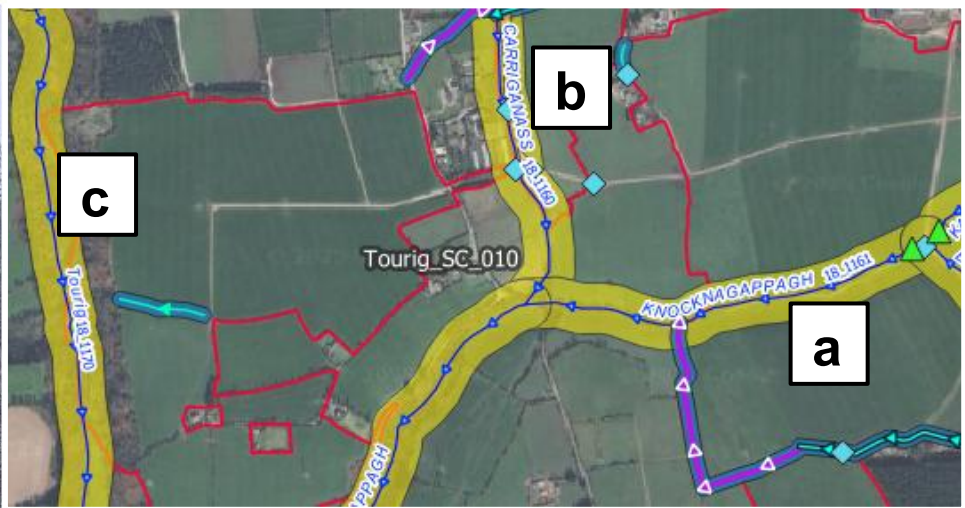
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RSK

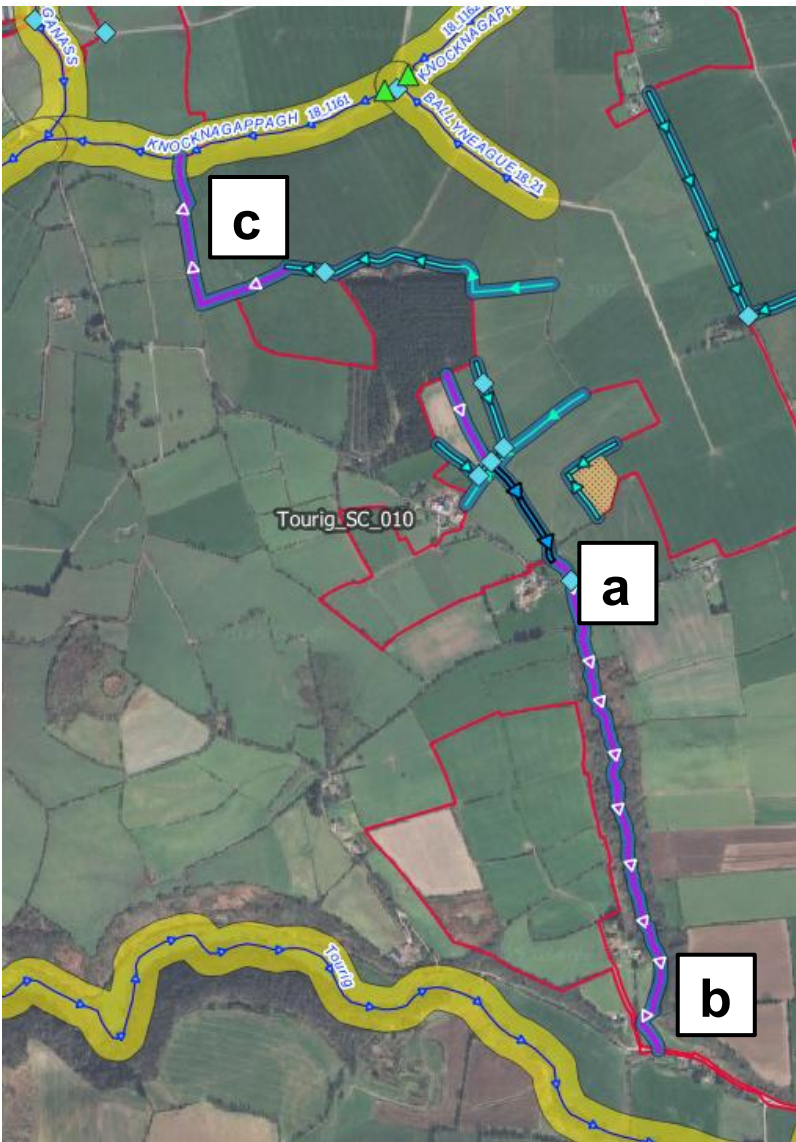


Note: Data points presented are georeferenced using open source data and/or a handheld GPS. This drawing / map is considered a conceptual model with reasonable accuracy for the purposes of environmental assessment. This drawing should not be relied upon for detailed design purposes.











## Primary drains



(a) Primary drain connecting two historic drains, photo looking southeast. (b) Same drain further downstream at the edge of the RLB







a



b







Outfalls recorded on site



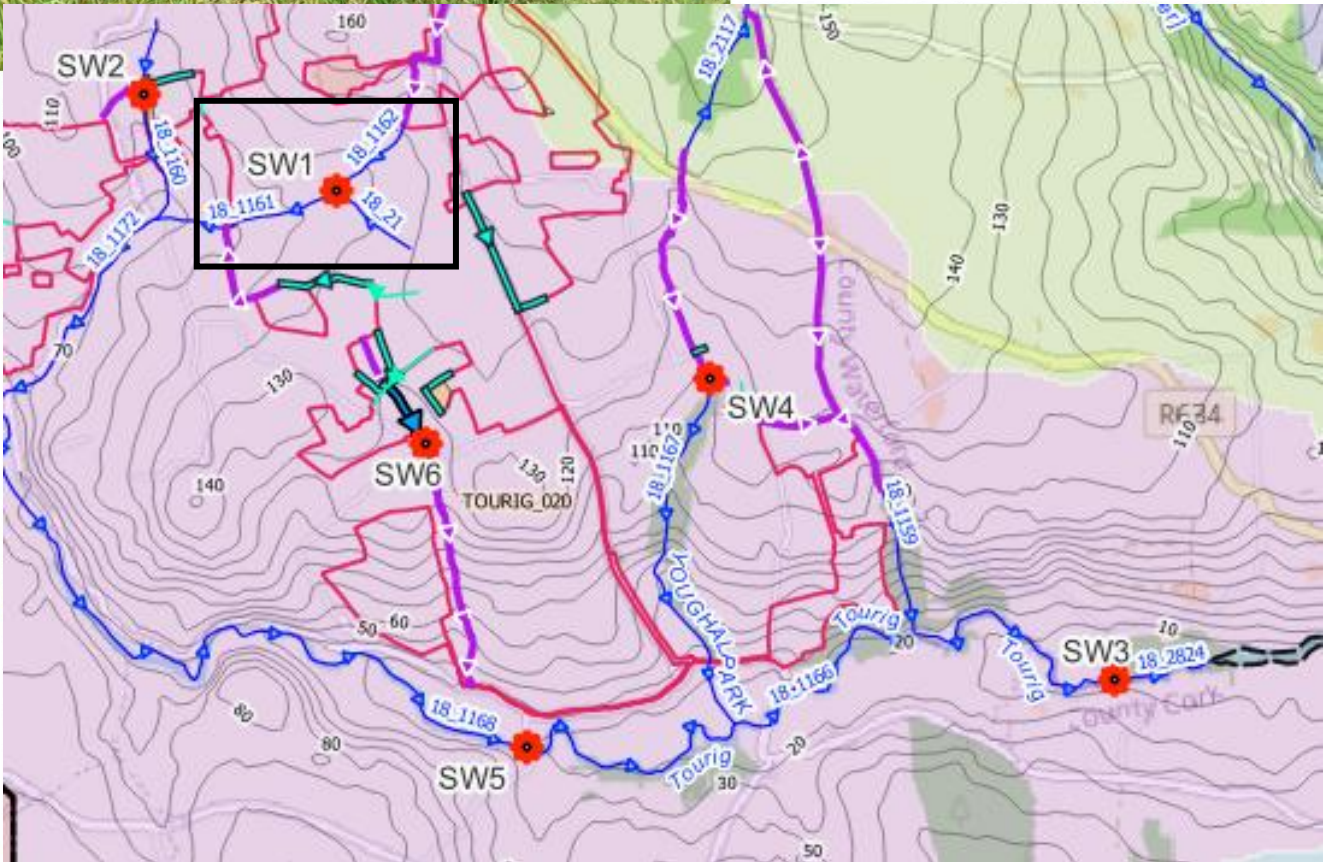


Agricultural wells on site

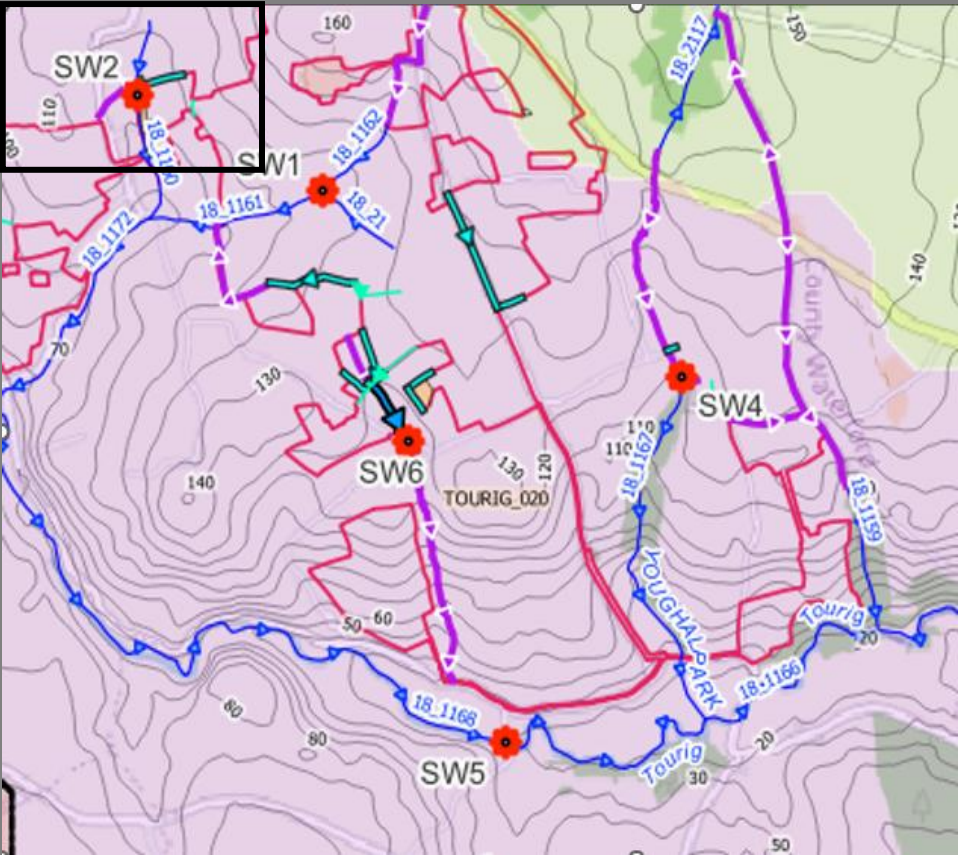
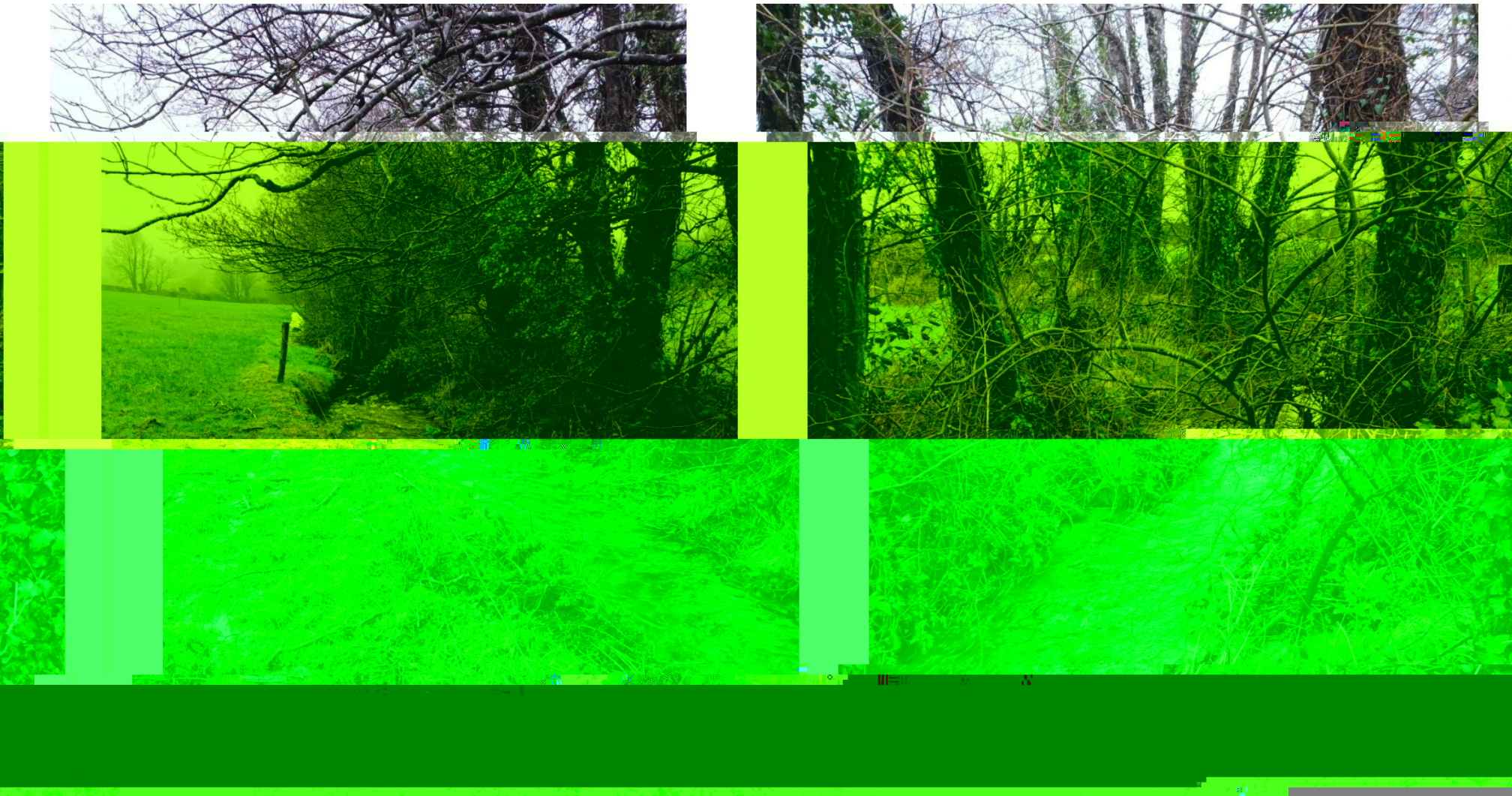




