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CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE EXPANSION OF A MATERIALS RECOVERY FACILITY AT CAPPOGUE AND DUNSINK, BALLYCOOLIN ROAD, DUBLIN 11.

Volume 2 – Main Body of the EIAR
CHAPTER 9 – SOILS, GEOLOGY AND HYDROGEOLOGY

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TABLE OF CONTENTS

9. SOILS, GEOLOGY AND HYDROGEOLOGY 1

9.1 Introduction 1
9.1.1 Statement of Competency 1
9.2 Assessment Methodology 1
9.2.1 Relevant Guidance and Legislation 2
9.2.1.1 Water Framework and Groundwater Directives, Status and Risk Assessment 2
9.2.2 Consultation 3
9.2.3 Proposed Development Site 3
9.2.4 Study Area 4
9.2.5 Impact Appraisal Methodology 4
9.2.6 Evaluation Criteria 4
9.2.6.1 Assessment of Magnitude and Significance of Impact on Soils, Geology and Hydrogeology 4
9.2.7 Desk Study 9
9.2.8 Field Assessments 9
9.3 Baseline Environment 10
9.3.1 Quaternary (Subsoils) Geology 10
9.3.2 Bedrock Geology 11
9.3.3 Geological Heritage 11
9.3.4 Economic Geology 12
9.3.5 Landslide Susceptibility 12
9.3.6 Intrusive Site Investigation 12
9.3.6.1 Summary of Soil Sample Results 13
9.3.7 Hydrogeology 21
9.3.7.1 Groundwater Vulnerability 21
9.3.7.2 Groundwater Bodies Description 21
9.3.7.3 Dublin Groundwater Body 22
9.3.7.4 Groundwater Body Classifications 22
9.3.8 Groundwater Supply Sources 23
9.3.9 Source Protection Zones 23
9.3.10 Group Water Schemes 23
9.3.11 Groundwater Productivity at the Development Site. 23

9.3.12 Groundwater Wells and Springs 23
9.3.13 Karst Features 24
9.3.14 Groundwater Quality and Conductivity 28
9.4 Potential Impacts 32
9.4.1 'Do Nothing' Impacts 32
9.4.2 Construction Phase Impacts 32
9.4.2.1 Advance Works 33
9.4.2.2 Development of Temporary Construction Site Compound 34
9.4.2.3 Site Clearance 34
9.4.2.4 Site Earthworks 35
9.4.2.5 Installation of Site Services and Surface Water Management Systems 36
9.4.2.6 Construction of Site Hard Stand and Granular Formation Surfaces 37
9.4.2.7 Construction of Site Buildings and Structures 38
9.4.2.8 Installation of Additional Ancillary Site Infrastructure and Elements 38
9.4.3 Operational Phase Impacts 39
9.4.3.1 Potential Direct Effects 39
9.4.3.2 Potential Indirect Effects 39
9.4.4 Decommissioning Phase Impacts 40
9.4.5 Cumulative Impacts 40
9.4.6 Summary of Potential Effects 41
9.5 Mitigation Measures 52
9.5.1 Mitigation by Design and Best Practice 52
9.5.2 Construction Phase Mitigation 53
9.5.2.1 Construction Environmental Management Plan 53
9.5.2.2 Sediment Control Measures 53
9.5.2.3 Measures for Preventing Hydrocarbons Spills 53
9.5.2.4 Measure for Preventing the Release of Cement Based Products 53
9.5.2.5 Measures to Protect the Surface Waters during Culverting Works 53
9.5.3 Operational Phase Mitigation 54
9.5.3.1 Regulatory Control 54
9.5.3.2 Accidents 54
9.5.4 Decommissioning Phase Mitigation 55
9.5.5 Cumulative 55
9.6 Residual Impacts 55
9.7 Interactions 63

9.7.1 Geology 63
9.7.2 Hydrogeology 63
9.8 References 64

LIST OF FIGURES

Page

Figure 9-1: Quaternary Geology 16
Figure 9-2: Bedrock Geology 17
Figure 9-3: Geological Heritage 18
Figure 9-4: Economic Geology 19
Figure 9-5: Landslide Susceptibility 20
Figure 9-6: Groundwater Vulnerability 25
Figure 9-7: Groundwater Bodies and Groundwater Aquifers 26
Figure 9-8: Groundwater Wells and Springs 27
Figure 9-9: Groundwater Monitoring Locations 31

LIST OF TABLES

Page

Table 9-1: Criteria Rating Site Importance of Geological Features (NRA, 2009) 4
Table 9-2: Criteria Rating Site Importance of Hydrogeological Features (NRA, 2009) 6
Table 9-3: Estimation of Magnitude of Impact on Geological Features (NRA, 2009) 7
Table 9-4: Estimation of Magnitude of Impact on Hydrogeological Features (NRA, 2009) 8
Table 9-5: Ratings of Significance of Impacts for Geology and Hydrogeology (NRA, 2009) 9
Table 9-6: Soil Sampling Results– Screening Criteria 14
Table 9-7: Groundwater Vulnerability 21
Table 9-8: Summary of Aquifer Classifications and Characteristics 22
Table 9-9: Groundwater Well Characteristics within 1km of Proposed Development 23
Table 9-10: Groundwater Monitoring Results 2021 / 2022 30
Table 9-11: Summary of Potential Unmitigated Impact Significance on Geology Attributes 42
Table 9-12: Summary of Potential Unmitigated Impact Significance on Hydrogeology Attributes 47
Table 9-13: Summary of Residual Impact Significance on Geology Attributes 57
Table 9-14: Summary of Residual Impact Significance on Hydrogeology 60

9. SOILS, GEOLOGY AND HYDROGEOLOGY

9.1 Introduction

The proposed development is defined in Chapter 1: Introduction and a detailed description of the proposed development is set out in Chapter 4: Description of the Existing and Proposed Development in the local environment, referred to in this chapter as the study area.

This chapter has been prepared to examine the potential significant effects of the proposed development on Soils, Geology and Hydrogeology present in the receiving environment at and surrounding the proposed development site.

The potential significant effects of the proposed development are assessed, having taken account of mitigation measures to reduce or eliminate any residual effects on receiving Soils, Geology and Hydrogeology.

Appendices 9.1, 9.2 and 9.3 have been prepared in support of this chapter. They are included in Volume 3 of this EIAR.

9.1.1 Statement of Competency

This chapter of the EIAR was prepared by Declan Morrissey B.Sc., M.Sc. Declan is a Senior Project Hydrogeologist with Fehily Timoney and Company and has 10 years' consultancy experience in Ireland and Canada. Declan has completed numerous soils, geology and hydrogeology impact assessments for energy and infrastructure projects in Ireland and Canada, including solar farm projects, wind farm projects, quarries, power plants, landfills and waste management facilities.

9.2 Assessment Methodology

The methodology adopted for this assessment is as follows:

- Review of appropriate guidance and legislation;
- Characterisation of the receiving geological and hydrogeological environments;
- Review of the proposed development;
- Assessment of potential effects;
- Identification of mitigation measures; and
- Assessment of residual impacts.

9.2.1 Relevant Guidance and Legislation

Relevant Guidance and Reference Documents / Data

The EIA guidelines referred to when completing this assessment are listed in Chapter 1: Introduction of Volume 2 of this EIAR. All topic specific relevant guidelines and reference documents/data that have been considered in the preparation of this chapter are shown below:

- NRA (2009), Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- IGI (2013), Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements;
- EPA (2003), Towards Setting Guideline Values for the Protection of Groundwater in Ireland.
- OSI (2022) Current and historic Ordnance Survey Ireland mapping, and ortho-photography;
- Geological Survey of Ireland (2022) Public Data Viewer (https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx);
- Environmental Protection Agency (2022) Review of online EPA Maps (https://gis.epa.ie/EPAMaps/);
- Geological Survey Ireland. 2003. Groundwater Working Group Publication: Guidance Document GW2;
- Geological Survey Ireland (n.d.a). Dublin GWB: Summary of Initial Characterisation.