Mapped river on site

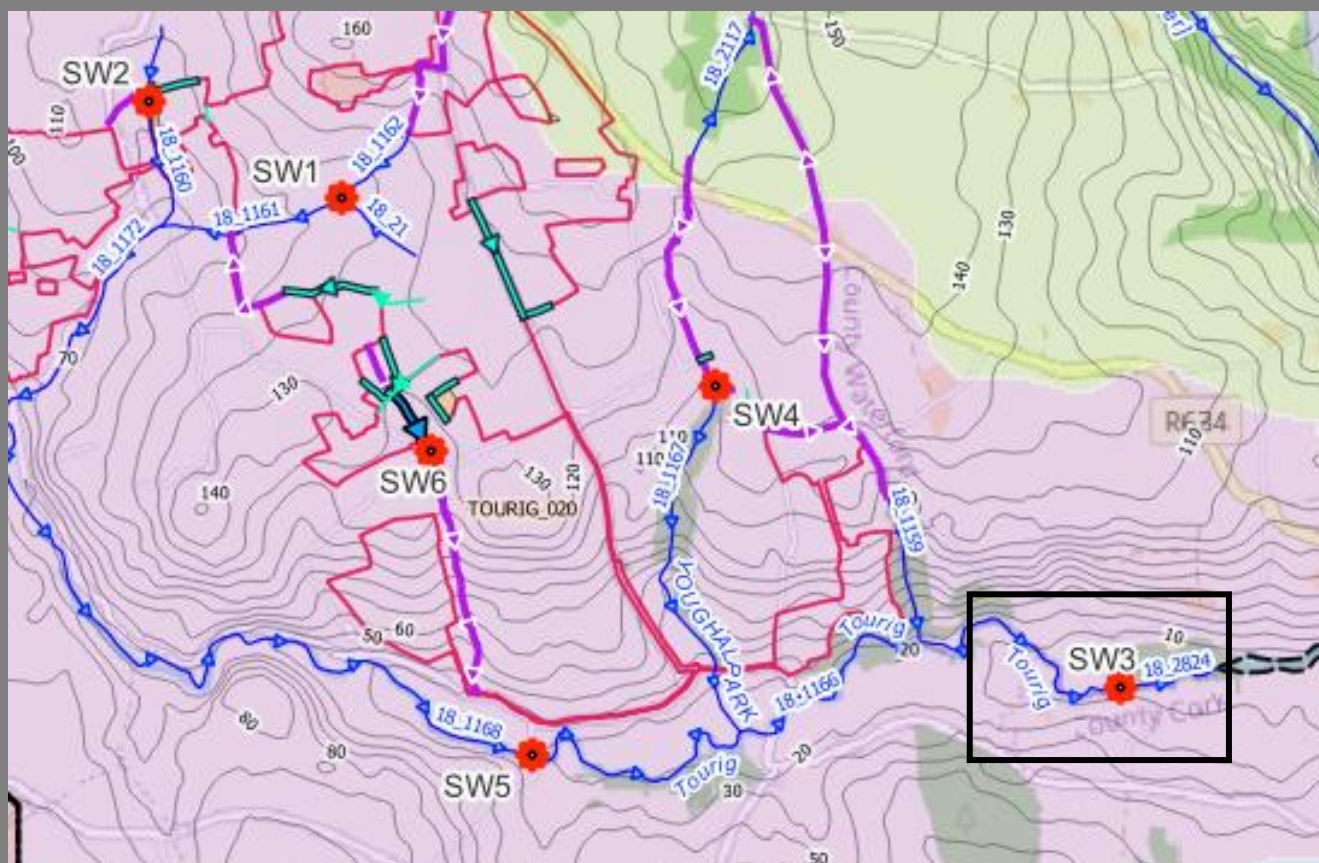




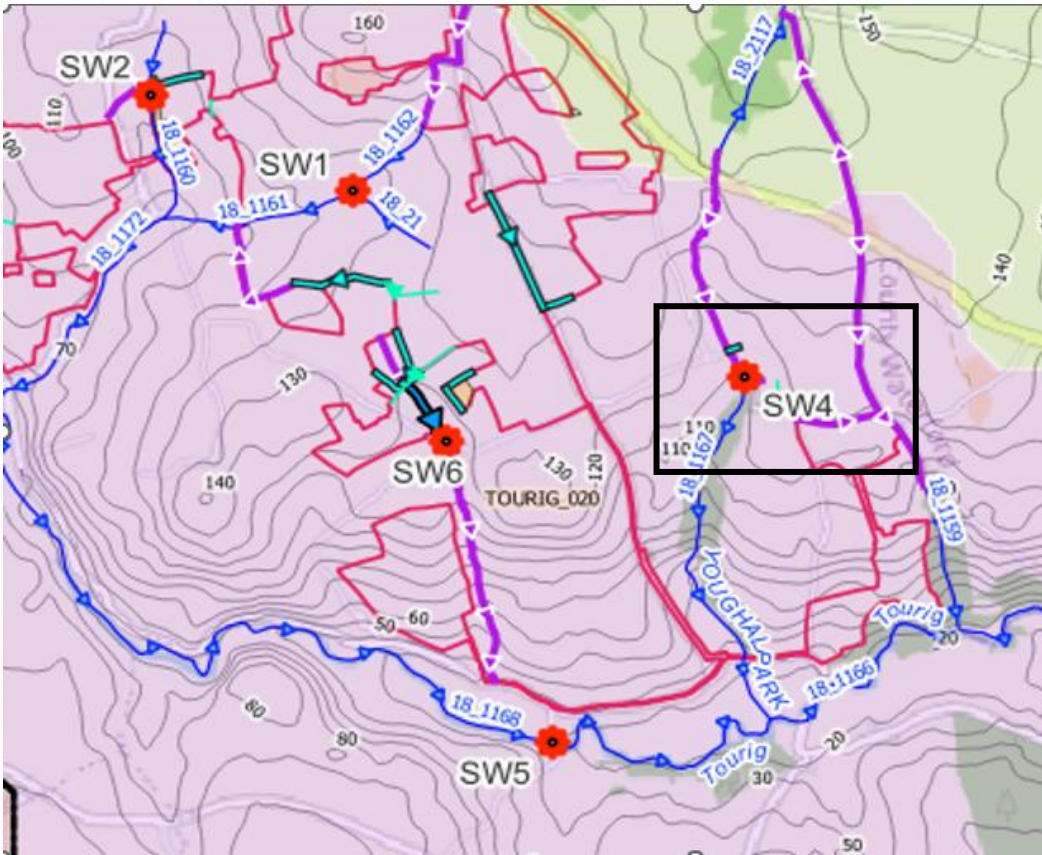


Mapped river on site



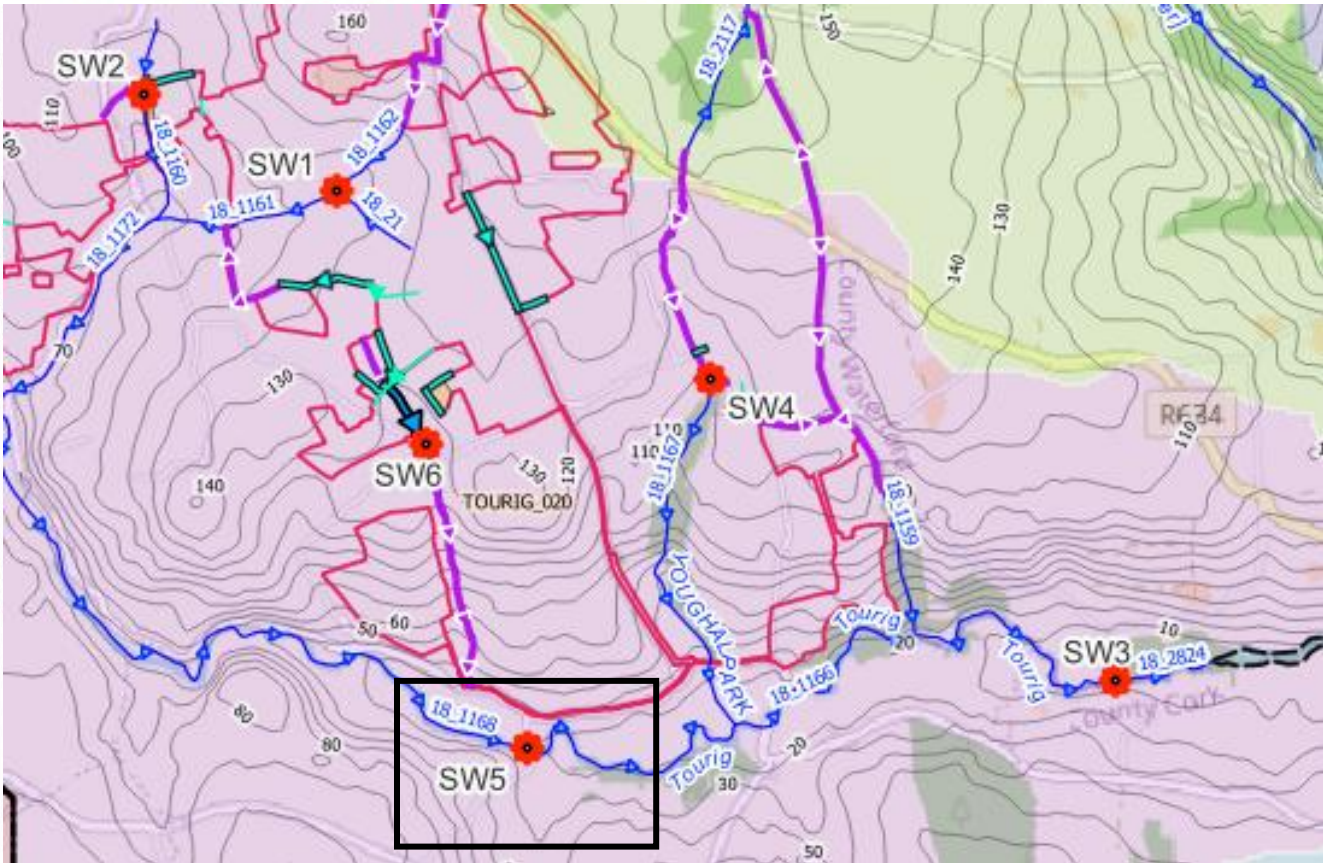
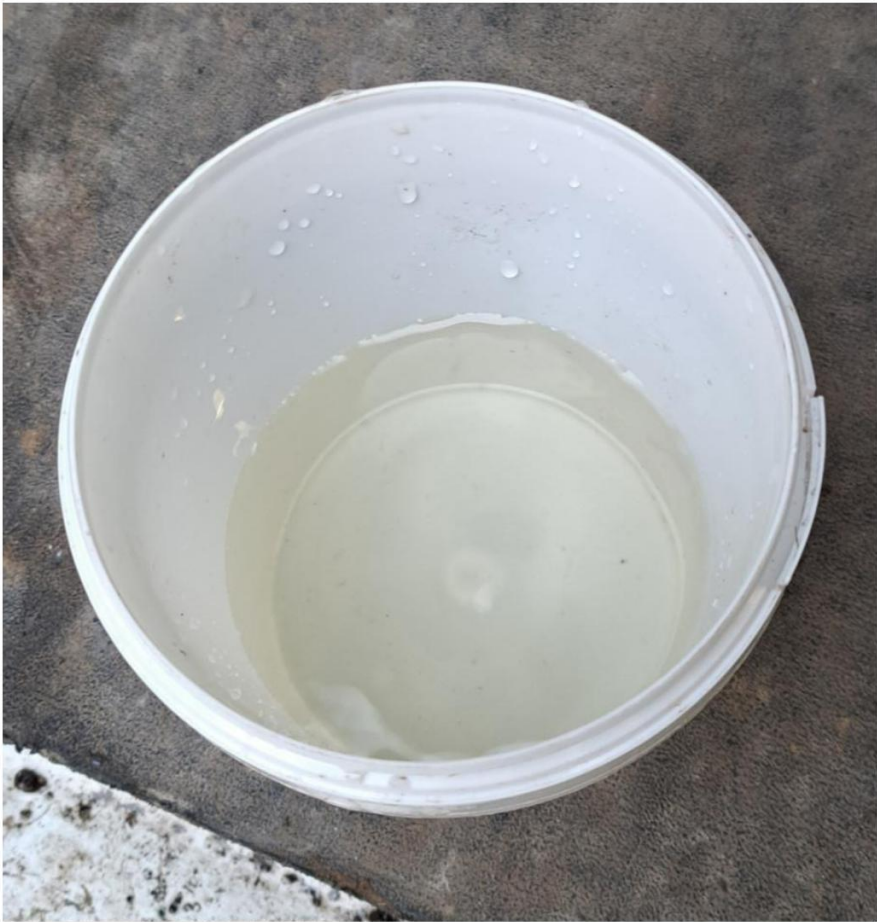




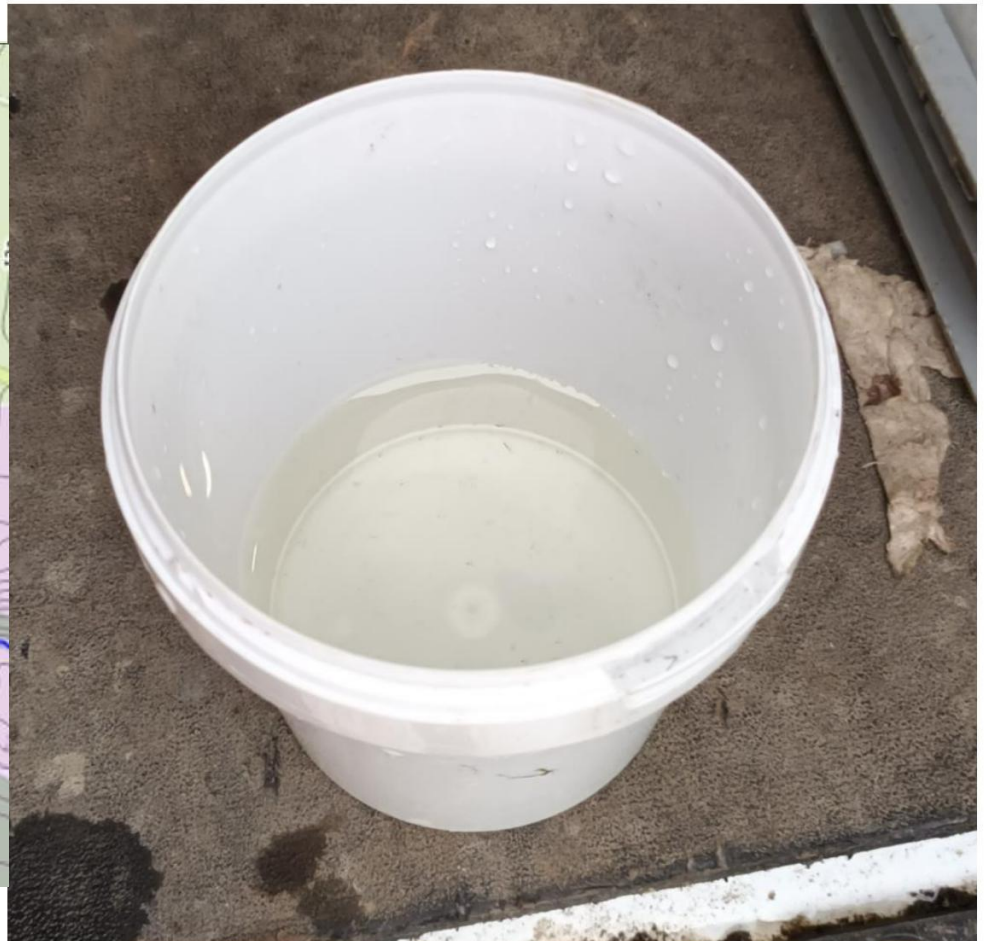
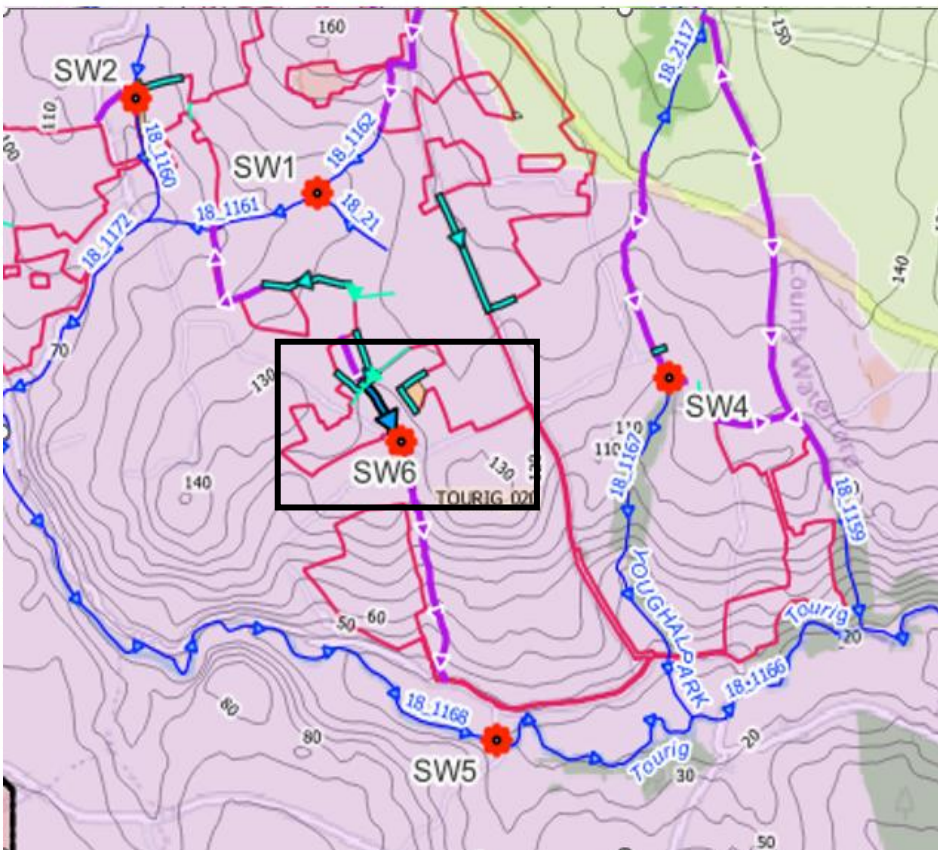


Historic drain connecting to a mapped river.









Historic drain connecting main area to the southwest area.





Perigus Energy Ireland Midco Limited

# Greenhills Renewable Energy Park

Flood Risk Assessment

605444 – R02

AUGUST 2026







## RSK GENERAL NOTES

**Project No.:** 605444-R02

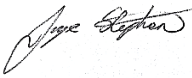
**Title:** Flood Risk Assessment

**Client:** Perigus Energy Ireland Midco Limited

**Date:** 12 August 2026

**Office:** Dublin

**Status:** Final (02)

| Author(s)                    |                                                                                     | Technical Reviewer & Approver  |                                                                                      |
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| Signature                    |  | Signature                      |  |
| Date:                        | 12 August 2026                                                                      | Date:                          | 12 August 2026                                                                       |

| Revision control sheet |            |                     |
|------------------------|------------|---------------------|
| Revision ref.          | Date       | Reason for revision |
| (01)                   | 21/11/2025 | First issue         |
| (02)                   | 12/11/2026 | Planning Submission |

RSK Ireland Ltd (RSK) has prepared this report for the sole use of the client, showing reasonable skill and care, for the intended purposes as stated in the agreement under which this work was completed. The report may not be relied upon by any other party without the express agreement of the client and RSK. No other warranty, expressed or implied, is made as to the professional advice included in this report.

Where any data supplied by the client or from other sources have been used, it has been assumed that the information is correct. No responsibility can be accepted by RSK for inaccuracies in the data supplied by any other party. The conclusions and recommendations in this report are based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Ireland Ltd.

# CONTENTS

---

|          |                                                                                 |           |
|----------|---------------------------------------------------------------------------------|-----------|
| <b>1</b> | <b>INTRODUCTION .....</b>                                                       | <b>1</b>  |
| 1.1      | Statement of Authority .....                                                    | 1         |
| <b>2</b> | <b>SOURCES OF INFORMATION .....</b>                                             | <b>2</b>  |
| 2.1      | Desk Study .....                                                                | 2         |
| 2.2      | Limitations .....                                                               | 2         |
| <b>3</b> | <b>SITE DESCRIPTION .....</b>                                                   | <b>3</b>  |
| 3.1      | Proposed Development .....                                                      | 3         |
| 3.2      | Location .....                                                                  | 3         |
| 3.3      | Site Hydrology .....                                                            | 3         |
| 3.4      | Site Soil and Subsoil .....                                                     | 4         |
| 3.5      | Site Hydrogeology .....                                                         | 4         |
| 3.5.1    | Aquifer Characteristics .....                                                   | 4         |
| 3.5.2    | Groundwater Vulnerability and Recharge .....                                    | 4         |
| <b>4</b> | <b>FLOOD RISK ASSESSMENT .....</b>                                              | <b>5</b>  |
| 4.1      | Introduction .....                                                              | 5         |
| 4.1.1    | Guidelines for FRAs .....                                                       | 5         |
| 4.1.2    | Sources of Flooding .....                                                       | 6         |
| 4.1.3    | Scoping and Assessing Flood Risk .....                                          | 7         |
| 4.1.4    | Assessing Likelihood of Flood Risk .....                                        | 7         |
| 4.2      | Stage 1 – Flood Risk Identification .....                                       | 11        |
| 4.2.1    | Flood Risk Management Plans .....                                               | 11        |
| 4.2.2    | Existing Flood Records .....                                                    | 11        |
| 4.2.3    | Tidal Flooding .....                                                            | 11        |
| 4.2.4    | Fluvial Flooding .....                                                          | 11        |
| 4.2.5    | Pluvial Flooding .....                                                          | 11        |
| 4.2.6    | Groundwater Flooding .....                                                      | 12        |
| 4.2.7    | Proposed Development and Flood Risk .....                                       | 12        |
| 4.2.8    | Human and/or Mechanical Error .....                                             | 12        |
| 4.2.9    | Proposed Development Design Implications .....                                  | 19        |
| 4.2.10   | FRA Stage 1 Conclusions .....                                                   | 19        |
| 4.3      | Stage 2 – Initial Flood Risk Assessment .....                                   | 20        |
| 4.3.1    | Assessing Potential Impacts of Development .....                                | 20        |
| 4.3.2    | Sustainable Planning and Justification Test .....                               | 20        |
| 4.3.3    | Assessment of Downstream Flood Risks .....                                      | 20        |
| 4.3.4    | Increased Hydraulic Loading / Runoff .....                                      | 20        |
| 4.4      | Mitigation Measures Associated with the Development .....                       | 28        |
| 4.4.1    | Mitigation for On-Site Runoff/Hydraulic Loading and Downstream Flood Risk ..... | 29        |
| 4.4.2    | Flood Risk Management in the Proposed Development Design .....                  | 30        |
| 4.4.3    | Data Gaps & Limitations .....                                                   | 31        |
| 4.5      | FRA Stage 2 – Conclusions .....                                                 | 31        |
| <b>5</b> | <b>REFERENCES .....</b>                                                         | <b>33</b> |



## TABLES

|                                                                                                                                                                        |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Table 3.1: Summary of the proposed solar farm location .....                                                                                                           | 3  |
| Table 4.1 Classification of vulnerability of different types of development (Table 3.1 OPW, 2009) .....                                                                | 9  |
| Table 4.2 Matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test (Table 3.2 OPW, 2009) ..... | 10 |
| Table 4.4 Local average long-term rainfall data, mm (1991-2020) at Cork Airport .....                                                                                  | 21 |
| Table 4.5 Met Eireann Return Period Rainfall Depths (Irish Grid; 203440, 081929) .....                                                                                 | 22 |
| Table 4.6 Specific Assessment Data .....                                                                                                                               | 22 |
| Table 4.7: Micro-catchment area and baseline runoff volumes (1 in 100 year storm) .....                                                                                | 25 |
| Table 4.8: Net increase in runoff as a function of the proposed development per micro-catchment areas and baseline runoff volumes (1 in 100 year store) .....          | 27 |

## FIGURES

|                                                                                                            |    |
|------------------------------------------------------------------------------------------------------------|----|
| Figure 4.1: Scoping and Screening for an FRA in ROI .....                                                  | 5  |
| Figure 4.2: Indicative flood zone map (Fig. 2.3 OPW, 2009) .....                                           | 8  |
| Figure 4.3 Sequential approach to mechanism in planning process (Fig. 3.2 OPW, 2009) .....                 | 10 |
| Figure 4.4: Past flood events not considering climate change (OPW, 2025) .....                             | 14 |
| Figure 4.5: NIFM, Present day, low and medium probability not considering climate change (OPW, 2025) ..... | 16 |
| Figure 4.6: NIFM, Future scenarios, considering climate change (OPW, 2025) .....                           | 17 |
| Figure 4.7: Hydrometric stations for river discharge rates (EPA, 2025) .....                               | 18 |
| Figure 4.9: Extract of Delineated Micro-Drainage Catchments across the Proposed Development .....          | 24 |
| Figure 4.10: Example of a hydrograph (CIRCA, 2015) .....                                                   | 29 |

# 1 INTRODUCTION

---

RSK Ireland was commissioned to carry out a Flood Risk Assessment (FRA) by Perigus Energy Ireland Midco Limited, (the Client). The assessment is in support of the planning application for the Greenhills Renewable Energy Park (the Project) in Co. Cork.

This FRA has been carried out in accordance with the Department of Housing and Local Government (DEHLG) and the Office of Public Works (OPW) document “*The Planning Process and Flood Risk Management Guidelines for Planning Authorities*” published in November 2009. This FRA identifies and sets out possible mitigation measures against potential risks of flooding from various sources. Sources of possible flooding include coastal, fluvial, pluvial (direct heavy rain), groundwater and human/mechanical error. The FRA provides an assessment of the subject site for flood risk purposes only.

## 1.1 Statement of Authority

RSK (Ireland) Ltd. (RSK), part of RSK Group, is a consultancy providing environmental services in the hydrological, hydrogeological and other environmental disciplines. The company and group provide consultancy to clients in both the public & private sectors. More information can be found at [www.rskgroup.com](http://www.rskgroup.com). The principal members of the RSK EIA team involved in this assessment include the following persons;

- Matt Buchanan is a Principal Consultant at RSK with over 8 years professional experience across the range of Water, Flood Risk, Environmental and Construction Sectors in the UK and Ireland. Matt is a Chartered Water and Environmental Manager (C.WEM), a Chartered Scientist (C.Sci) and Chartered Environmentalist (CEnv) with the Chartered Institution of Water and Environmental Management. Matt has a strong technical background in flood risk, flood risk assessment and hydrological assessment and studies across the UK and Ireland. Matt has worked with a range of public bodies (OPW, EPA, EA & SEPA) on large-scale flood relief schemes to assess, quantify and optioneer sustainable solutions for the client and affected communities. Matt has also worked with a range of private sector developers aiding through planning and development stage to ensure timely and cost-effective construction programmes.
- Dr. Jayne Stephens - B.S.c (Environmental Science), PhD (Environmental and Infection Microbiology). Jayne is a Senior Environmental consultant with c. 7 years' experience working in microbiology, water, and environmental disciplines.
- Chloe Walsh – B.S.c (Earth and Ocean Science), graduate environmental consultant with c. 1.5 years' experience working in mineral exploration. Member in training (MIT) with Institute of Geologists of Ireland (IGI).



## 2 SOURCES OF INFORMATION

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### 2.1 Desk Study

A desktop study was undertaken to identify local hydrology, hydrogeology and specific Water Framework Directive (WFD) status and risks. The following sources were consulted;

- Environmental Protection Agency Map Viewer (2025) Environmental Protection Agency. Available at: <https://gis.epa.ie/EPAMaps/>, accessed August 2025.
- Geological Survey of Ireland - GSI (2025) Public Data Viewer Series. Available at: <https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx>, accessed August 2025.
- Geohive Public Map Viewer. Available at: Available at: <https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx>, accessed August 2025.
- Office of Public Works (OPW) Flood maps. (2025) Available at: <https://www.floodinfo.ie/map/floodmaps/>, accessed August 2025.

### 2.2 Limitations

Reliance has been placed on factual and anecdotal data obtained from the sources identified. RSK cannot be held responsible for any omissions, misrepresentations, errors or inaccuracies with the supplied information. This FRA has been completed with the objective to ensure flood risk is minimised where possible and mitigated against effects from the Project. It is based on current site conditions, as surveyed in February 2025 and the available information provided by the client, the OPW maps and Environmental Protection Agency (EPA) maps. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report in whole or in part.

All opinions expressed are based upon current design standards and policies in force at the date of this report. These standards may be subject to change with the passage of time.

The opinions expressed herein are intended to provide general guidance as to how a problem related to a particular development might be resolved. However, conclusions can only sensibly be arrived at upon detailed design stages.

As a consequence of the above, RSK Ltd. will not be held liable for any consequential losses, howsoever caused, as a consequence of inaccurate missing, incomplete, or erroneous data contained in this report, nor any data capable of being subject to variable interpretation by means of its generalised nature.

## 3 SITE DESCRIPTION

### 3.1 Proposed Development

Greenhills Renewable Energy Park (the Proposed Development) comprises a solar farm with interconnecting cables, battery energy storage system, 220kV AIS substation and loop-in grid connection.

This FRA covers the Redline Boundary (RLB).

### 3.2 Location

The Proposed Development is adjacent to the R364 road approximately 7km north-west of the settlement of Youghal and 6.5km north-east of Killeagh, Co. Cork.

**Table 3.1: Summary of the proposed solar farm location**

|                     |                                            |
|---------------------|--------------------------------------------|
| <b>Name</b>         | Greenhills Renewable Energy Park           |
| <b>Address</b>      | Greenhills Renewable Energy Park, Co. Cork |
| <b>Centre point</b> | E 603434.73, N 581729.18 (ITM)             |

A total land area of the proposed solar farm is approximately 320 hectares and is characterised by relatively flat topography with associated elevations ranging between 23 metres above ordnance datum (mAOD) and 166mAOD and slopes ranging from between 0.5 and 20° with an average slope of 4°.

Land Cover maps (EPA, Corine (2018)<sup>1</sup>) indicates that the land use at the solar farm is agricultural, with much of the area classified as pastures.

### 3.3 Site Hydrology

The Proposed Development is situated within the Blackwater (Munster) Catchment (ID: 18, Area: c. 3307.64 km<sup>2</sup>). Surface water runoff associated with the Site drains into Tourig\_SC\_010 sub catchment and the Tourig\_020, Glendine (Blackwater)\_010 and Tourig\_010 River sub basins. Surface waters drain from the Site via the historical drains into the Tourig and the Glendine Rivers before discharging to the Lower Blackwater M/Estuary Youghal Harbour Transitional Waterbody (IE\_SW\_020\_01000, which flows to the Youghal Bay Coastal Waterbody and eventually into the Western Celtic Sea Coastal waterbody (IE\_SW\_010\_0000).

In terms of local drainage and non-mapped surface water features, the solar farm site is characterised by artificial drainage networks including agricultural and land reclamation / improvement works.

<sup>1</sup> CORINE Land Cover (2018). Online: <https://land.copernicus.eu/pan-european/corine-land-cover/clc2018>. [Accessed: July 2025]



### **3.4 Site Soil and Subsoil**

Consultation with the available National Soil Map (EPA map viewer<sup>2</sup>) indicates that most of the site is underlain by Acid Deep Well Drained Mineral (AminDW) soil.

Consultation with the available subsoil maps (EPA map viewer) indicates that most of the Proposed Development is underlain by sandstone till (TDSs). There are minor pockets of bedrock at or close to surface and Alluvium.

The subsoil permeability across the proposed development is moderate or not mapped.

### **3.5 Site Hydrogeology**

#### **3.5.1 Aquifer Characteristics**

The Proposed Development is underlain by a Locally Important Aquifer (LI) which describes bedrock which is moderately productive only in local zones. The Proposed Development overlies the Glenville Groundwater Body which covers an area of 1,107km<sup>2</sup>. There are no karst features close to the site.