Relevant Legislation

All topic legislation that has been considered in the preparation of this chapter are shown below:

- European Union (2000/60/EC), Water Framework Directive;
- European Union (2006/118/EC), Groundwater Directive;
- European Communities Environmental Objectives (Groundwater) Regulations (S.I. No. 9 of 2010), as amended;
- European Communities (Water Policy) Regulations (S.I. No. 722 of 2003) as amended.

This chapter has been prepared in compliance with the above relevant guidance and legislation.

9.2.1.1 Water Framework and Groundwater Directives, Status and Risk Assessment

The Water Framework Directive (WFD) provides for the protection, improvement and sustainable use of waters, including rivers, lakes, coastal waters, estuaries and groundwater within the EU Member States. It aims to prevent deterioration of these water bodies and enhance the status of aquatic ecosystems; promote sustainable water use; reduce pollution; and contribute to the mitigation of floods and droughts.

Under the Water Framework Directive large geographical areas of aquifer have been subdivided into smaller groundwater bodies (GWB) for them to be effectively managed.

The overriding purpose of the WFD is to achieve at least 'good status' in all European waters and to ensure that no further deterioration occurs in these waters. European waters are classified as ground waters, rivers, lakes, transitional and coastal waters. The WFD has been implemented in Ireland by dividing the island of Ireland into eight river basin districts under the 1st Cycle. These districts are natural geographical areas that occur in the landscape.

The River Basin Management Plan 2018-2021 has been prepared adopted by Department of Housing, Planning and Local Government. The plan sets out the actions that Ireland will take to prevent deterioration of the status of groundwater and ensuring a balance of abstraction and recharge in all groundwater bodies to achieve good groundwater status by 2027. This plan is still in effect at the present time; however it is set to be replaced by the Draft River Basin Management Plan 2022 – 2027, which is currently in the latter stages of being prepared.

The Groundwater Directive establishes a regime which sets groundwater quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater. The Directive establishes quality criteria that takes account of local characteristics and allows for further improvements to be made based on monitoring data and new scientific knowledge.

The Directive thus represents a proportionate and scientifically sound response to the requirements of the WFD as it relates to assessments on chemical status of groundwater and the identification and reversal of significant and sustained upward trends in pollutant concentrations in groundwater.

9.2.2 Consultation

The scope for this assessment has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties as summarised in Chapter: 6 Scoping and Consultation in Volume 2 of this EIAR. The following consultation responses have been considered in the preparation of this chapter:

- Response from Geological Survey Ireland dated 11/04/2022 (See Appendix 6.2 of Volume 3 of this EIAR for details of this response).

9.2.3 Proposed Development Site

A description of the proposed development site is provided in Chapter 1 – Introduction, of Volume 2 of this EIAR

In the context of this chapter, the following is noted with respect to the development site:

- The proposed development site was historically used for agricultural purposes (up until the late 1990's / early 2000's approximately).
- South-western sections of the site bordering Barn Lodge Grove Road were previously used by third parties for the unauthorized storage of scrap vehicles.
- South-western sections of the site have also experienced fly tipping in the past.

9.2.4 Study Area

For the purposes of this assessment, the study area in the context of the receiving soils, geological and hydrogeological environment is defined as the local environment at and surrounding the development site at the 1:50,000 Scale presented in this chapter's figures.

9.2.5 Impact Appraisal Methodology

The following elements were examined to determine the potential significant effects of the proposed development on the Soils, Geology and Hydrogeology within the study area:

- Characterisation of the soils, geological and hydrogeological regimes underlying the study area; and
- Description and assessment of the likely significant effects of the proposed development.

9.2.6 Evaluation Criteria

During each phase (construction, operation, and decommissioning) of the proposed development, several activities will take place on site, some of which will have the potential to cause significant effects on the soil, geological and hydrogeological regimes at the proposed development site.

9.2.6.1 Assessment of Magnitude and Significance of Impact on Soils, Geology and Hydrogeology

An impact rating has been developed for each of the phases of the proposed development based on the Institute for Geologists Ireland (IGI) Guidance for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements. In line with the IGI Guidance the receiving environment (Geological Features) was first identified. Using the NRA rating criteria in Appendix C of the IGI Guidance the importance of the geological (Table 9-1) and hydrogeological (Table 9-2) features are rated followed by an assessment of the magnitude of the geological and hydrogeological impacts (Table 9-3 and Table 9-4, respectively). This determines the significance of the impact prior to application of mitigation measures as set out in Table 9-5.

Table 9-1: Criteria Rating Site Importance of Geological Features (NRA, 2009)

Magnitude	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and/or soft organic soil underlying the site is significant on a national or regional scale	• Geological feature on a regional or national scale (NHA). • Large existing quarry or pit. • Proven economically extractable mineral resource.
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale.	• Contaminated soil on site with previous heavy industrial usage; • Large recent landfill site for mixed wastes;

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

Table 9-2: Criteria Rating Site Importance of Hydrogeological Features (NRA, 2009)

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

The assessment of the magnitude of an impact incorporates the timing, scale, size and duration of the potential impact. The magnitude criteria for geological impacts are defined as set out in Table 9-3 and for hydrogeological impacts in Table 9-4.

Table 9-3: Estimation of Magnitude of Impact on Geological Features (NRA, 2009)

Magnitude	Criterion	Description and Example
Large Adverse	Results in loss of attribute	• Loss of high proportion of future quarry or pit reserves; • Irreversible loss of high proportion of local high fertility soils; • Removal of entirety of geological heritage feature; • Requirement to excavate / remediate entire waste site; • Requirement to excavate and replace high proportion of peat, organic soils and/or soft mineral soils beneath alignment.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	• Loss of moderate proportion of future quarry or pit reserves; • Removal of part of geological heritage feature; • Irreversible loss of moderate proportion of local high fertility soils; • Requirement to excavate / remediate significant proportion of waste site; • Requirement to excavate and replace moderate proportion of peat, organic soils and/or soft mineral soils beneath alignment.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	• Loss of small proportion of future quarry or pit reserves; • Removal of small part of geological heritage feature; • Irreversible loss of small proportion of local high fertility soils and/or; • high proportion of local low fertility soils; • Requirement to excavate / remediate small proportion of waste site; • Requirement to excavate and replace small proportion of peat, organic soils and/or soft mineral soils beneath alignment.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	No measurable changes in attributes.
Minor Beneficial	Results in minor improvement of attribute quality	Minor enhancement of geological heritage feature.
Moderate Beneficial	Results in moderate improvement of attribute quality	Moderate enhancement of geological heritage feature.
Major Beneficial	Results in major improvement of attribute quality	Major enhancement of geological heritage feature.

Table 9-4: Estimation of Magnitude of Impact on Hydrogeological Features (NRA, 2009)

Magnitude	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	Removal of large proportion of aquifer. Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems. Potential high risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >2% annually.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Removal of moderate proportion of aquifer. Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems. Potential medium risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >1% annually.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Removal of small proportion of aquifer. Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems. Potential low risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >0.5% annually.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Calculated risk of serious pollution incident <0.5% annually.

The matrix in Table 9-5 determines the significance of the impacts based on the importance and magnitude of the impacts as determined by Table 9-1 and Table 9-3 (geology) and Table 9-2 and Table 9-4 (hydrogeology).

Table 9-5: Ratings of Significance of Impacts for Geology and Hydrogeology (NRA, 2009)

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

The significance of all likely effects on soils, geology and hydrogeology associated with each phase of the proposed development is assessed in Section 9.4.