#### **3.5.2 Groundwater Vulnerability and Recharge**

The groundwater vulnerability on site varies from moderate (M) to rock at or near surface (X). Most of the site is classed at high (H), with more extreme ground water vulnerability mapped close to the rivers and towards the south of the Proposed Development RLB.

The Proposed Development is assigned a recharge coefficient of 60% with the exception of areas with a vulnerability rating of X (rock at or near the surface) where the recharge coefficient is 85%. Both settings have an estimated recharge ranging from 151-200mm/yr

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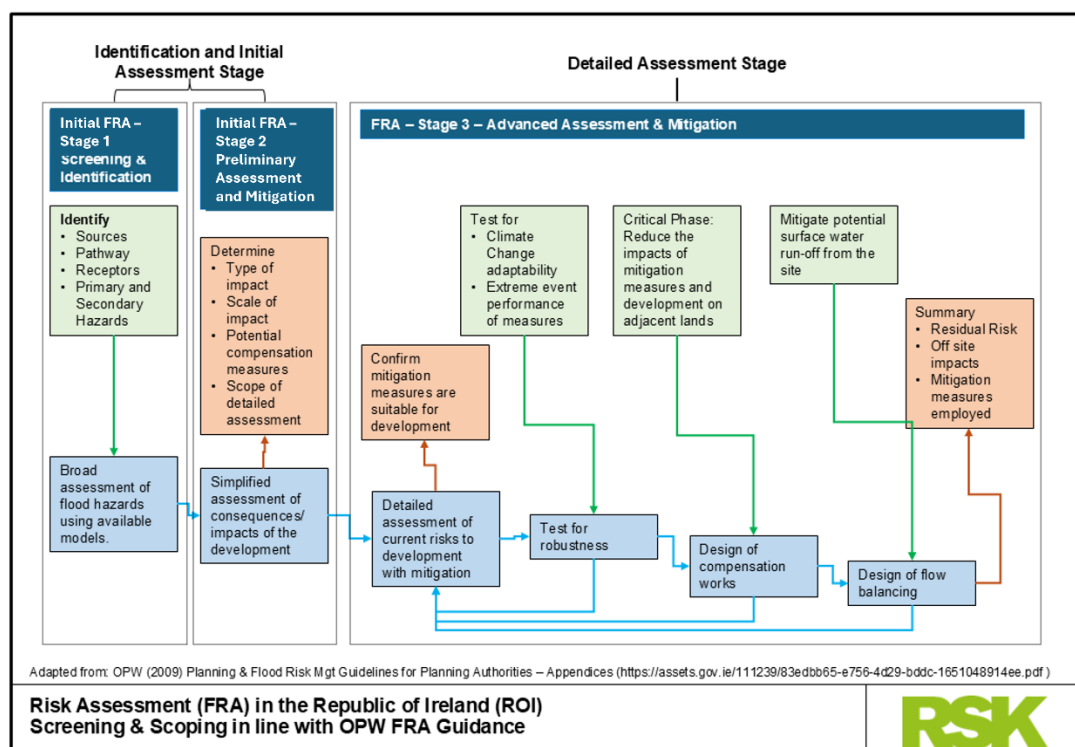
<sup>2</sup> Environmental Protection Agency (EPA) (ND) EPA Map Viewer [Online], Layer SIS National Soils - Available at: <https://gis.epa.ie/EPAMaps/>

## 4 FLOOD RISK ASSESSMENT

### 4.1 Introduction

#### 4.1.1 Guidelines for FRAs

This FRA Report follows the guidelines set out in the DEHLG/OPW Guidelines on the Planning Process and Flood Risk Management published in November 2009. This assessment will address where surface water and groundwater within or around the site boundary comes from (i.e., the source), how and where it flows (i.e. the pathways) and the people and assets affected by it (i.e., the receptors). This stage aims to quantify the risk posed to the development and to the surrounding environment by this development.



**Figure 4.1: Scoping and Screening for an FRA in ROI**

The policy that governs the application of flood risk assessment in Ireland is outlined in the DEHLG Guidelines for Planning Authorities – Flood Risk Management (2009). The stages are set out below.

#### Flood Risk Assessment Stage 1

The purpose of Stage 1 (Flood Risk Identification) is to establish whether flood risk issues from any fluvial or surface water sources exist or may exist in the future, in accordance with the area of regional planning guidelines, development plans and Local Authority

Plans (LAP's) or a proposed development site that may warrant further investigation at the appropriate lower level plan or planning application levels (**Figure 4.1**);

### **Flood Risk Assessment Stage 2**

The purpose of Stage 2 (Initial Flood Risk Assessment) is to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information and to scope the extent of the risk of flooding which may involve preparing indicative flood zone maps. Where hydraulic models exist the potential impact of a development on flooding elsewhere and of the scope of possible mitigation measures can be assessed. In addition, the requirements of a detailed assessment should be scoped and assessed.

### **Flood Risk Assessment Stage 3**

The purpose of Stage 3 (Detailed Flood Risk Assessment) is to build on the assessment undertaken in Stage 1 and Stage 2. Stage 3 is required if Stage 1 and Stage 2 conclude the proposed development requires a Justification Test to be passed. Stage 3 assesses flood risk issues in sufficient detail (a hydraulic model may be required) and to provide a quantitative appraisal of potential flood risk to a proposed or existing development or land to be zoned, of its potential impact on flood risk elsewhere and of the effectiveness of any proposed mitigation measures.

#### **4.1.2 Sources of Flooding**

The components to be considered in the identification and assessment of flood risk are:

- Tidal flooding from high sea levels. Flooding occurs when sea levels along the coast or in estuaries exceed neighbouring land levels, or overcome coastal defences where these exist, or when waves overtop the coastline or coastal defences.
- Fluvial flooding from water courses. Flooding occurs when rivers and streams break their banks and water flows out onto the adjacent low-lying areas (the natural floodplains). This can arise where the runoff from heavy rain exceeds the natural capacity of the river channel and can be exacerbated where a channel is blocked or constrained or, in estuarine areas, where high tide levels impede the flow of the river out into the sea. While there is a lot of uncertainty on the impacts of climate change on rainfall patterns, there is a clear potential that fluvial flood risk could increase into the future.
- Pluvial flooding from rainfall / surface water. Flooding occurs when the amount of rainfall exceeds the capacity of urban storm water drainage systems or the infiltration capacity of the ground to absorb it. This excess water flows overland, ponding in natural or man-made hollows and low-lying areas or behind obstructions. This occurs as a rapid response to intense rainfall before the flood waters eventually enter a piped or natural drainage system. This type of flooding is driven in particular by short, intense rainstorms.
- Ground Water flooding from springs / raised ground water. Flooding occurs when the level of water stored in the ground rises as a result of prolonged rainfall, to meet the ground surface and flows out over it, i.e., when the capacity of this underground reservoir is exceeded. Groundwater flooding results from the



interaction of site-specific factors such as local geology, rainfall infiltration routes and tidal variations. While the water level may rise slowly, it may cause flooding for extended periods of time. Hence, such flooding may often result in significant damage to property or disruption to transport. In Ireland, groundwater flooding is most commonly related to turloughs in the karstic limestone areas prevalent in particular in the west of Ireland.

- Human/mechanical error. Flooding due to human or mechanical error. Flooding can also be caused by the failure or exceedance of capacity of built or man-made infrastructure, such as bridge collapses, from blocked piped sewerage networks, or the failure or over-topping of reservoirs or other water-retaining embankments (such as raised canals).

### 4.1.3 Scoping and Assessing Flood Risk

The two components of flood risk, as outlined in the FRM Guidelines, are the likelihood of flooding and the potential consequences arising from planned works; expressed as:

**Flood Risk = Likelihood of flooding x Consequences of flooding**

- Likelihood of flooding is normally defined as the percentage probability of a flood of a given magnitude or severity occurring or being exceeded in any given year. For example, a 1% probability indicates the severity of a flood that is expected to be exceeded on average once in 100 years, i.e., it has a 1 in 100 (1%) chance of occurring in any one year.
- Consequences of flooding depend on the hazards associated with the flooding (e.g., depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality), and the vulnerability of people, property and the environment potentially affected by a flood (e.g., the age profile of the population, the type of development, presence and reliability of mitigation measures etc).

### 4.1.4 Assessing Likelihood of Flood Risk

In the FRM Guidelines, the likelihood of a flood occurring in an area is identified and separated into Flood Zones (Figure 4.2), which indicate a high, moderate or low risk of flooding from fluvial or tidal sources, defined as follows:

- Flood Zone A - Where the probability of flooding is highest (greater than 1% Annual Exceedance Probability (AEP) or 1 in 100 for river flooding and 0.5% AEP or 1 in 200 for coastal flooding) and where a wide range of receptors would be located and therefore vulnerable;
- Flood Zone B - Where the probability of flooding is moderate (between 0.1% AEP or 1 in 1000 and 1% AEP or 1 in 100 for river flooding and between 0.1% AEP or 1 in 1000 year and 0.5% AEP or 1 in 200 for coastal flooding); and
- Flood Zone C - Where the probability of flooding is low (less than 0.1% AEP or 1 in 1000 for both river and coastal flooding).



**Figure 4.2: Indicative flood zone map (Fig. 2.3 OPW, 2009)**

As outlined in the FRM Guidelines, future developments must avoid where possible areas at risk of flooding, as such, essential infrastructure, including electricity substations, should be located within Flood Zone C. The FRM Guidelines categorises all types of development as either;

1. Highly Vulnerable,
2. Less Vulnerable and
3. Water Compatible e.g., flood infrastructure, docks, amenity open space (Table 4.1).

As the development of the Greenhills Renewable Energy Park is essential infrastructure including electricity substations, it is considered a 'highly vulnerable development'.

**Table 4.1 Classification of vulnerability of different types of development (Table 3.1 OPW, 2009)**

| Vulnerability class                                                | Land uses and types of development which include*:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Highly vulnerable development (including essential infrastructure) | <p>Garda, ambulance and fire stations and command centres required to be operational during flooding;</p> <p>Hospitals;</p> <p>Emergency access and egress points;</p> <p>Schools;</p> <p>Dwelling houses, student halls of residence and hostels;</p> <p>Residential institutions such as residential care homes, children's homes and social services homes;</p> <p>Caravans and mobile home parks;</p> <p>Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and</p> <p>Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding</p> |
| Less vulnerable development                                        | <p>Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions;</p> <p>Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans;</p> <p>Land and buildings used for agriculture and forestry;</p> <p>Waste treatment (except landfill and hazardous waste); Mineral working and processing; and</p> <p>Local transport infrastructure.</p>                                                                                                                                                                                                                                                                                                                                                                      |
| Water compatible development                                       | <p>Flood control infrastructure;</p> <p>Docks, marinas and wharves;</p> <p>Navigation facilities;</p> <p>Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location;</p> <p>Water-based recreation and tourism (excluding sleeping accommodation);</p> <p>Lifeguard and coastguard stations;</p> <p>Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and</p> <p>Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).</p>                                                                                                                                                          |

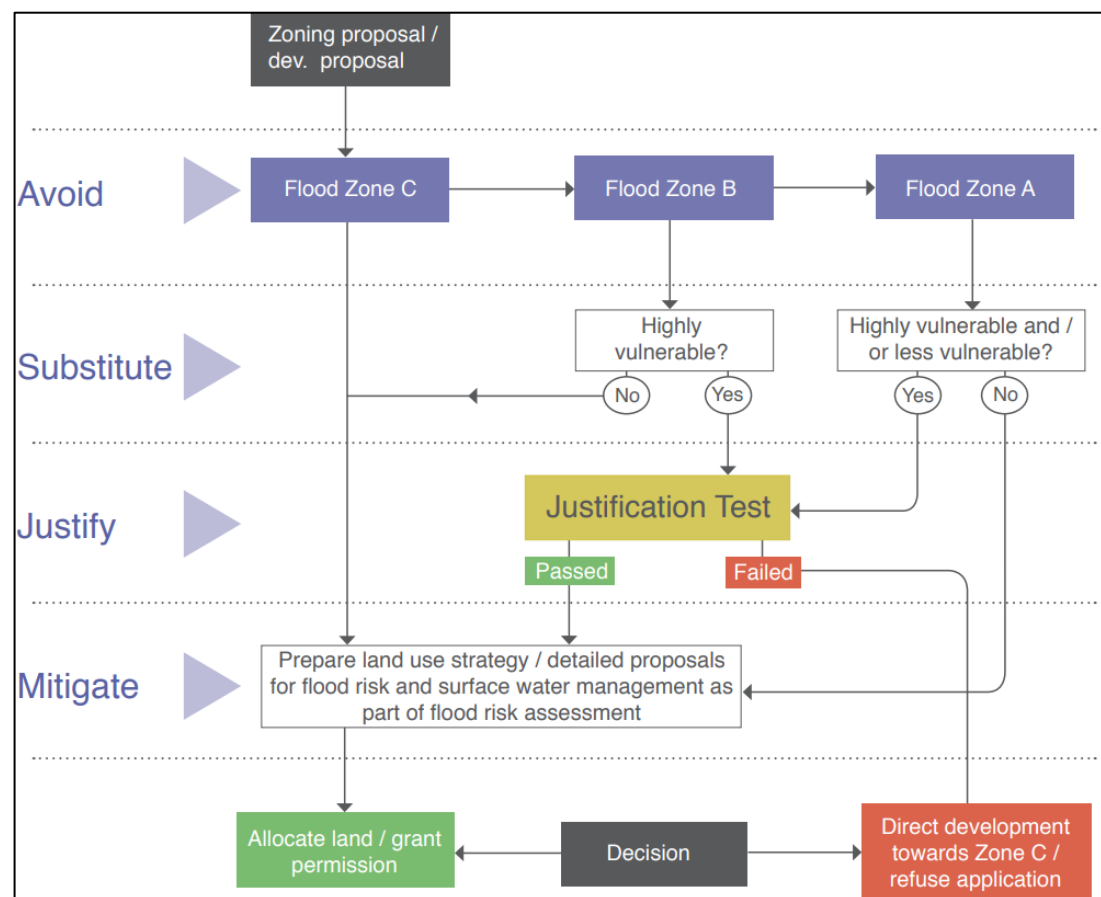
*\*Uses not listed here should be considered on their own merits*

Presented in **Table 4.2**, from the OPW (2009), a Justification Test is a guiding document that aims to determine the appropriateness of a particular development in areas that may be at risk of flooding. A Justification Test is required to assess such proposals in the light of proper planning and sustainable development objectives.



**Table 4.2 Matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test (Table 3.2 OPW, 2009)**

| Vulnerability class                                                | Flood Zone A       | Flood Zone B       | Flood Zone C |
|--------------------------------------------------------------------|--------------------|--------------------|--------------|
| Highly vulnerable development (including essential infrastructure) | Justification Test | Justification Test | Appropriate  |
| Less vulnerable development                                        | Justification Test | Appropriate        | Appropriate  |
| Water compatible development                                       | Appropriate        | Appropriate        | Appropriate  |



**Figure 4.3 Sequential approach to mechanism in planning process (Fig. 3.2 OPW, 2009)**

## 4.2 Stage 1 – Flood Risk Identification

The flood risk identification stage was carried out in order to establish whether a flood risk exists within the boundaries of the proposed Development or the surrounding vicinity. **Table 4.3** summaries the preliminary screening of flood maps provided by the OPW.

### 4.2.1 Flood Risk Management Plans

The Site is situated in an area that is included and assessed under OPW (2018) flood risk management plan, under Blackwater (Munster) catchment.

### 4.2.2 Existing Flood Records

Inspection of Base Maps from Ordinance Survey of Ireland records, i.e. First Edition 6-inch map (1839-1842) and the Map Genie 25-inch map indicates that the site itself does not flood.