9.2.7 Desk Study

Prior to intrusive site investigations, a desk study was undertaken to determine the baseline conditions within the study area and planning boundary to provide relevant background information. The desk top study involved an examination of the sources of information listed in Section 9.2.1.

To determine the existing soil, geological and hydrogeological regimes within the study area the following EPA and GSI online datasets and mapping from the sources outlined in Section 9.2.1 were reviewed:

- Quaternary Geology;
- Bedrock Geology;
- Economic Geology;
- Geological Heritage;
- Landslide Susceptibility;
- Catchment & Management Units;
- Groundwater Bodies Status and Risk;
- Drinking Water Protection Areas;
- Groundwater Resources (Aquifers);
- Groundwater Wells and Springs;
- Karst Features;
- Groundwater Vulnerability.

9.2.8 Field Assessments

Between January and May 2022 an intrusive site investigation was undertaken by Ground Investigations Ireland (GII).

The scope of the geotechnical survey is summarised with the information obtained referenced in this chapter:

- Advancement of 20 No. trial pits to a maximum depth of 3.5m below ground level (BGL).
- Completion of 6 No. dynamic probes to determine soil strength/density characteristics.
- Advancement of 4 No. cable percussion boreholes to a maximum depth of 3.9m BGL.
- Advancement of 4 No. rotary core follow-on boreholes to a maximum depth of 8.40m BGL.
- Installation of 2 No. groundwater monitoring wells
- Geotechnical & Environmental Laboratory testing.

Detailed logs of all trial pits and boreholes advanced during the intrusive site investigation works are present in Appendix 9.1: Ground Investigation Report.

9.3 Baseline Environment

The receiving soils, geological and hydrogeological environment of the proposed development site are described hereunder.

The geological descriptions as recommended by NRA (2009) and IGI (2013) include underlying quaternary and bedrock geology, areas of geological heritage, areas of economic interest with respect to geological resources and potential for soil contamination. The hydrogeological descriptions as recommended by NRA (2009) and IGI (2013) include groundwater bodies, groundwater supply sources, groundwater protection zones, group water schemes, and wells and springs.

This section also includes site-specific information obtained during the intrusive site investigation and groundwater monitoring.

9.3.1 Quaternary (Subsoils) Geology

The subsoils present at the proposed development site were taken from the GSI 1:50,000 Quaternary Geology of Ireland map (GSI, 2022) and comprise of 'till derived from limestones' (TLs). Other deposits in the study area include 'alluvium' (A), 'alluvium (gravelly)' (Ag), 'alluvium (sandy)' (As), 'eskers comprised of gravels of basic reaction' (BasEsk), 'embankments' 'gravels derived from chert' (GCH), 'gravels derived from limestones' (GLs), 'lacustrine sediments' (L), 'lacustrine silts' (Lsi), 'landfill', 'marine beach sands' (Mbs), 'bedrock outcrop or subcrop' (Rck), 'urban', 'windblown sands' (Ws) and 'windblown sands and dunes' (Wsd).

At surface, the intrusive site investigations completed within the proposed development site generally encountered concrete to a maximum depth of 0.30m BGL or topsoil to a maximum depth of 0.30m BGL.

Made Ground deposits were encountered from surface or beneath the concrete and topsoil to a maximum depth of 0.40m BGL to 1.30m BGL. The deposits were described generally as *brown/dark brown slightly sandy slightly gravelly Clay with occasional cobbles and boulders* or a *grey/greyish brown sandy subangular to subrounded fine to coarse Gravel with occasional cobbles and boulders*. These deposits contained rare fragments of concrete, red brick, metal, and plastic. No anthropogenic material was observed within these deposits.

Cohesive deposits were encountered beneath the Made Ground and were described typically as *brown slightly sandy slightly gravelly CLAY with occasional cobbles and boulders* overlying *a dark grey slightly sandy slightly gravelly CLAY with occasional cobbles and boulders*. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. The strength of the cohesive deposits typically increased with depth and was firm to stiff or stiff below 1.20m BGL at each of the borehole locations. These deposits had occasional (<5%), some (5%-20%) or many (20%-50%) cobble and boulder content.

Granular deposits were encountered below the cohesive deposits at some locations and were typically described as *grey and brown slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with occasional cobbles*. The secondary sand and fines constituents varied across the site and with depth, while occasional (<5%), some (5%-20%) or many (20%-50%) cobble and boulder content was also present.

The quaternary geology of the study area is presented in Figure 9-1.

9.3.2 Bedrock Geology

The GSI 1:100,000 scale bedrock geology map (GSI, 2022) shows the proposed development site is primarily underlain by the Tober Colleen Formation. The Tober Colleen Formation is described as comprising dark-grey, calcareous, commonly bioturbated mudstones and subordinate thin micritic limestone. A small area in the northwest corner of the proposed development site is underlain by Waulsortion Limestone bedrock. Waulsortion Limestones are described as dominantly pale-grey, crudely bedded or massive limestone.

There are multiple unnamed faults within and surrounding the site, most of the stratigraphic sequences in the area are separated by fault lines that run either north-south or northeast-southwest. However, it is considered that due to the age of these faults they are no longer active and do not present an issue for operation of the site.

Bedrock was encountered during the intrusive site investigation varying in depth from 3.30m BGL to 4.15m BGL. Rotary core boreholes recovered *medium strong thinly bedded dark grey fine grained argillaceous fossiliferous LIMESTONE*. The degree of weathering ranged from unweathered to partially weathered. This is typical of the Tober Colleen Formation.

The bedrock geology of the study area is presented in Figure 9-2.

9.3.3 Geological Heritage

The GSI - Irish Geological Heritage Section (IGH) and NPWS (National Parks and Wildlife Service) have undertaken a programme to identify and select important geological and geomorphological sites throughout the country for designation as NHAs (Natural Heritage Areas) – the Irish Geological Heritage Programme. This is being addressed under 16 different geological themes. For each theme, a larger number of sites (from which to make the NHA selection) are being examined, to identify the most scientifically significant. The criterion of designating the minimum number of sites to exemplify the theme means that many sites of national importance are not selected as the very best examples. However, a second tier of County Geological Sites (CGS) (as per the National Heritage Plan) means that many of these can be included in County Development Plans and receive a measure of recognition and protection through inclusion in the planning system.

The GSI Online Irish Geological Heritage database (GSI, 2022) indicates that the proposed development is not located in an area of specific geological heritage interest, including NHAs and CGS. The nearest site of significant geological heritage feature to the proposed development site is Huntstown Quarry (Site Name: DF022). The geological feature is described by the GSI as 'a working limestone quarry'. This is one of the few sites currently known where the base of the Tober Colleen is seen overlying Waulsortian Limestones. The feature is located approximately 0.7km northeast of proposed development site in the Dublin Fingal townland, Huntstown.

The distribution of Geological Heritage sites is shown on Figure 9-3.

9.3.4 Economic Geology

The GSI Online Minerals Database accessed via the Public Data Viewer (GSI, 2022) shows there are three quarries within the study area. This nearest quarry to the proposed development site is the aforementioned Huntsown Quarry for extraction of limestone. The quarry is located approximately 0.7km northeast of proposed development sites, see Figure 9-4.

The Aggregate Potential Mapping database indicates that the proposed development site is not located within an area with potential for granular aggregate. Mapping indicates there is a very high potential for crushed rock aggregate.

9.3.5 Landslide Susceptibility

The GSI Online Landslides Susceptibility Database accessed via the Public Data Viewer (GSI, 2022) shows landslide susceptibility at the proposed development site is low, see Figure 9-5. The nearest landslide event to the proposed development occurred ca. 4km to the south-southwest, recorded as a transitional slide occurring in 1990.

9.3.6 Intrusive Site Investigation

The site investigation factual report is provided in Appendix 9.1: Factual Ground Investigation Report, Volume 3 of this EIAR.