There is a reoccurring flood event (Blackwater Ballynatray Lackaroe), reported on in 2005 and 2006 and which is located 2.6km downstream (**Figure 4.4**)

### 4.2.3 Tidal Flooding

Tidal flooding is caused by elevated sea levels or overtopping by wave action. There has been tidal flooding recorded in the coastal areas, downstream of the site, and there is none on site. The tidal flooding that has taken place is approximately 5km from the solar farm, in the area surrounding where the Glendine (Blackwater)\_010 River enters Youghal Harbour.

### 4.2.4 Fluvial Flooding

Fluvial flooding is caused by rivers, watercourses or drains overflowing. National indicative fluvial mapping present day scenarios at low and medium probability, indicate no flooding within the proposed Site Boundaries (**Figure 4.5**). The National Indicative Flood Mapping for future scenarios database operated by the OPW also confirms there are no areas represented as being low, medium or high probability risk to flood areas within the Site boundaries (**Figure 4.6**).

The nearest fluvial flooding occurs on the Tourig River located c. 1.1km east and south of the site. All areas of the site therefore reside in Flood Zone C, meaning the probability of flooding is low (less than 0.1% AEP or 1 in 1000 year flood event). It should be noted however that water from the site does drain into the Tourig River (sub catchment (Tourig\_SC\_010)).

Due to the proximity to potential receptors at the downstream extents, local and anecdotal knowledge has also informed the assessment. Changes to the hydrology of the site in terms of artificial drainage has meant that there are reports that some flooding has become more common in recent years. This is further discussed in Section 4.2.8.

### 4.2.5 Pluvial Flooding

Pluvial flood maps produced as part of the OPW's CFRAM do not indicate pluvial flood zones at the proposed development, or surrounding area. Therefore, the residual risk

from pluvial flooding is considered nil. Pluvial flooding is usually caused by intense rainfall that may only last a few hours, often referred to as flooding from surface water. Surface water flooding can also occur as a result of overland flow or ponding during periods of extreme prolonged rainfall. During pluvial flooding events, water follows natural valley lines, creating flow paths along roads, through and around developments and ponding in low spots, which often coincide with fluvial floodplains in low lying areas. It is generally noted, areas at risk from fluvial flooding will almost certainly be at risk from pluvial flooding.

Pluvial flood risk is potentially impacted by developments whereby changes in surfaces, ground sealing, and the introduction of drainage networks will fundamentally modify surface water runoff patterns and rates, potentially exacerbating pluvial, and fluvial risk at on site or downstream receptors.

#### **4.2.6 Groundwater Flooding**

Groundwater flooding can occur on some sites in connection with high water tables and increased recharge following long periods of wet weather. Groundwater flooding typically occurs in areas underlain by limestone and where underlying geology is highly permeable with high capacity to receive and store rainfall. The groundwater underneath the site is located within Locally Important Aquifer (LI) which describes bedrock which is moderately productive only in local zones. There has been no previously documented groundwater flooding within the site boundary. According to the Geological Survey Ireland (GSI), Groundwater Flooding Probability Maps (2016-2019), there is no evidence of a Low, Medium or High Probability groundwater flooding event within the boundary of the development. Therefore, the residual risk from groundwater flooding is considered low.

As a result groundwater flood risk has been screened out of this assessment.

#### **4.2.7 Proposed Development and Flood Risk**

While the Proposed Development includes the addition of 2,100,000m<sup>2</sup> of solar panel surfaces, this does not impact the existing ground below the solar panel array. Therefore, the existing natural responses and processes (recharge potential of rain percolating to groundwater, overland flow, catchment response to rainfall events) will remain unaffected. Other features which may have impacted the existing hydrological regime include minor additions of hardstanding across the site (i.e. substation, transformer, temporary work compounds and access track associated hardstanding) These are deemed to represent negligible increases to impermeable surfaces in comparison to the total area of the Proposed Development. Therefore, the Proposed Development represents a negligible change of the hydrological regime, and it is not foreseen that there will be any negative impacts on flood risk in the vicinity or downstream of the site. The nearest Hydrometric stations for river discharge rates are presented in **Figure 4.7**.

#### **4.2.8 Human and/or Mechanical Error**

Construction of drainage channels and enhancement of existing drainage associated with the proposed development have the potential to impact the hydrological regime at the site. In particular human error related to poor design, or if poorly managed during construction phase of a development, the installation of drainage channels and associated infrastructure such as culverts or attenuation features can lead to excessive





wetting and/or drying in areas of the site which does not conform to baseline conditions  
i.e., localised flooding or excessive draining.

This Past Flood Event Summary Report summarises all past flood events within 2.5 kilometres of the map centre.

This report has been downloaded from [www.floodinfo.ie](http://www.floodinfo.ie) (the "Website"). The users should take account of the restrictions and limitations relating to the content and use of the Website that are explained in the Terms and Conditions. It is a condition of use of the Website that you agree to be bound by the disclaimer and other terms and conditions set out on the Website and to the privacy policy on the Website.

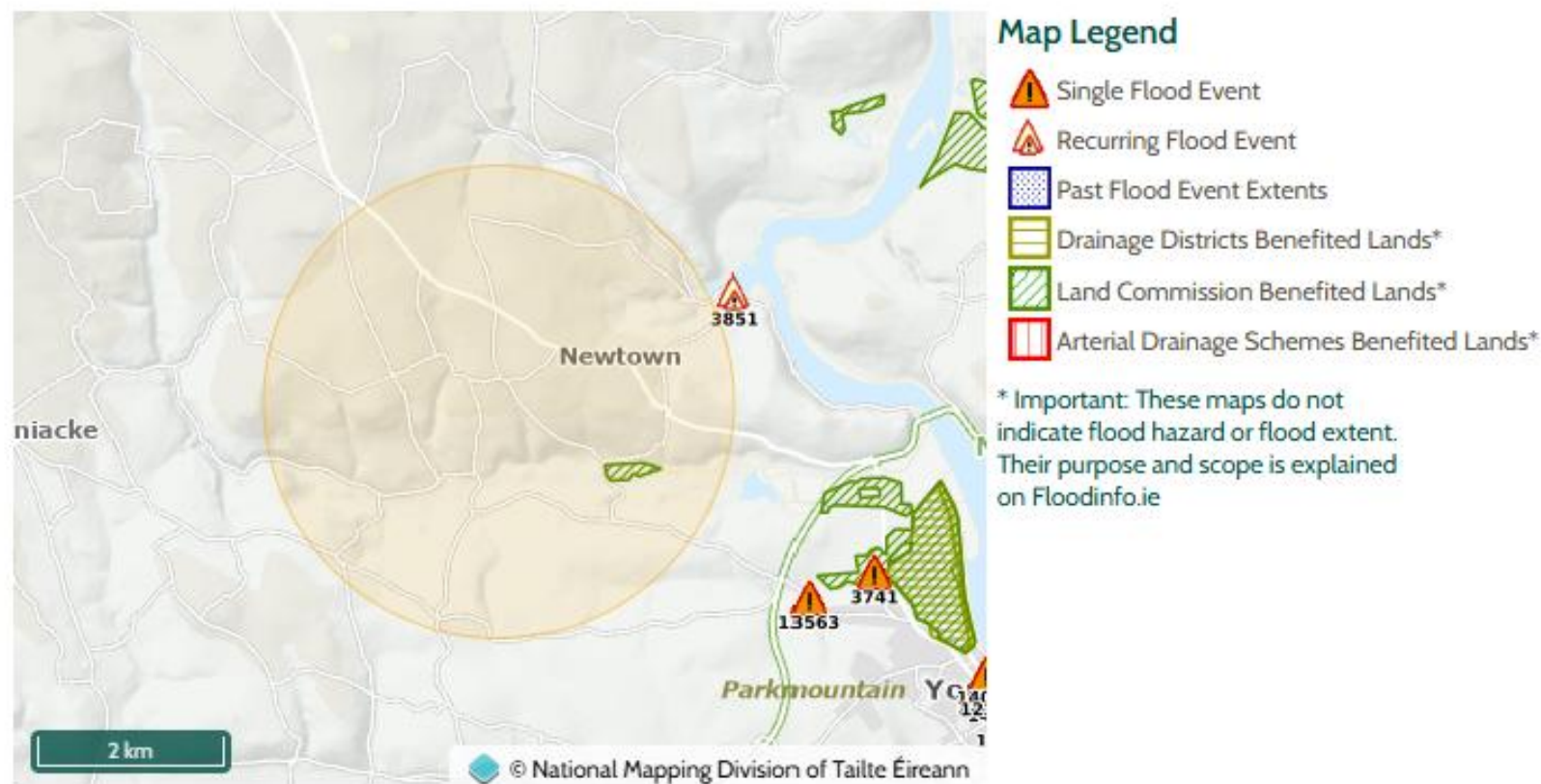


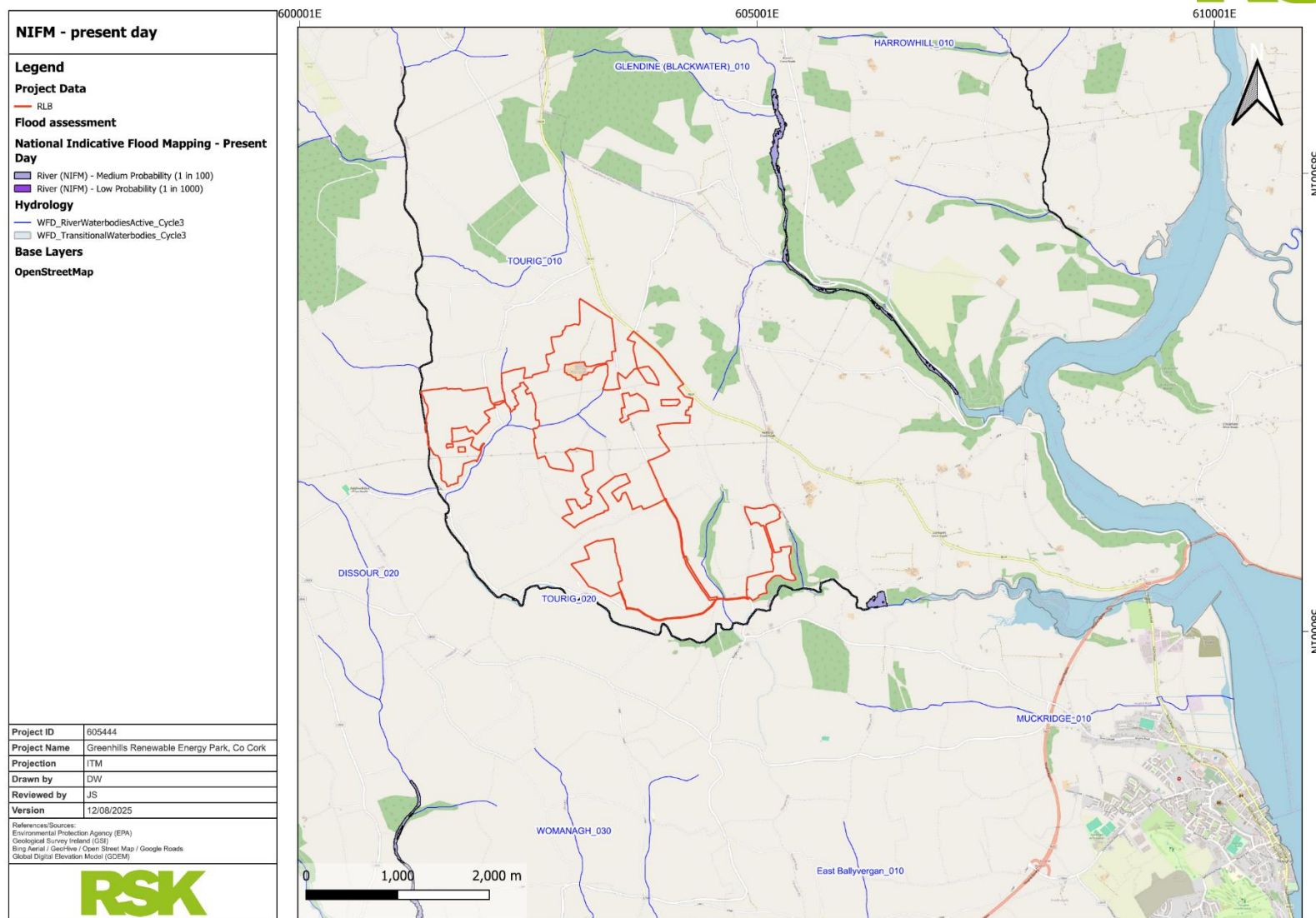
Figure 4.4: Past flood events not considering climate change (OPW, 2025<sup>3</sup>)



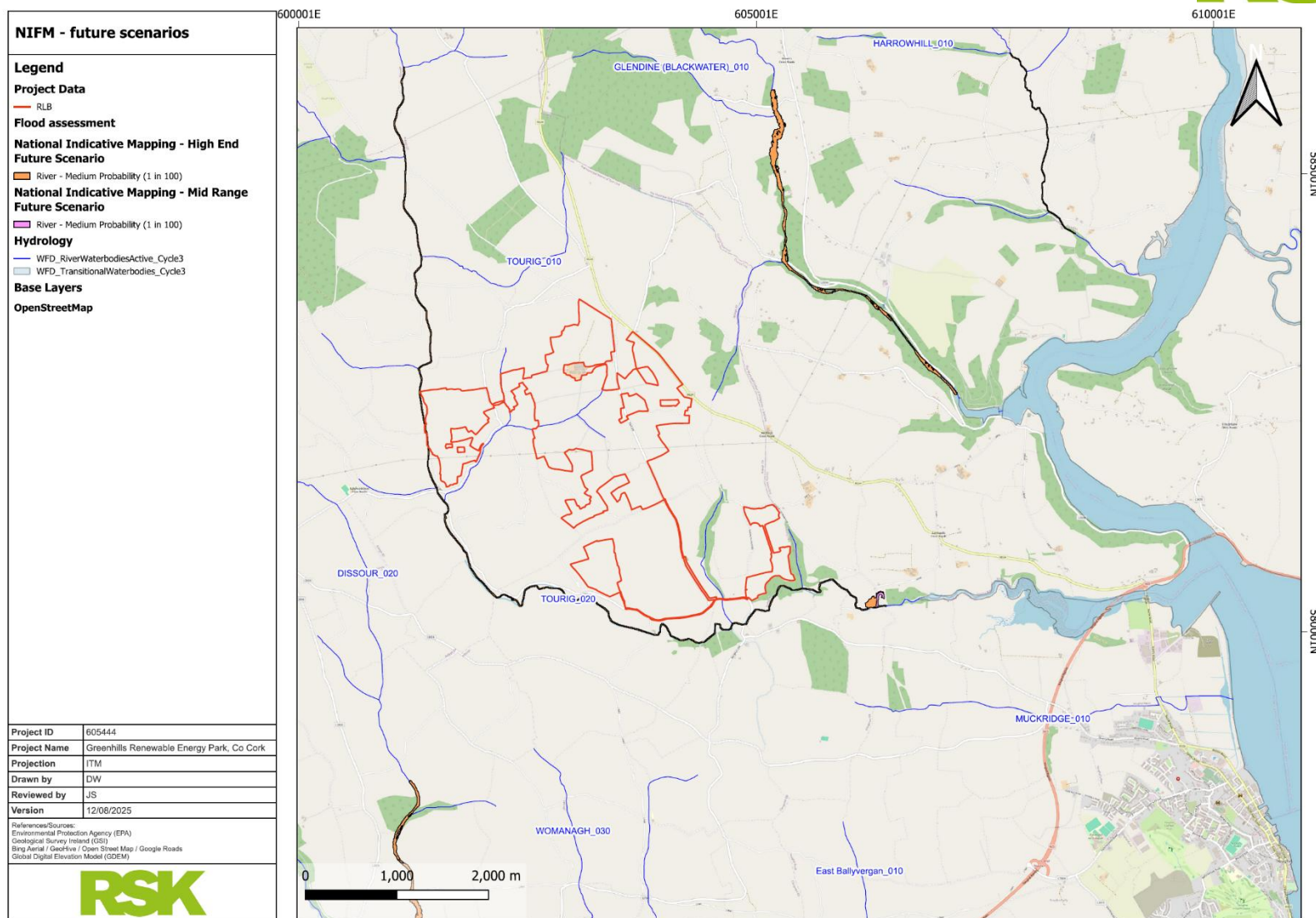
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<sup>3</sup> [https://www.floodinfo.ie/map/floodmaps/pf\\_report/?X=6796916.7085745055&Y=-882193.1846390939](https://www.floodinfo.ie/map/floodmaps/pf_report/?X=6796916.7085745055&Y=-882193.1846390939)





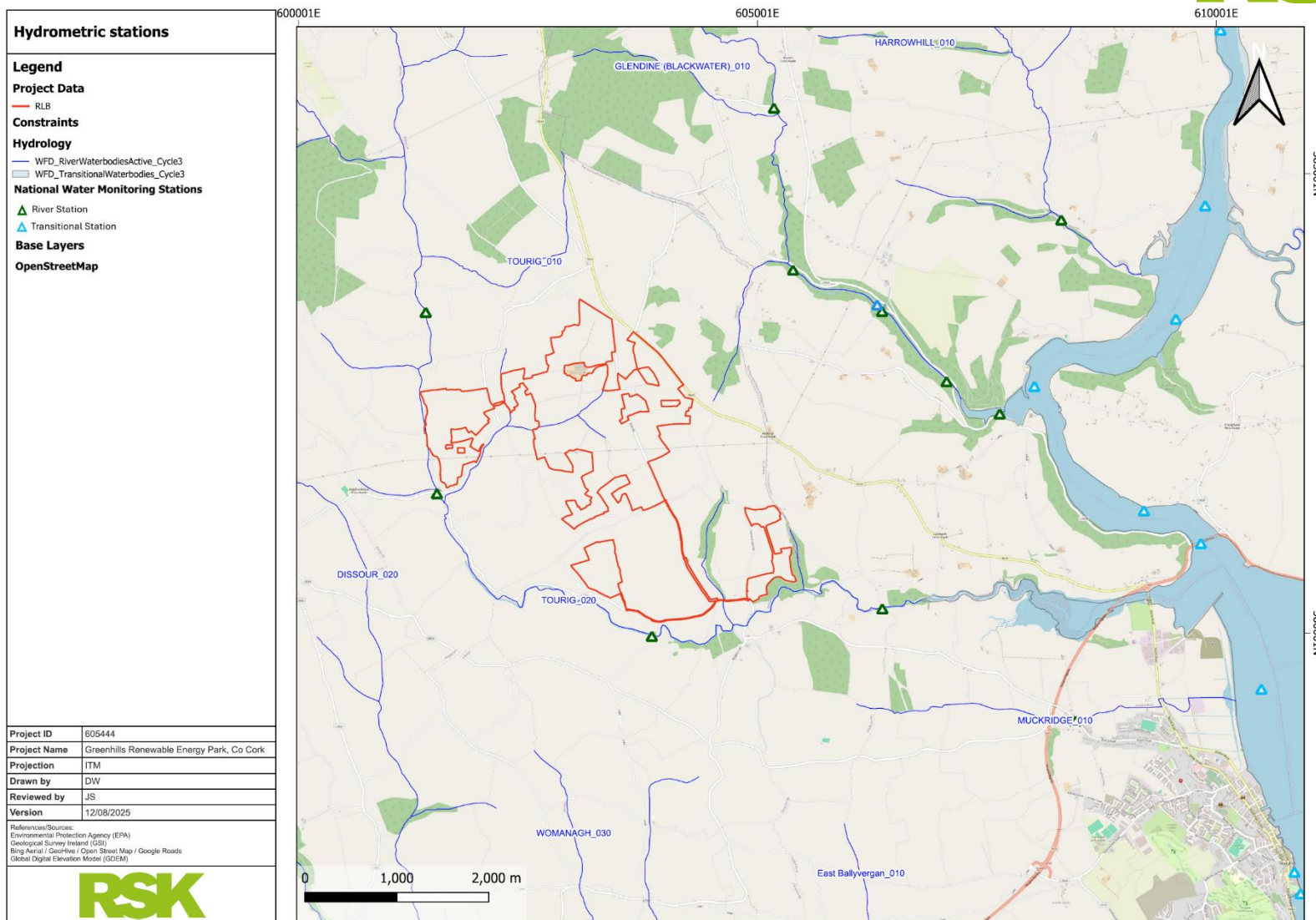
**Figure 4.5: NIFM, Present day, low and medium probability not considering climate change (OPW, 2025)**



Note: Data points presented are georeferenced using open source data and/or a handheld GPS. This drawing / map is considered a conceptual model with reasonable accuracy for the purposes of environmental assessment. This drawing should not be relied upon for detailed design purposes.

**Figure 4.6: NIFM, Future scenarios, considering climate change (OPW, 2025)**





**Figure 4.7: Hydrometric stations for river discharge rates (EPA, 2025)**



#### **4.2.9 Proposed Development Design Implications**

The Proposed Development will be comprised mostly by static infrastructure associated with the production of renewable energy (i.e. solar arrays). The nature of the predominant design element of the Proposed Development i.e. the continuous solar array has the potential to increase run-off rate and overland flow given the solar panels are a sheer, impermeable surface. There is a minor potential to increase run-off with a slight increase in impermeable hardstanding surfaces across the Proposed Development.

However, the Proposed Development site is an undeveloped Greenfield site. The design proposals indicate no change to the underlying ground conditions within the RLB. Areas where there is increased hardstanding represent a negligible change to the ground conditions in comparison to the whole area of the Proposed Development. Therefore, it is anticipated that there will be no net change to the hydrological regime. The proposed design allows for the maintenance of the natural hydrological regime and there will be no adverse effects downstream or on- or off-site.

#### **4.2.10 FRA Stage 1 Conclusions**

Stage 1 was completed based on the data presented in public records and anecdotal, local information gathered in accordance with guidelines set out in the DEHLG/OPW Guidelines (OPW, 2009).

The nature of the Proposed Development is industrial use. This type of development is categorised as a 'Highly Vulnerable Development' according to the FRM guidelines. The Proposed Development lies within Flood Zone C, with no records or reports of flooding on-site.

However, there are reports of fluvial flooding downstream of the Proposed Development from anecdotal information gathered from the Local Authority. The areas lie within the Medium (Flood Zone B) to High (Flood Zone A) probability of fluvial flooding. The review of available information has identified that fluvial flood risk is present for the Proposed Development from events on the River Tourig (Tourig\_020).

The Proposed Development has the potential to lead to an increase in recharge potential, an increase in immediate overland flow, a decrease in the time allowed for percolation to occur and as such a net increase in the overall hydrological response to rainfall events on-site.

Despite the Proposed Development falling within Flood Zone C, the site is classed as a 'Highly Vulnerable Development'. There is anecdotal evidence of fluvial flood risk downstream from the location of the Proposed Development. A Stage 2 Assessment is required.

## 4.3 Stage 2 – Initial Flood Risk Assessment

### 4.3.1 Assessing Potential Impacts of Development

### 4.3.2 Sustainable Planning and Justification Test

In line with The Planning System and Flood Risk Management guidance, a Justification Test is required for certain land uses in Flood Zone A or B. The Proposed Development does not require a Justification Test. As stated in Section 4.2.10, the Proposed Development is considered 'Highly Vulnerable'. However, it is in Flood Zone C and will not exacerbate flooding on-site or to downstream receptors off-site.

### 4.3.3 Assessment of Downstream Flood Risks

#### 4.3.3.1 Fluvial Flooding

The OPW National Indicative Fluvial Maps (NIFM) (<https://www.floodinfo.ie/map/floodmaps/>) were consulted with reference to fluvial flooding present day and future scenarios. This shows that both 1% (Low) and 0.1% (Medium) AEP fluvial flood events are predicted downstream of the location of the Proposed Development for the present-day scenario.

The Mid-Range Future Scenario (MRFS) and High-End Future Scenario (HEFS) also indicate slightly increased flooding in the Tourig River downstream of the location of the Proposed Development site but not impacting the site.

The Proposed Development site has a proposed drainage design outlined in the Drainage Management Plan. This outlines that the Proposed Development will result in a net increase in attenuation of rainwater in the form of swales, check dams and settlement/attenuation ponds. This will allow a controlled dispersal of overland flow and reduce run-off rates. Therefore, the risk of leading to an increase in flood risk on-site or downstream of the site is deemed to be negligible and mitigated by design.

#### 4.3.3.2 Assessment of Sensitive Receptors

There are sensitive receptors located in close proximity to the site. These receptors are agricultural and residential in nature. Some agricultural areas are located within the RLB. Other residential receptors are range from approximately 10m to 64m from the Proposed Development RLB.

### 4.3.4 Increased Hydraulic Loading / Runoff

#### 4.3.4.1 Rainfall and Evapotranspiration

The most recent 30-year annual average rainfall (1991-2020) recorded at Cork Airport rainfall station, which is approximately 40km southwest of the Proposed Development, is presented in **Table 4.4**<sup>4</sup>.

<sup>4</sup> [Cork Airport 1991–2020 averages](#)

**Table 4.3 Local average long-term rainfall data, mm (1991-2020) at Cork Airport**

| Station: Cork Airport |      |      |      |      |      |      |      |     |       |     |       |       |
|-----------------------|------|------|------|------|------|------|------|-----|-------|-----|-------|-------|
| Jan                   | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep | Oct   | Nov | Dec   | Total |
| 131.3                 | 97.2 | 91.5 | 86.5 | 80.8 | 83.3 | 87.2 | 94.6 | 92  | 131.2 | 127 | 136.6 | 1239  |

The average potential evapotranspiration was also collected from Cork Airport and the long-term average is 505.3mm/yr<sup>5</sup>.

The effective rainfall is calculated from:

$$\text{Effective rainfall} = \text{Average Annual Rainfall} - \text{Evapotranspiration}$$

Therefore 1239mm/yr-505.3mm/yr give effective rainfall of 733.7mm/yr. Although areas of the site are indicated to have an 85% recharge rate the recharge coefficient estimated from the site of 60% recharge (GSI map viewer) has been used across the entire site as this is a more conservative value. Therefore, annual recharge and runoff rates for the Proposed Development are estimated to be 440.22mm/yr.

Potential significant storm events including events with a 1 in 100 year return period over 1 hour duration, 25-day duration and 30-day or month duration (inferred using available data). The local data was collected from the Killeagh (Monabraher) station<sup>6</sup> approximately 2km west from site and is summarised in **Table 4.5**.

For the purpose of this FRA, predicted extreme or worst-case values are used, as presented in **Table 4.6**.

<sup>5</sup> [Monthly Data - Met Éireann - The Irish Meteorological Service](#)

<sup>6</sup> Met Éireann, Historical Data, Available at; [www.met.ie](http://www.met.ie), Accessed; August 2025



**Table 4.4 Met Eireann Return Period Rainfall Depths (Irish Grid; 203440, 081929)<sup>7</sup>**

| Met Eireann<br>Return Period Rainfall Depths for sliding Durations<br>Irish Grid: Easting: 203440, Northing: 81929, |          |        |        |        |        |        |        |        |        |        |        |        |        |        |
|---------------------------------------------------------------------------------------------------------------------|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| DURATION                                                                                                            | Interval |        | Years  |        |        |        |        |        |        |        |        |        |        |        |
|                                                                                                                     | 6months, | 1year, | 2,     | 3,     | 4,     | 5,     | 10,    | 20,    | 30,    | 50,    | 75,    | 100,   | 150,   | 200,   |
| 5 mins                                                                                                              | 2.9,     | 3.8,   | 4.2,   | 4.8,   | 5.2,   | 5.5,   | 6.4,   | 7.5,   | 8.1,   | 9.0,   | 9.7,   | 10.3,  | 11.1,  | 11.8,  |
| 10 mins                                                                                                             | 4.1,     | 5.3,   | 5.9,   | 6.7,   | 7.3,   | 7.7,   | 9.0,   | 10.4,  | 11.3,  | 12.5,  | 13.5,  | 14.3,  | 15.5,  | 16.4,  |
| 15 mins                                                                                                             | 4.8,     | 6.2,   | 6.9,   | 7.9,   | 8.5,   | 9.0,   | 10.6,  | 12.2,  | 13.3,  | 14.7,  | 15.9,  | 16.9,  | 18.2,  | 19.3,  |
| 30 mins                                                                                                             | 6.5,     | 8.3,   | 9.2,   | 10.6,  | 11.4,  | 12.1,  | 14.1,  | 16.3,  | 17.7,  | 19.6,  | 21.3,  | 22.5,  | 24.3,  | 25.7,  |
| 1 hours                                                                                                             | 8.7,     | 11.2,  | 12.4,  | 14.2,  | 15.3,  | 16.2,  | 18.9,  | 21.8,  | 23.7,  | 26.2,  | 28.4,  | 30.0,  | 32.5,  | 34.3,  |
| 2 hours                                                                                                             | 11.7,    | 15.0,  | 16.6,  | 19.0,  | 20.5,  | 21.7,  | 25.3,  | 29.2,  | 31.7,  | 35.0,  | 37.9,  | 40.0,  | 43.3,  | 45.8,  |
| 3 hours                                                                                                             | 13.9,    | 17.8,  | 19.8,  | 22.5,  | 24.4,  | 25.7,  | 30.0,  | 34.6,  | 37.5,  | 41.5,  | 44.9,  | 47.4,  | 51.3,  | 54.2,  |
| 4 hours                                                                                                             | 15.7,    | 20.1,  | 22.3,  | 25.5,  | 27.5,  | 29.0,  | 33.9,  | 39.1,  | 42.3,  | 46.8,  | 50.6,  | 53.5,  | 57.8,  | 61.0,  |
| 6 hours                                                                                                             | 18.7,    | 23.9,  | 26.5,  | 30.2,  | 32.6,  | 34.5,  | 40.2,  | 46.3,  | 50.2,  | 55.4,  | 59.9,  | 63.3,  | 68.4,  | 72.2,  |
| 9 hours                                                                                                             | 22.3,    | 28.4,  | 31.5,  | 35.9,  | 38.7,  | 40.9,  | 47.7,  | 54.9,  | 59.4,  | 65.6,  | 70.9,  | 75.0,  | 81.0,  | 85.5,  |
| 12 hours                                                                                                            | 25.2,    | 32.1,  | 35.6,  | 40.5,  | 43.7,  | 46.2,  | 53.8,  | 61.9,  | 67.1,  | 74.0,  | 80.0,  | 84.5,  | 91.3,  | 96.4,  |
| 18 hours                                                                                                            | 29.9,    | 38.1,  | 42.2,  | 48.1,  | 51.9,  | 54.8,  | 63.8,  | 73.4,  | 79.5,  | 87.7,  | 94.8,  | 100.1, | 108.1, | 114.1, |
| 24 hours                                                                                                            | 33.8,    | 43.1,  | 47.7,  | 54.3,  | 58.6,  | 61.9,  | 72.0,  | 82.8,  | 89.7,  | 98.9,  | 106.9, | 112.8, | 121.8, | 128.6, |
| 2 days                                                                                                              | 43.2,    | 54.0,  | 59.3,  | 66.9,  | 71.7,  | 75.4,  | 86.7,  | 98.7,  | 106.1, | 116.2, | 124.8, | 131.2, | 140.8, | 148.0, |
| 3 days                                                                                                              | 51.2,    | 63.2,  | 69.1,  | 77.4,  | 82.8,  | 86.8,  | 99.1,  | 112.0, | 120.1, | 130.9, | 140.0, | 146.9, | 157.1, | 164.7, |
| 4 days                                                                                                              | 58.3,    | 71.4,  | 77.9,  | 86.9,  | 92.6,  | 96.9,  | 110.2, | 124.0, | 132.5, | 144.0, | 153.7, | 160.9, | 171.7, | 179.7, |
| 6 days                                                                                                              | 71.2,    | 86.3,  | 93.6,  | 103.8, | 110.3, | 115.1, | 129.9, | 145.3, | 154.8, | 167.4, | 178.0, | 185.9, | 197.6, | 206.4, |
| 8 days                                                                                                              | 82.9,    | 99.7,  | 107.8, | 119.1, | 126.2, | 131.5, | 147.7, | 164.4, | 174.7, | 188.3, | 199.8, | 208.3, | 220.8, | 230.2, |
| 10 days                                                                                                             | 93.9,    | 112.3, | 121.1, | 133.3, | 141.0, | 146.7, | 164.2, | 182.1, | 193.1, | 207.6, | 219.9, | 228.9, | 242.3, | 252.2, |
| 12 days                                                                                                             | 104.4,   | 124.2, | 133.7, | 146.8, | 155.0, | 161.1, | 179.7, | 198.8, | 210.4, | 225.8, | 238.8, | 248.3, | 262.4, | 272.8, |
| 16 days                                                                                                             | 124.4,   | 146.8, | 157.5, | 172.2, | 181.4, | 188.2, | 208.9, | 230.0, | 242.9, | 259.8, | 274.0, | 284.4, | 299.8, | 311.2, |
| 20 days                                                                                                             | 143.4,   | 168.2, | 179.9, | 196.1, | 206.2, | 213.7, | 236.3, | 259.2, | 273.2, | 291.5, | 306.8, | 318.1, | 334.6, | 346.8, |
| 25 days                                                                                                             | 166.2,   | 193.8, | 206.8, | 224.6, | 235.7, | 243.9, | 268.7, | 293.7, | 308.9, | 328.9, | 345.4, | 357.6, | 375.5, | 388.7, |