As part of the baseline assessment of the study area an intrusive site investigation was undertaken between January and May 2022 to confirm the geological succession underlying the site.

The investigation comprised the excavation of 20 No. trial pits to a maximum depth of 3.0m BGL, 4 No. cable percussion boreholes to maximum depths 3.9m BGL and 4 No. rotary core follow-on boreholes to a maximum depth of 8.40m BGL. 2 No. of the 4 No. rotary open hole drillholes were completed as groundwater monitoring wells (BH08, BH09). 6 No. dynamic probes to determine soil strength/density characteristics were also completed.

The intrusive site investigations completed within the proposed development site generally encountered concrete, made ground/fill or topsoil ranging from 0.3m to 1.1m in thickness overlying cohesive and granular deposits to a maximum depth of 4.5m BGL.

Bedrock was encountered during the intrusive site investigation varying in depth from 3.30m BGL to 4.15m BGL.

Geotechnical, chemical and environmental laboratory testing was scheduled on a range of soil samples. The geotechnical testing on soils included moisture content, Atterberg limits, Particle Size Distribution (PSD), California Bearing Ratio (CBR), Moisture Condition Value (MCV) and 2.5kg Compaction tests. Rock strength testing included Point Load (Is50) and Unconfined Compressive Strength (UCS) testing. Testing was undertaken by Professional Soils Laboratory (PSL) in the UK.

Environmental soil samples collected from 20 No. trial pits (1 No. sample per trial pit sampled) were analysed for Engineers Ireland Suite E, Diesel Range Organics (DRO) and sulphate. Groundwater samples were collected for a range of inorganic and organic compounds. Analysis was completed by Element Materials Technology Laboratory in the UK.

A summary of the soil samples is provided in Section 9.3.6.1 and a summary of the groundwater results is provided is Section 9.3.14. Groundwater samples collected from two existing monitoring boreholes at the existing facility are also discussed in Section 9.3.14.

9.3.6.1 Summary of Soil Sample Results

There are no legislated threshold values for soils in Ireland. As such, cognisance was taken of the following legislative/guidance documents as part of this assessment:

- Dutch Guideline Values (*Dutch List*)[1]
- LQM / CIEH Suitable for Use Levels Human Health Risk Assessment[2]

The *Dutch List* of parameters for the assessment of soil contamination is a comprehensive set of standards devised by the Dutch Government. Although this guidance is specific to conditions in The Netherlands, it is often used elsewhere in Europe as a useful indicator of the relative significance of contamination. The guideline values were derived for both soils and groundwater by the Dutch government research agency (RIVM) using a toxicological risk-based approach (i.e., based on determining the maximum tolerable risk from available toxicity and exposure data). This approach takes into account the risk to the ecosystem as well as risks to human health.

A further screening exercise has been undertaken whereby contaminant concentrations recorded in soils have been assessed against the UK's *Suitable for Use Levels* (S4ULs) published in 2015 by LQM/CIEH. These precautionary screening levels are designed to be representative of minimal risk to human health in a number of land use scenarios. Furthermore, they also provide assessment criteria for both aliphatic and aromatic hydrocarbon fractions, and individual polycyclic aromatic hydrocarbons (PAHs) compounds. The commercial screening level was applicable for this assessment.

A summary of these results is outlined in Table 9-6 below, while the laboratory reports are presented in Appendix 5 of Appendix 9.1: Factual Ground Investigation Report, Volume 3 of this EIAR. Only parameters with reported concentrations above the laboratory limit of detection (LOD) are included in Table 9-6.

[1] Directorate General for Environmental Protection *"Intervention Values and Target Values – Soil Quality Standards"*, Department of Soil Protection, The Ministry of Housing, Spatial Planning and Environment, The Netherlands. (a.k.a. The New *Dutch List*).

[2] Nathanail, C. P., McCaffrey, C., Gillett, A. G., Ogden, R. C. and Nathanail, J. F. 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham. Copyright Land Quality Management Limited reproduced with permission

All samples returned for the site have concentrations below the LQM/CIEH commercial screening criteria. All but two parameters (lead in TP06 at 0.5m BGL; zinc in TP18 at 3.0m BGL) were below the Dutch List screening criteria. In the trial pit log, the upper 0.8m of material was noted as containing occasional metal and wire which may attribute towards the slightly elevated lead concentrations. There is no apparent reason for the elevated zinc concentration in TP18. These limit value exceedances constitute minor, localized exceedances, with the vast majority of monitoring results complying with the Dutch List limits. There is no evidence that historic land use activities on-site (i.e. historic agriculture, storage of scrap vehicles) have caused soil contamination on-site.

No asbestos containing material (ACM) was present in the samples.

Table 9-6: Soil Sampling Results– Screening Criteria

Parameter	Units	Max	No of tests	SL1	No > SL1	SL2	No > SL2
				Dutch List		LQM / CIEH Com	
pH	pH units	11.0	20	-	-	-	-
Arsenic	$mg.kg^{-1}$	24	20	55	0	640	0
Cadmium	$mg.kg^{-1}$	3.4	20	12	0	190	0
Chromium	$mg.kg^{-1}$	55	20	380	0	8,600	0
Copper	$mg.kg^{-1}$	94	20	190	0	68,000	0
Lead	$mg.kg^{-1}$	703	20	530	1	-	-
Nickel	$mg.kg^{-1}$	48	20	210	0	980	0
Selenium	$mg.kg^{-1}$	4	20	100	0	12,000	0
Water Soluble Boron	$mg.kg^{-1}$	5	20	-	-	-	-
Zinc	$mg.kg^{-1}$	949	20	720	1	730,000	0
Total EPH C8-C40 (Mineral Oil)	$mg.kg^{-1}$	3,424	20	5,000	-	-	-
Naphthalene	$mg.kg^{-1}$	0.16	20	40	0	190	0
Acenaphthylene	$mg.kg^{-1}$	0.05	20	-	-	83,000	0
Fluorene	$mg.kg^{-1}$	0.11	20	-	-	63,000	0
Phenanthrene	$mg.kg^{-1}$	0.34	20	-	-	22,000	0
Anthracene	$mg.kg^{-1}$	0.06	20	40	0	520,000	0
Fluoranthene	$mg.kg^{-1}$	0.42	20	40	0	23,000	0
Pyrene	$mg.kg^{-1}$	0.39	20	-	-	54,000	0
Benzo[a]anthracene	$mg.kg^{-1}$	0.22	20	40	0	170	0
Chrysene	$mg.kg^{-1}$	0.24	20	40	0	350	0
Benzo[b]fluoranthene	$mg.kg^{-1}$	0.27	20	40	0	44	0

Parameter	Units	Max	No of tests	SL1	No > SL1	SL2	No > SL2
				Dutch List		LQM / CIEH Com	
Benzo[k]fluoranthene	$mg.kg^{-1}$	0.1	20	40	0	1,200	0
Benzo[a]pyrene	$mg.kg^{-1}$	0.19	20	40	0	35	0
Indeno(1,2,3-c,d)Pyrene	$mg.kg^{-1}$	0.16	20	40	0	500	0
Benzo[g,h,i]perylene	$mg.kg^{-1}$	0.16	20	40	0	3,900	0
Total Of 17 PAH's	$mg.kg^{-1}$	2.84	20	-	-	-	-

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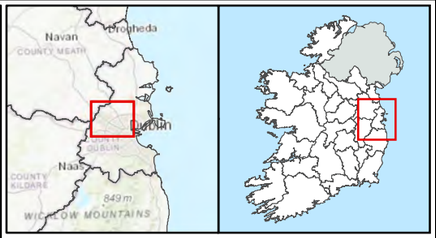

Legend

- Site Boundary

Quaternary Sediments:

- A, Alluvium
- Ag, Alluvium (gravelly)
- As, Alluvium (sandy)
- BasEsk, Eskers comprised of gravels of basic reaction
- Embankment
- GCh, Gravels derived from chert
- GLs, Gravels derived from Limestones
- L, Lacustrine sediments
- Landfill
- Lsi, Lacustrine silts
- Mbs, Marine beach sands
- Rck, Bedrock outcrop or subcrop
- TLs, Till derived from limestones
- Urban
- Water
- Ws, Windblown sands
- Wsd, Windblown sands and dunes

TITLE:	Quaternary Geology		
PROJECT:	SID Application, EIAR and IE Licence Application for Thorntons		
FIGURE NO:	9.1		
CLIENT:	Thorntons Recycling		
SCALE:	1:50000	**REVISION:**	0
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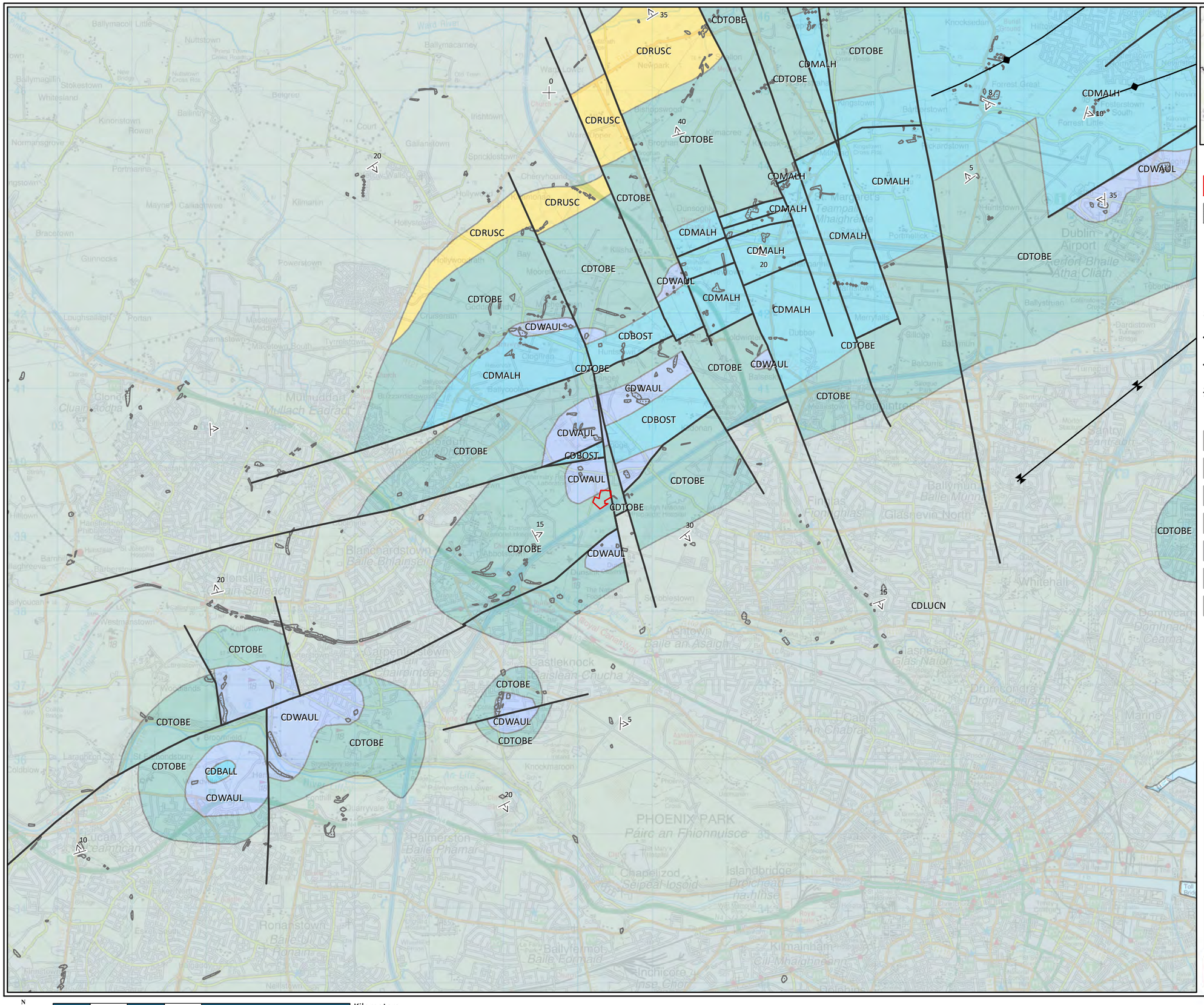
N W E S

0 1 2 4 Kilometers



Legend

- Site Boundary
- Bedrock Outcrop

Bedrock Structural Symbols:

- Horizontal Bedding
- Strike and dip of bedding, right way up

Stratigraphic and Structural Linework:

- Anticlinal Axis
- Fault
- Synclinal Axis

Bedrock Geology:

- Ballysteen Formation
- Boston Hill Formation
- Lucan Formation
- Malahide Formation
- Rush Conglomerate Formation
- Tober Colleen Formation
- Waulsortian Limestones

TITLE:	Bedrock Geology		
PROJECT:	SID Application, EIAR and IE Licence Application for Thorntons		
FIGURE NO:	9.2		
CLIENT:	Thorntons Recycling		
SCALE:	1:50000	**REVISION:**	0
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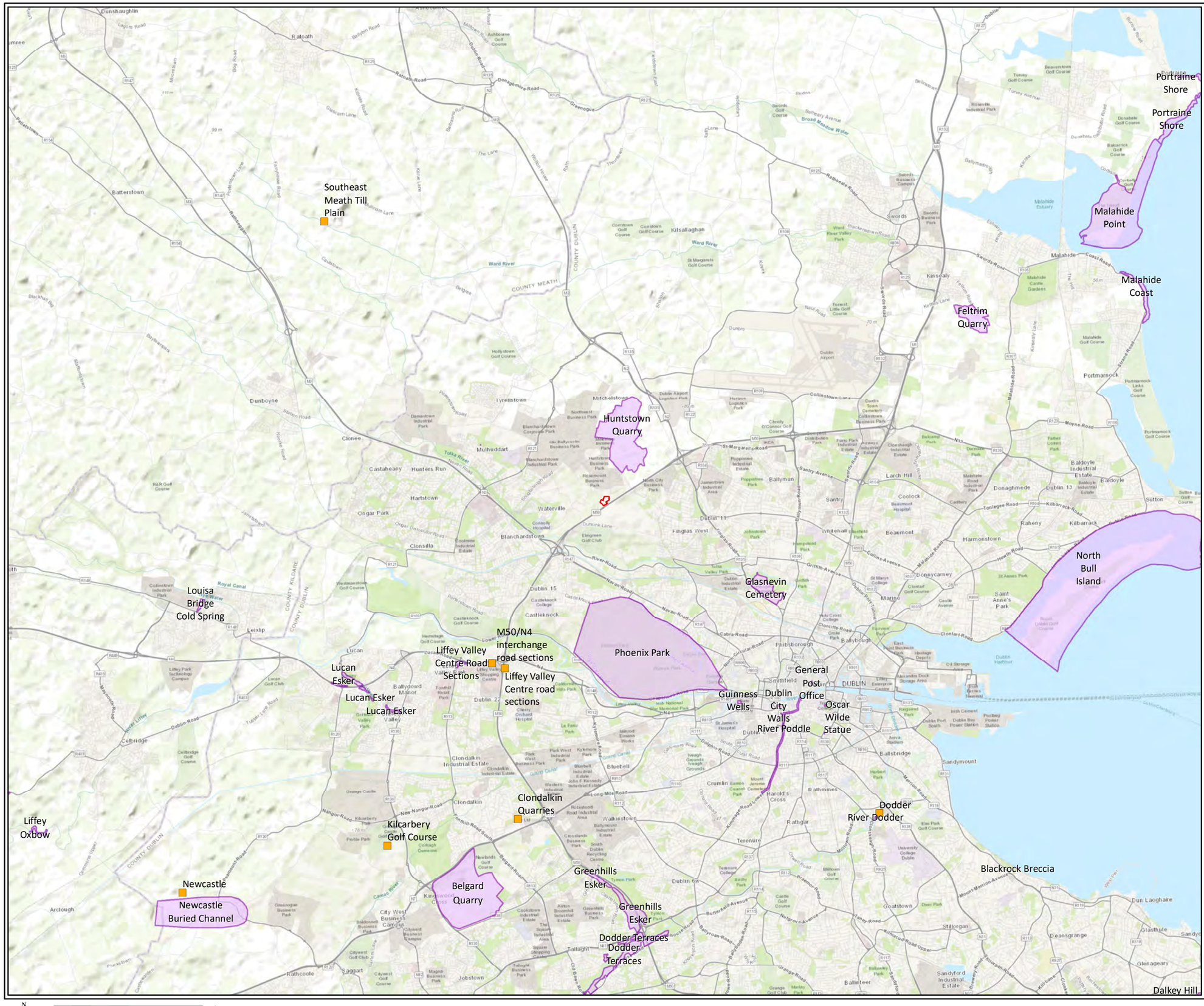

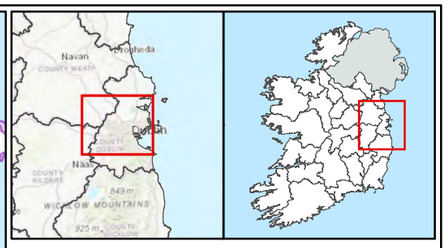

Legend

- Site Boundary
- Geological Heritage Sites
- Geological Heritage Sites (Audited Boundaries)

TITLE:	Geological Heritage		
PROJECT:	SID Application, EIAR and IE Licence Application for Thorntons		
FIGURE NO:	9.3		
CLIENT:	Thorntons Recycling		
SCALE:	1:100000	**REVISION:**	0
DATE:	11/08/2022	**PAGE SIZE:**	A3

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Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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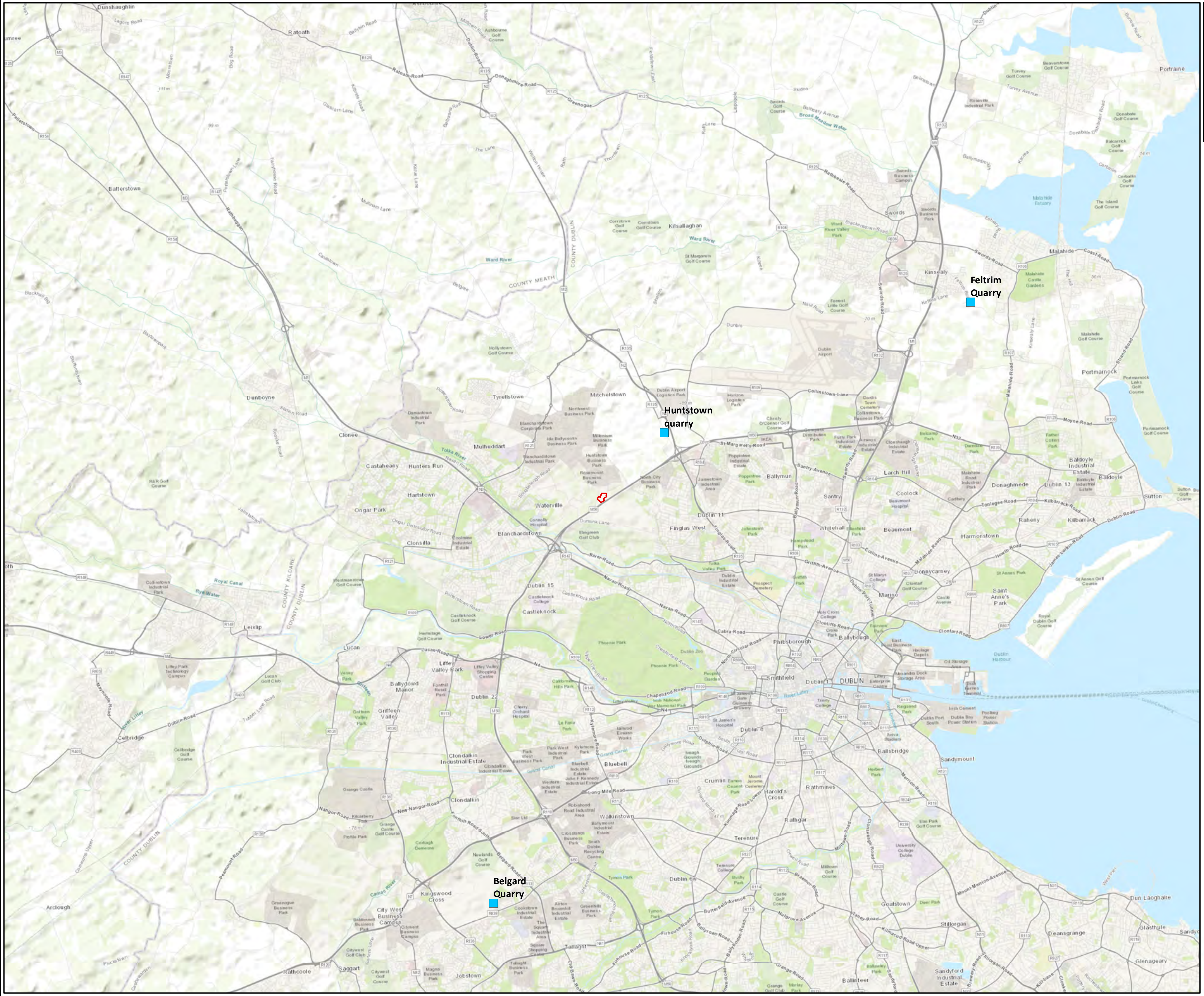

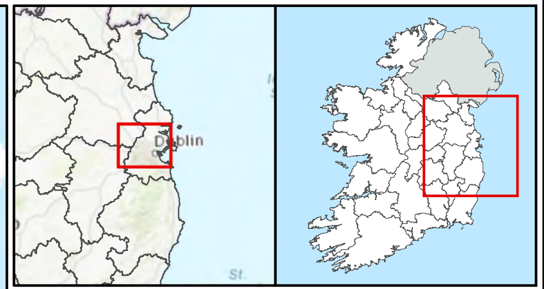

Kilometers 0 1 2 4

Legend

Site Boundary

Active Quarries:

Crushed Rock

TITLE:	Economic Geology
PROJECT:	SID Application, EIAR and IE Licence Application for Thorntons
FIGURE NO:	9.4
CLIENT:	Thorntons Recycling
SCALE:	1:100000
REVISION:	0
DATE:	11/08/2022
PAGE SIZE:	A3