NOTES:  
N/A Data not available  
These values are derived from a Depth Duration Frequency (DDF) Model  
For details refer to:  
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',  
Available for download at [www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies\\_TN61.pdf](http://www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf)

**Table 4.5 Specific Assessment Data**

| Category                                       | Value | Unit     |
|------------------------------------------------|-------|----------|
| 1 in 100 Year Rainfall Event (25 day duration) | 357.6 | mm/month |
| 1 in 100 Year Rainfall Event (1 hour duration) | 30.0  | mm/hr    |
| Average Annual Rainfall (1991-2020)            | 1239  | mm/yr    |
| Long term average evapotranspiration           | 505.3 | mm/yr    |
| Average Annual Effective Rainfall (Long term)  | 733.7 | mm/yr    |

#### 4.3.4.2 Preliminary Water Balance Assessment

For the purposes of assessing changes in runoff at the site as a function of the development, the following data compiled from GIS mapping software is considered;

- Total Area Solar Array Panels = c. 2,100,000 m<sup>2</sup>
- Transformer hardstands = c. 15,835 m<sup>2</sup>
- New access track length = 5,135m
- Access track width = 4m
- Total length of existing public road that will be utilised = 7,595 m
- BESS hardstand area = 8,980m<sup>2</sup>

<sup>7</sup> Met Eireann, Rainfall Return Periods, Available at; <https://www.met.ie/climate/services/rainfall-return-periods>, Accessed; August 2025

- Electrical Substation hardstand area = 18,540 m<sup>2</sup>
- Temporary Compound(s) = 13,300 m<sup>2</sup>
- 1 in 100 year rainfall event = c. 30.0mm of rainfall in 1 hour.
- Recharge capacity = 60% of Effective Rainfall (Note: This is considered a conservative value i.e. higher potential recharge coefficient in the range associated with the site.

This assessment is considered a simple preliminary water balance assessment for the purposes of qualifying and adding context to potential impacts of the development in terms of hydrological response to rainfall and flooding. It considers and uses site specific data as well as associated downstream attribute data. (Note: This is not considered advanced modelling for flood risk assessment (FRA Stage 3)). Surface water networks draining the site are mapped.

**Figure 4.8** shows the locations of the micro-drainage catchments delineated relative to the overall Proposed Development.

**Table 4.7** summarises a preliminary water balance analysis and potential net increase in runoff for the Site during a 1 in 100 year storm event.

**Table 4.8** summarises a preliminary water balance analysis and potential net increase in runoff for the Site during a 1 in 100 year storm event relative to baseline conditions.

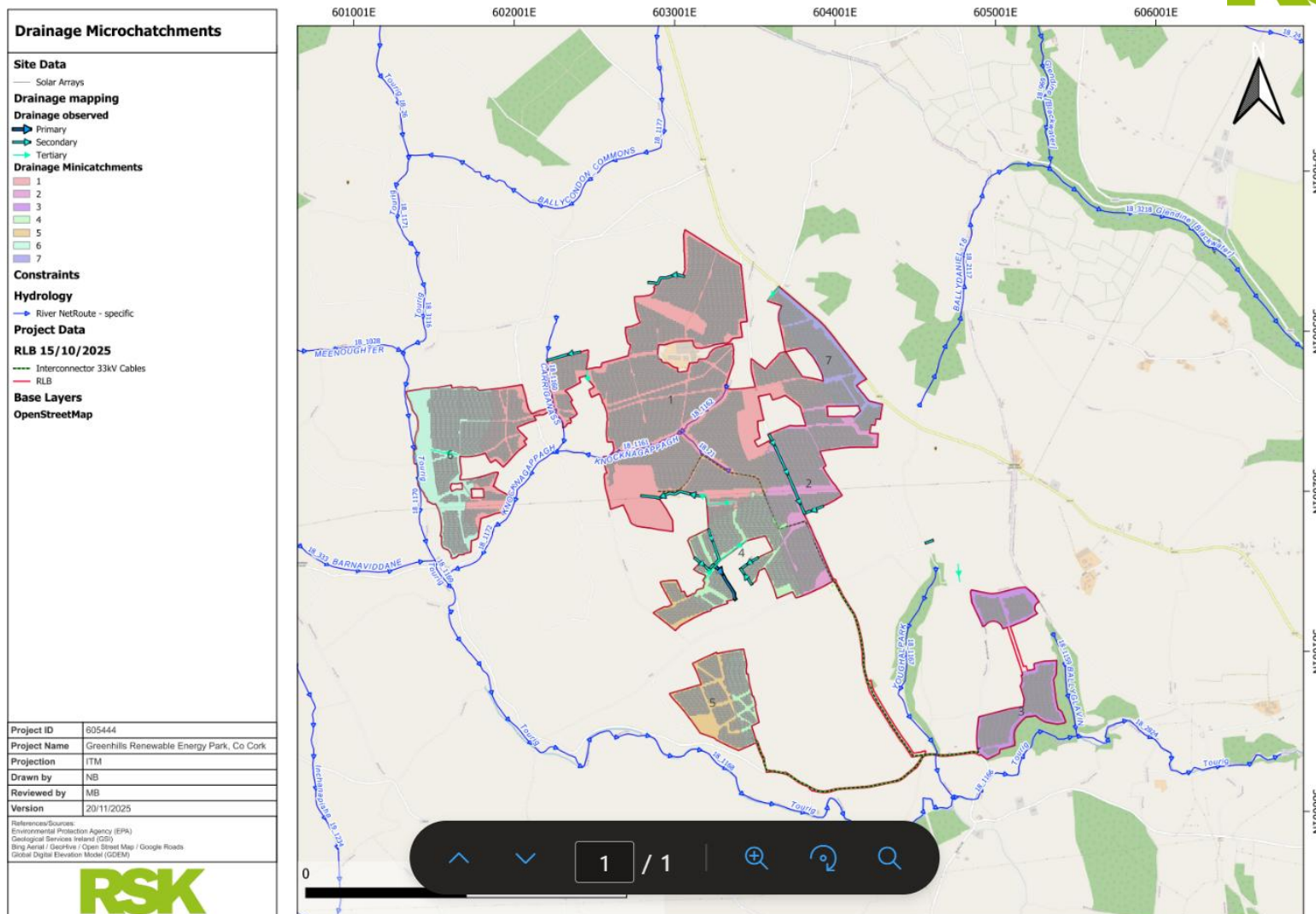


Figure 4.8: Extract of Delineated Micro-Drainage Catchments across the Proposed Development



**Table 4.6: Micro-catchment area and baseline runoff volumes (1 in 100 year storm)**

| Net increase in runoff as a function of the Development per micro-catchment area and baseline runoff volumes (1 in 100 Year Hour Storm Event) |                         |                               |                                          |                                                               |                                        |                                              |                                                          |                                                         |                                        |                                            |                                                          |                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------------------|------------------------------------------|---------------------------------------------------------------|----------------------------------------|----------------------------------------------|----------------------------------------------------------|---------------------------------------------------------|----------------------------------------|--------------------------------------------|----------------------------------------------------------|------------------------------------|
|                                                                                                                                               |                         |                               |                                          | Greenfield Scenario                                           |                                        |                                              |                                                          | Developed Scenario                                      |                                        |                                            |                                                          |                                    |
| Micro Catchment                                                                                                                               | Category                | Approx Area (m <sup>2</sup> ) | 1 in 100 Year Rainfall Event (m/hr Rain) | Capped Recharge Capacity % of Effective Rainfall <sup>1</sup> | Rejected Recharge / Runoff (m/hr Rain) | Runoff Discharge Rate (m <sup>3</sup> /hour) | Net Increase Runoff Discharge Rate (m <sup>3</sup> /sec) | Recharge Capacity. % of Effective Rainfall <sup>2</sup> | Rejected Recharge / Runoff (m/hr Rain) | Runoff Discharge Rate (m <sup>3</sup> /hr) | Net Increase Runoff Discharge Rate (m <sup>3</sup> /sec) | Net Increase (m <sup>3</sup> /sec) |
| 1                                                                                                                                             | Temp Compound Hardstand | 9,731.98                      | 0.03                                     | 60.00%                                                        | 0.012                                  | 116.78                                       | 0.03                                                     | 0.00%                                                   | 0.03                                   | 291.96                                     | 0.08                                                     | -                                  |
| 1                                                                                                                                             | Transformer Hardstands  | 7,832.70                      | 0.03                                     | 60.00%                                                        | 0.012                                  | 93.99                                        | 0.03                                                     | 0.00%                                                   | 0.03                                   | 234.98                                     | 0.07                                                     | -                                  |
| 1                                                                                                                                             | New Access Track        | 8,452.33                      | 0.03                                     | 60.00%                                                        | 0.012                                  | 101.43                                       | 0.03                                                     | 0.00%                                                   | 0.03                                   | 253.57                                     | 0.07                                                     | -                                  |
| 1                                                                                                                                             | BESS Hardstand          | 7,762.22                      | 0.03                                     | 60.00%                                                        | 0.012                                  | 93.15                                        | 0.03                                                     | 0.00%                                                   | 0.03                                   | 232.87                                     | 0.06                                                     | -                                  |
| 1                                                                                                                                             | Substation Hardstand    | 33,489.31                     | 0.03                                     | 60.00%                                                        | 0.012                                  | 401.87                                       | 0.11                                                     | 0.00%                                                   | 0.03                                   | 1,004.68                                   | 0.28                                                     | -                                  |
| 1                                                                                                                                             | Subtotal                |                               |                                          |                                                               |                                        |                                              | <b>0.22</b>                                              |                                                         |                                        |                                            | <b>0.56</b>                                              | <b>0.34</b>                        |
| 2                                                                                                                                             | Transformer Hardstands  | 2,320.80                      | 0.03                                     | 60.00%                                                        | 0.012                                  | 27.85                                        | 0.01                                                     | 0.00%                                                   | 0.03                                   | 69.62                                      | 0.02                                                     | -                                  |
| 2                                                                                                                                             | New Access Track        | 936.49                        | 0.03                                     | 60.00%                                                        | 0.012                                  | 11.24                                        | 0.00                                                     | 0.00%                                                   | 0.03                                   | 28.09                                      | 0.01                                                     | -                                  |
| 2                                                                                                                                             | Subtotal                |                               |                                          |                                                               |                                        |                                              | <b>0.01</b>                                              |                                                         |                                        |                                            | <b>0.03</b>                                              | <b>0.02</b>                        |
| 3                                                                                                                                             | Temp Compound Hardstand | 3,001.08                      | 0.03                                     | 60                                                            | 0.012                                  | 36.01                                        | 0.01                                                     | 0                                                       | 0.03                                   | 90.03                                      | 0.03                                                     | -                                  |
| 3                                                                                                                                             | Transformer Hardstands  | 1,500.52                      | 0.03                                     | 60                                                            | 0.012                                  | 18.01                                        | 0.01                                                     | 0                                                       | 0.03                                   | 45.02                                      | 0.01                                                     | -                                  |
| 3                                                                                                                                             | New Access Track        | 755.43                        | 0.03                                     | 60                                                            | 0.012                                  | 9.07                                         | 0.00                                                     | 0                                                       | 0.03                                   | 22.66                                      | 0.01                                                     | -                                  |
| 3                                                                                                                                             | Subtotal                |                               |                                          |                                                               |                                        |                                              | <b>0.02</b>                                              |                                                         |                                        |                                            | <b>0.04</b>                                              | <b>0.03</b>                        |
| 4                                                                                                                                             | Temp Compound hardstand | 3,001.08                      | 0.03                                     | 60                                                            | 0.012                                  | 36.01                                        | 0.01                                                     | 0                                                       | 0.03                                   | 90.03                                      | 0.03                                                     | -                                  |