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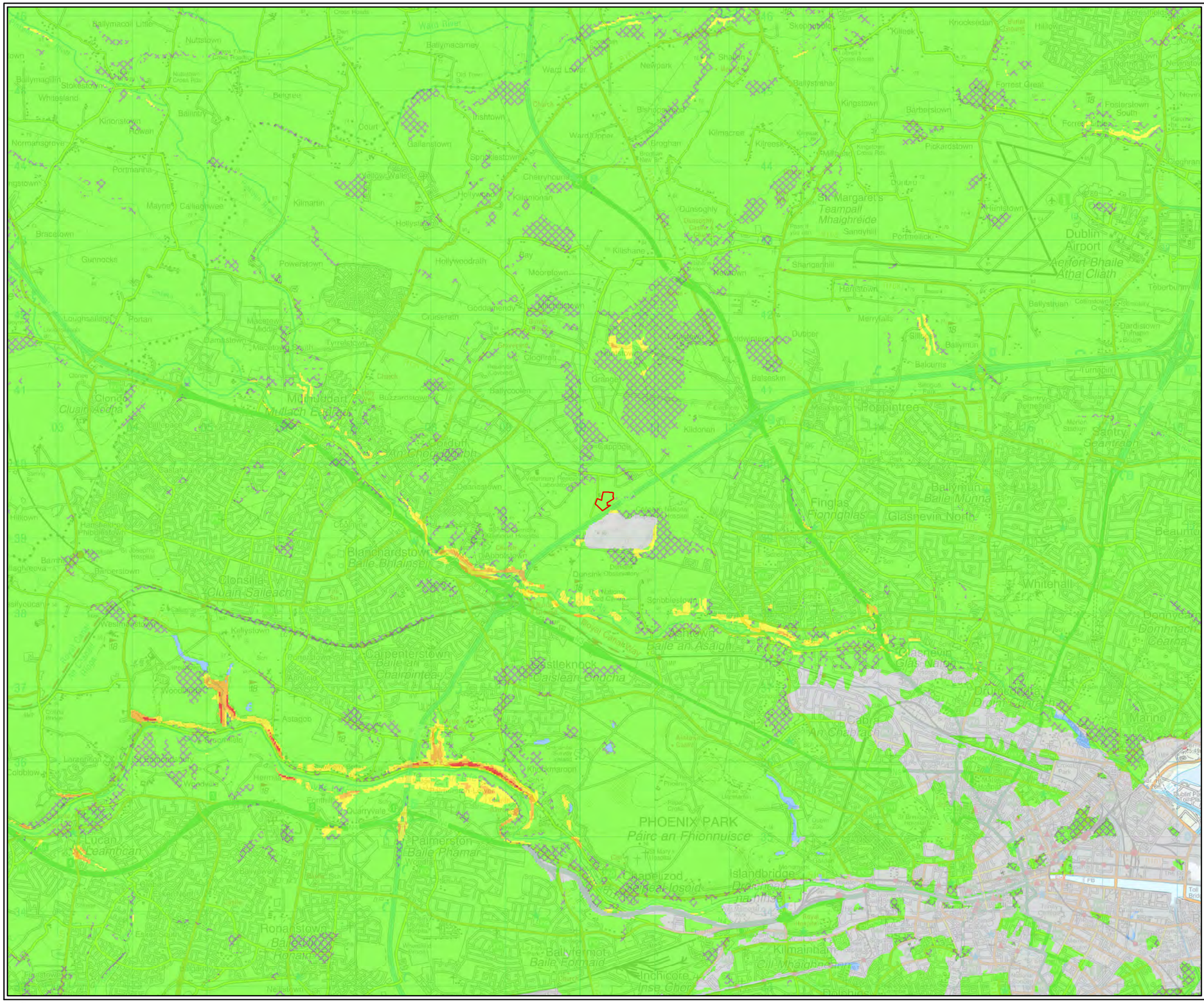

Legend

- Site Boundary

Landslide Susceptibility:

- Low
- Low (inferred)
- Moderately Low
- Moderately Low (inferred)
- Moderately High
- Moderately High (inferred)
- High
- Made
- Water

N W E S

0 1 2 4 Kilometers

TITLE:	Landslide Susceptibility		
PROJECT:	SID Application, EIAR and IE Licence Application for Thorntons		
FIGURE NO:	9.5		
CLIENT:	Thorntons Recycling		
SCALE:	1:50000	**REVISION:**	0
DATE:	11/08/2022	**PAGE SIZE:**	A3

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9.3.7 Hydrogeology

9.3.7.1 Groundwater Vulnerability

The Groundwater Vulnerability classified by the GSI at the proposed development site ranges from 'extreme rock at or near surface or karst' (X) to 'high' due to thin layers (<3m) of moderate to high permeability subsoil above bedrock.

The groundwater vulnerability for the proposed development site is presented in Table 9-7. This table outlines the standard ratings of vulnerability used by the GSI, with the existing site conditions highlighted in grey based on the findings of the intrusive site investigation (moderate and high permeability). The entire external yard area of the existing waste management facility comprises a concrete hardstand, providing a low permeability surface which significantly reduces or eliminates any direct infiltration of rainfall within the facility to the underlying groundwater.

Table 9-7: Groundwater Vulnerability

Vulnerability Rating	Hydrogeological Conditions		
	Subsoil Permeability (Type) and Thickness		
	High Permeability (sand/gravel)	Moderate Permeability (sandy soil)	Low Permeability (clayey subsoil, clay, peat)
Extreme (E)	**0 - 3.0 m**	**0 - 3.0 m**	**0 - 3.0 m**
High (H)	> 3.0 m	3.0 -10.0 m	3.0 - 5.0 m
Moderate (M)	N/A	>10.0 m	5.0 - 10.0 m
Low (L)	N/A	N/A	>10 m

Groundwater vulnerability as described by the GSI for the study area is shown on Figure 9-6.

9.3.7.2 Groundwater Bodies Description

The proposed development is located within the Dublin Groundwater Body (GWB) as shown in Figure 9-7.

The description of the GWB has been taken from the 'Summary of Initial Characterisation' draft reports for each defined GWB published by the GSI in accordance with the Groundwater Working Group Publication: Guidance Document GW2 (2003). The GWB Characterisation Reports are available from the GSI Public Data Viewer. Site specific data including subsoil type encountered during intrusive investigations has been used to supplement and validate the published information.

According to interim classification work carried out as part of the Water Framework Directive and published by the EPA, the Dublin GWB is classified as having *'Good'* status in terms of quality and quantity. The Dublin GWB risk status is under review.

9.3.7.3 Dublin Groundwater Body

The Dublin GWB is located in the Greater Dublin City area and extends southwest towards Kildare. The GWB is generally low lying, with higher elevations to the south at the foothills of the Dublin Mountains and to the northwest. Elevations decrease towards river estuaries.

The Dublin GWB is comprised of Dinantian Upper Impure Limestones, Dinantian Lower Impure Limestones, Dinantian Pure Unbedded Limestones, Dinantian Mixed Sandstones, Shales and Limestones and Namurian Undifferentiated rock.

The aquifer types within the Dublin GWB are classified as LI - Locally important bedrock aquifer which is moderately productive only in local zones and PI - Poor aquifer which is generally unproductive except for local zones.

According to the 'Summary of Initial Characterisation' report for the Dublin GWB (GSI, n.d.a), the majority of groundwater flow within this GWB is considered to occur within the upper weathered bedrock and in conduits at depths of 30 to 50m BGL. The groundwater flow direction in the GWB is generally towards the coast and also towards the River Liffey and Dublin City. Groundwater flow paths within the aquifer are not expected on a regional level, with common flow lengths of less than a kilometre.

Information provided by the GSI indicates that the main recharge mechanism to the GWB outside of Dublin City locally is via diffuse recharge percolating through the subsoil. The amount of effective rainfall which will recharge the GWB is determined by the thickness and permeability of the soil, and the slope. Due to the low permeability of the GWB, a high proportion of the recharge will discharge rapidly to surface watercourses from the upper layers of the aquifer. Beneath Dublin City, it is conservatively estimated that on 10% of the city area is available for recharge as the remainder is an impermeable layer.

The main discharge mechanism from the Dublin GWB is directly to the Irish Sea along the coast. Discharge to overlying gravel aquifers and to overlying rivers will also occur if they are in hydraulic conductivity with the aquifer.