| Net increase in runoff as a function of the Development per micro-catchment area and baseline runoff volumes (1 in 100 Year Hour Storm Event) |                         |                               |                                          |                                                               |                                        |                                              |                                                          |                                                        |                                        |                                            |                                                          |                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------------------|------------------------------------------|---------------------------------------------------------------|----------------------------------------|----------------------------------------------|----------------------------------------------------------|--------------------------------------------------------|----------------------------------------|--------------------------------------------|----------------------------------------------------------|------------------------------------|
|                                                                                                                                               |                         |                               |                                          | Greenfield Scenario                                           |                                        |                                              |                                                          | Developed Scenario                                     |                                        |                                            |                                                          |                                    |
| Micro Catchment                                                                                                                               | Category                | Approx Area (m <sup>2</sup> ) | 1 in 100 Year Rainfall Event (m/hr Rain) | Capped Recharge Capacity % of Effective Rainfall <sup>1</sup> | Rejected Recharge / Runoff (m/hr Rain) | Runoff Discharge Rate (m <sup>3</sup> /hour) | Net Increase Runoff Discharge Rate (m <sup>3</sup> /sec) | Recharge Capacity % of Effective Rainfall <sup>2</sup> | Rejected Recharge / Runoff (m/hr Rain) | Runoff Discharge Rate (m <sup>3</sup> /hr) | Net Increase Runoff Discharge Rate (m <sup>3</sup> /sec) | Net Increase (m <sup>3</sup> /sec) |
| 4                                                                                                                                             | Transformer Hardstands  | 1,160.40                      | 0.03                                     | 60                                                            | 0.012                                  | 13.92                                        | 0.00                                                     | 0                                                      | 0.03                                   | 34.81                                      | 0.01                                                     | -                                  |
| 4                                                                                                                                             | New Access Track        | 1,215.03                      | 0.03                                     | 60                                                            | 0.012                                  | 14.58                                        | 0.00                                                     | 0                                                      | 0.03                                   | 36.45                                      | 0.01                                                     | -                                  |
| 4                                                                                                                                             | Subtotal                |                               |                                          |                                                               |                                        |                                              | <b>0.02</b>                                              |                                                        |                                        |                                            | <b>0.04</b>                                              | <b>0.03</b>                        |
| 5                                                                                                                                             | Transformer Hardstands  | 1,160.40                      | 0.03                                     | 60                                                            | 0.012                                  | 13.92                                        | 0.00                                                     | 0                                                      | 0.03                                   | 34.81                                      | 0.01                                                     | -                                  |
| 5                                                                                                                                             | New Access Track        | 2,289.33                      | 0.03                                     | 60                                                            | 0.012                                  | 27.47                                        | 0.01                                                     | 0                                                      | 0.03                                   | 68.68                                      | 0.02                                                     | -                                  |
| 5                                                                                                                                             | Subtotal                |                               |                                          |                                                               |                                        |                                              | <b>0.01</b>                                              |                                                        |                                        |                                            | <b>0.03</b>                                              | <b>0.02</b>                        |
| 6                                                                                                                                             | Transformer Hardstands  | 1,280.44                      | 0.03                                     | 60                                                            | 0.012                                  | 15.37                                        | 0.00                                                     | 0                                                      | 0.03                                   | 38.41                                      | 0.01                                                     | -                                  |
| 6                                                                                                                                             | New Access Track        | 1,970.28                      | 0.03                                     | 60                                                            | 0.012                                  | 23.64                                        | 0.01                                                     | 0                                                      | 0.03                                   | 59.11                                      | 0.02                                                     | -                                  |
| 6                                                                                                                                             | Subtotal                |                               |                                          |                                                               |                                        |                                              | <b>0.01</b>                                              |                                                        |                                        |                                            | <b>0.03</b>                                              | <b>0.02</b>                        |
| 7                                                                                                                                             | Temp Compound Hardstand | 3,001.08                      | 0.03                                     | 60                                                            | 0.012                                  | 36.01                                        | 0.01                                                     | 0                                                      | 0.03                                   | 90.03                                      | 0.03                                                     | -                                  |
| 7                                                                                                                                             | Transformer Hardstands  | 580.20                        | 0.03                                     | 60                                                            | 0.012                                  | 6.96                                         | 0.00                                                     | 0                                                      | 0.03                                   | 17.41                                      | 0.00                                                     | -                                  |
| 7                                                                                                                                             | New Access Track        | 2,454.83                      | 0.03                                     | 60                                                            | 0.012                                  | 29.46                                        | 0.01                                                     | 0                                                      | 0.03                                   | 73.64                                      | 0.02                                                     | -                                  |
| 7                                                                                                                                             | Subtotal                |                               |                                          |                                                               |                                        |                                              | <b>0.02</b>                                              |                                                        |                                        |                                            | <b>0.05</b>                                              | <b>0.03</b>                        |

<sup>1</sup> Conservative Value for Water Balance Calc's; <sup>2</sup> Hardstand Areas assumed impermeable

**Table 4.7: Net increase in runoff as a function of the proposed development per micro-catchment areas and baseline runoff volumes (1 in 100 year store)**

| Proposed Development baseline run off volumes (1 in 100 Year Hour Storm Event) |                                    |                                           |                                                                |                                        |                                            |                                             |                                    |                                                          |
|--------------------------------------------------------------------------------|------------------------------------|-------------------------------------------|----------------------------------------------------------------|----------------------------------------|--------------------------------------------|---------------------------------------------|------------------------------------|----------------------------------------------------------|
| Micro catchment                                                                | Approximate Area (m <sup>2</sup> ) | 1 in 100 Year Rainfall Event (m/sec Rain) | Capped Recharge Capacity. % of Effective Rainfall <sup>1</sup> | Rejected Recharge / Runoff (m/hr Rain) | Runoff Discharge Rate (m <sup>3</sup> /hr) | Runoff Discharge Rate (m <sup>3</sup> /sec) | Net Increase (m <sup>3</sup> /sec) | Net Increase against baseline micro-catchment runoff (%) |
| 1                                                                              | 1,585,257.15                       | 0.03                                      | 60.00%                                                         | 0.012                                  | 19,023.09                                  | 5.28                                        | 0.336                              | 6.37%                                                    |
| 2                                                                              | 402,600.60                         | 0.03                                      | 60.00%                                                         | 0.012                                  | 4,831.21                                   | 1.34                                        | 0.016                              | 1.21%                                                    |
| 3                                                                              | 189,994.07                         | 0.03                                      | 60.00%                                                         | 0.012                                  | 2,279.93                                   | 0.63                                        | 0.026                              | 4.15%                                                    |
| 4                                                                              | 188,741.58                         | 0.03                                      | 60.00%                                                         | 0.012                                  | 2,264.90                                   | 0.63                                        | 0.027                              | 0.00%                                                    |
| 5                                                                              | 323,767.35                         | 0.03                                      | 60.00%                                                         | 0.012                                  | 3,885.21                                   | 1.08                                        | 0.017                              | 1.60%                                                    |
| 6                                                                              | 341,131.31                         | 0.03                                      | 60.00%                                                         | 0.012                                  | 4,093.58                                   | 1.14                                        | 0.016                              | 1.43%                                                    |
| 7                                                                              | 168,760.88                         | 0.03                                      | 60.00%                                                         | 0.012                                  | 2,025.13                                   | 0.56                                        | 0.030                              | 0.00%                                                    |

<sup>1</sup>Conservative Value for Water Balance Calc's



Water balance calculations allow for the addition of hardstand infrastructure area (land take) during the construction and operational phases of the Proposed Development. A 1 in 100-year storm event scenario results in a net increase of surface water runoff associated with the Proposed Development. The water balance assessment while allowing for the addition of hardstanding does not include the surface area of the solar panel arrays across the site as they are raised up to approximately 3m above the ground level.

This indicates a moderate, adverse impact of the Proposed Development on the run-off regime. However, this net increase of 4.40% from baseline conditions is a relatively small increase to run-off rates in comparison to the overall footprint of the Proposed Development. The ground conditions and hydrological processes will be largely unaffected by the Proposed Development (including the placement of the solar panel arrays) as the ground beneath will be unchanged and allow the existing hydrological regime to prevail. In addition, there is suitable mitigation measures designed to be implemented within the Proposed Development (see Drainage Management Plan) to alleviate potential adverse impacts to the discharging surface water bodies downstream of the site.

#### **4.4 Mitigation Measures Associated with the Development**

Under the 2013-2015 Work Programme of the Common Implementation Strategy (CIS) for the Water Framework Directive (WFD), and in response to the 2012 Blueprint to Safeguard Europe's Water Resources proposals, the Working Group Programme of Measures has developed guidance for supporting the implementation of Natural Water Retention Measures (NWRM) in Europe (European Commission, 2015).

The OPW and EPA Catchments Unit in conjunction with Local Authorities are actively adopting and promoting NWRM as part of a broader suite of mitigation measures that could contribute to the achievement of environmental objectives (WFD) set out in the third River Basin Management Plan (RBMP) (EPA Catchment Unit, 2022).

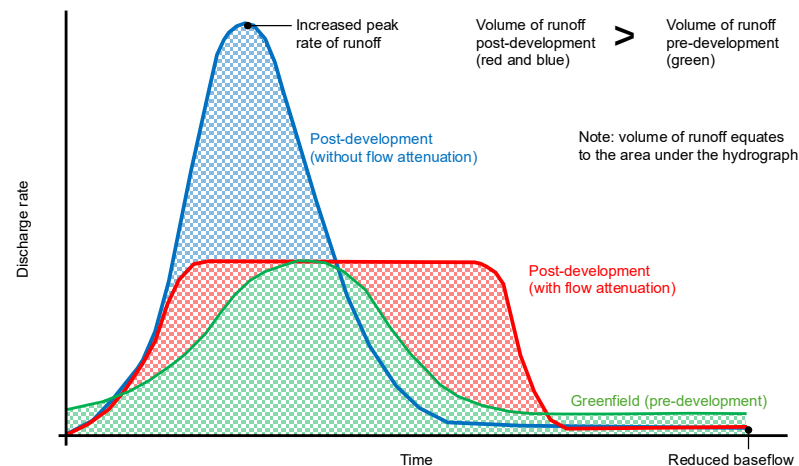
Flood Relief Scheme and Flood Risk Management objectives such as Land Use Management and Natural Flood Risk Management are relevant to the proposed Development, whereby; the assessment and design of the Proposed Development will qualify and mitigate any potential adverse impact in terms of hydrological response to rainfall and flood risk within or downstream of the site. The objective of mitigation in this respect will be to achieve, at a minimum, a neutral impact, and to identify and promote beneficial impacts (net decrease in hydrological response to rainfall) at the site, particularly in terms of Natural Water Retention Measures (NWRM) as part of baseline conditions, including the planting of new native woodlands, provision of additional hedgerows and buffer strips, enhancement of existing hedgerows in-situ and provision of additional flood attenuation through swales, check dams and settlement ponds.

Flood Relief Schemes, outlined by the OPW, are in place for Youghal, south of the Proposed Development. These include measures applicable in all areas, which are detailed as:

- Sustainable Urban Drainage Systems (SuDS). Objective: Planning authorities will seek to reduce the extent of hard surfacing and paving and require the use of

sustainable drainage techniques to reduce the potential impact of development on flood risk downstream.

- An example of hydrograph from a rainfall event is presented in **Figure 4.10**. On a site which has no SuDS or attenuating features, following a rainfall event, the event hydrograph would rise, peak and recede following the natural hydrological regime of the site (i.e. represented by the blue line). In developments where SuDS measures are implemented, attenuation of the run-off/discharge occurs which leads to a more gradual event hydrograph. The run-off/discharge is stored, held and gradually released over time which results in a flatter, less peaky event hydrograph (i.e. represented by the red line).
- Land Use Management and Natural Flood Risk Management. Objective: during the project-level assessments of physical works and more broadly at a catchment-level to identify any measures, such as natural water retention measures (such as restoration of wetlands and woodlands), that can have benefits for Water Framework Directive, flood risk management and biodiversity objectives.



**Figure 4.9: Example of a hydrograph (CIRCA, 2015)**

#### 4.4.1 Mitigation for On-Site Runoff/Hydraulic Loading and Downstream Flood Risk

To mitigate any net change in hydraulic loading to surface waters during the construction and operational phases of the Development, the following mitigation measures can be utilised where appropriate;

- Check dams, dams, other flow restricting infrastructure
- Collector drains
- Swales
- Permanent stilling ponds
- Attenuation lagoons
- Buffered outfalls to vegetated areas
- Controlling dewatering flow/pump rates;

- Restricting pumped water discharge directly to drainage or surface water networks.
- Offline storage ponds, overland sediment traps,
- Riverbank restoration
- River morphology and floodplain restoration – removal of embankments, re-meandered river reach
- In stream structure – large woody debris
- Land and soil management practices – cover crops, cross contour hedgerows.

These mitigation measures will reduce the risk of downstream flooding by attenuation of site runoff and potential flood water when it occurs. The compensation areas will allow the release of this flood water at a reduced flow rate which will benefit downstream areas at risk of further flooding.

#### **4.4.2 Flood Risk Management in the Proposed Development Design**

The Proposed Development has the potential to result in an increase in runoff during the construction and operational phases relative to baseline conditions. However, with appropriate SuDS measures and mitigation by design, the potential impact of any increase to run-off rates or increase to downstream flood risk can be reduced or removed.

The combined attenuation capacity of the proposed drainage infrastructure will be designed to attenuate a net increase in runoff, including during extreme storm events relative to greenfield or baseline runoff rates. These mitigation measures required during the construction and operational phases will buffer the discharge rate and reduce the hydrological response to rainfall at the site, maintain (or improve) the hydrological regime at the site, in turn, reducing loading on the receiving surface water drainage network. This will mitigate against the potential for rapid runoff and rapid hydrological responses to rainfall, lessening the likelihood of flooding of the drainage network or downstream of the development.

Mitigation measures have been considered and designed in line with engineering and construction best practices and methodologies, including the following guidance documents;

- Scottish Environment Protection Agency (SEPA) (2009) Flood Risk Management (Scotland) Act 2009 – Surface Water Management Planning Guidance
- Scottish Environment Protection Agency (SEPA) (2015) Natural Flood Management Handbook
- CIRIA (2006) Control of Water Pollution from Linear Construction Projects – Technical Guidance
- CIRIA (2015) The SuDS Manual (C753)

The following observations and recommendations are made with a view to ensuring mitigation measures are designed and deployed effectively;

- A detailed drainage design has been proposed in the Drainage Management Plan for the Proposed Development. This has designed a series of SuDS mitigation



measures that will intercept, slow and attenuate the discharge from the Proposed Development. Mitigation measures include a series of swales, check dams and settlement/attenuation ponds. Therefore, the risk of leading to an increase in flood risk on-site or downstream of the site is deemed to be negligible and mitigated by design.

- A detailed SWMP has been completed for the Proposed Development which details specific surface water drainage and associated infrastructure required prior to the commencement of the construction phase. The SWMP includes a detailed drainage layout and how this should be maintained before, during and after the construction phase ends.
- It is recommended that construction of the Proposed Development is done in conjunction with relevant stakeholders including relevant authorities and other stakeholders such as landholders etc. in line with River Basin Management practices i.e. engagement at local level.

#### **4.4.3 Data Gaps & Limitations**

This FRA Stage 2 assessment has been conducted using indicative flood extents and any available LiDAR data.

As per the [www.floodinfo.ie](http://www.floodinfo.ie) terms and conditions, OPW mapped flood extents, which have been traced (indicative) and used for this assessment, should not be relied upon for detailed design.

General flood risk at the Site has been identified and initial assessment undertaken with a view to prescribing suitable mitigation measures, identifying data gaps and to scope any further assessment or conceptual design for the Proposed Development to proceed to detailed design phase, pending planning consent.

### **4.5 FRA Stage 2 – Conclusions**

The Proposed Development does not lie within probable flood zones likely to be susceptible to flooding. While there are some anecdotal reports of off-site downstream flooding, there has been no on-site flood risk identified.

A 1 in 100 year storm event scenario results in a net increase of surface water runoff associated with the Proposed Development, calculated to be 0.016-0.185m<sup>3</sup>/s, (or 0.01-4.15% relative to the associated micro catchment). The magnitude of potential net increase in runoff as a function of the Proposed Development at the Site is considered an adverse moderate effect. The proposed development has included in its design the latest best practice guidance to ensure that flood risk within or downstream of the Site is not increased as a function of the Proposed Development, i.e., a neutral impact at a minimum. This means that the attenuation capacity in the constructed drainage network associated with the Proposed Development will have capacity to attenuate the calculated net increase during a 1 in 100 year storm event.

A detailed Drainage Management Plan has been prepared to ensure surface water runoff at the site is managed effectively and does not exacerbate flood risk to the surrounding areas upstream and downstream. It is recommended that all surface water management is implemented in consultation with relevant stakeholders. The proposed drainage



measures, which will exist in-situ for the lifespan of the Proposed Development, will attenuate the run-off (and any excess run-off produced) to the specific greenfield run-off rate. The Proposed Development will not increase the risk of flooding elsewhere in the catchment and indeed is likely to improve on the baseline. Based on this information, the Proposed Development complies with the appropriate policy guidelines for the area and is at no risk of flooding. There is no risk of increasing flood risk on-site and no risk of exacerbating flood risk to downstream receptors.

## 5 REFERENCES

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- EPA (2024) “3rd Cycle Blackwater Munster Catchment Report (HA 18)” Environmental Protection Agency-Catchment Science & Management Unit. Version no (1).
- EPA Catchments Unit (2020) Natural Water Retention Measures – implementing the Flood Risk Management Plans.
- European Commission (2015) *Directorate-General for Environment, EU policy document on natural water retention measures : by the drafting team of the WFD CIS Working Group Programme of Measures (WG PoM)*
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- Office of Public Works (2009) “The Planning System and Flood Risk Management, Guidelines for Planning Authorities” Environment, Heritage and Local Government