9.3.7.4 Groundwater Body Classifications

The GSI classifications for the Dublin GWB, including the principal aquifer characteristics are summarised in Table 9-8, and shown on Figure 9-7:

Table 9-8: Summary of Aquifer Classifications and Characteristics

Groundwater Body	European Code	Aquifer Name	GSI Aquifer Classification	Status	Transmissivity (m^2/day)
Dublin	IE_EA_G_008	Unnamed	LI[1], PI[2]	Good	10-150

[1] LI: Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
[2] PI: Locally Important Aquifer - Bedrock which is Generally Productive except for Local Zones

9.3.8 Groundwater Supply Sources

A review of published information on groundwater supply sources within the study area was undertaken to identify potential groundwater dependant receptors at potential risk from the proposed development. These include group water schemes (GWS), source protection zones and private supply wells with information on these features obtained from the GSI Groundwater database.

The GSI maintains a database of Public Supply Source Protection Areas. From a review of the database there are no Public Supply Source Protection Areas within the site study area (GSI, 2022).

9.3.9 Source Protection Zones

The GSI maintains a database of Public Supply Source Protection Areas. From a review of the database there are no Public Supply Source Protection Areas within the site boundary or study area (GSI, 2022).

9.3.10 Group Water Schemes

Based on a review of the current GSI groundwater database, there are no Group Water Schemes (GWS) within the site boundary or study area (GSI, 2022).

9.3.11 Groundwater Productivity at the Development Site.

The development site lies above a section of the Dublin GWB that comprises a locally important aquifer that consists of bedrock which is moderately productive only in local zones.

9.3.12 Groundwater Wells and Springs

Based on a review of the GSI Groundwater Wells and Springs database there are 4 no. groundwater Well recorded (to 200m accuracy) within 1km of the proposed development site (GSI, 2022). For the nature of the proposed development, the 1km search radius for groundwater wells and springs is based on a standard industry approach.

Figure 9-8 shows the location of groundwater wells included in the GSI dataset and the available details are included in Table 9-9:

Table 9-9: Groundwater Well Characteristics within 1km of Proposed Development

GSI Well ID	Groundwater Well Type	Total Depth (m)	Depth to Bedrock	Yield (m^3/day)	Yield Class
2923SEW004	Borehole	76.2	Not available	109.1	Good
2923SEW047	Borehole	3.8	Not available	Not available	Not available
2923SEW048	Borehole	3.2	Not available	Not available	Not available
2923SEW049	Borehole	3.6	Not available	Not available	Not available

9.3.13 Karst Features

According to the GSI datasets (GSI, 2021), there are no karst features recorded within the study area as shown in Figure 9-8. The nearest karst feature to the site is a spring named St. Columbs Well (2923SWK003). The spring is located approximately 9.5km south-southwest of the proposed development site.

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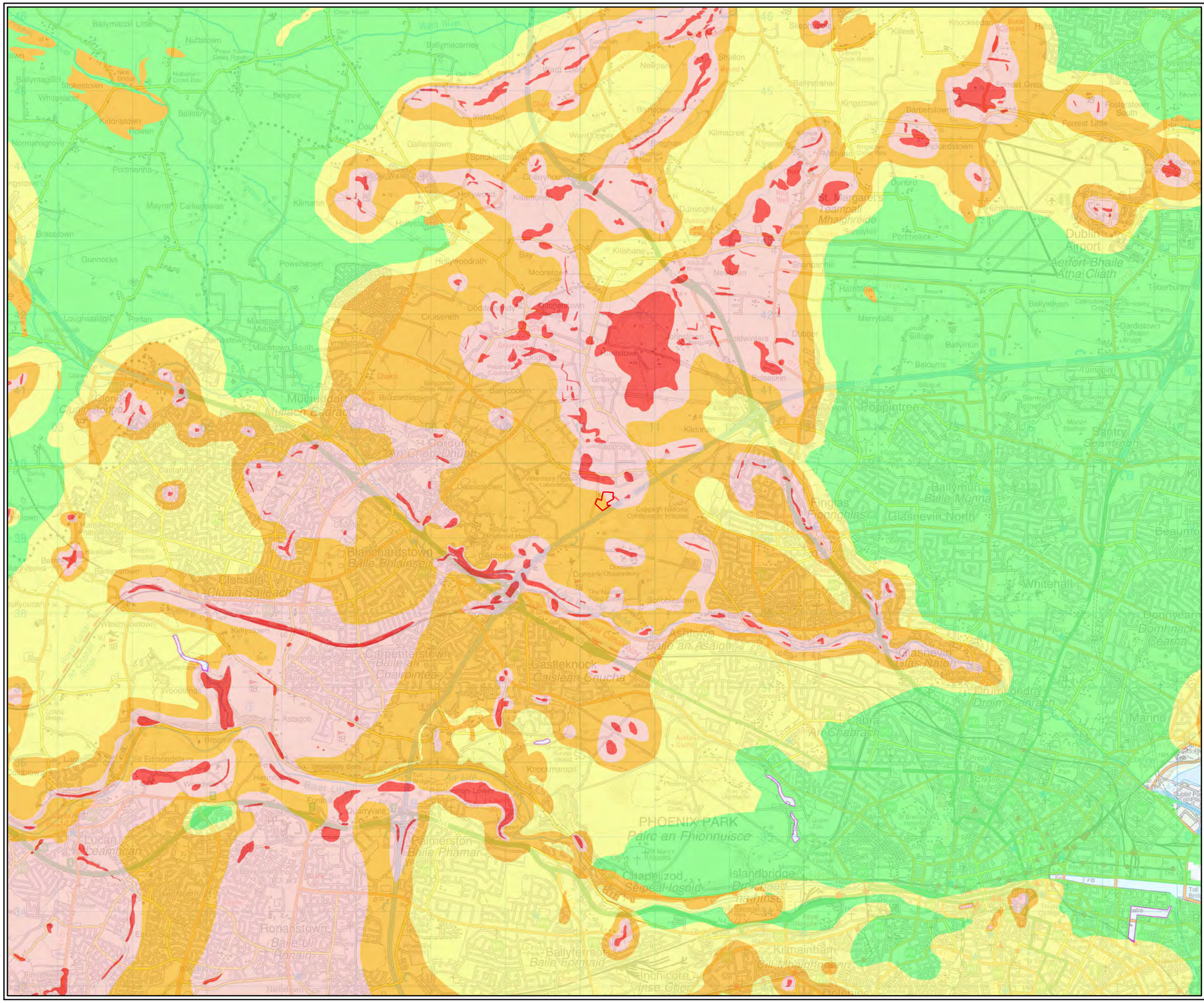

Legend

- Site Boundary

Groundwater Vulnerability:

- E - Extreme
- H - High
- M - Moderate
- L - Low
- Water
- X - Rock Near Surface or Karst

N W E S

0 1 2 4 Kilometers

TITLE:	Groundwater Vulnerability		
PROJECT:	SID Application, EIAR and IE Licence Application for Thorntons		
FIGURE NO:	9.6		
CLIENT:	Thorntons Recycling		
SCALE:	1:50000	**REVISION:**	0
DATE:	11/08/2022	**PAGE SIZE:**	A3

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Site Boundary

WFD Ground Water

Source Protection Area

Source Protection Area

Group Scheme Source Protection

Group Scheme Source Protection

Sand and Gravel

Locally important gravel

Bedrock

Lk: Locally Important Aquifer -

Ll: Locally Important Aquifer - Bedrock Mod Productive Locally

Lm: Locally Important Aquifer - Bedrock Generally Mod Productive

Pl: Poor Aquifer Bedrock Generally Unproductive Except Locally

Pu: Poor Aquifer Bedrock Generally Unproductive

Rkd: Regionally Important Aquifer - Karstified (diffuse)

N W E S

0 1 2 4 Kilometers

TITLE: Groundwater Bodies and Groundwater Aquifers

PROJECT: SID Application, EIAR and IE Licence Application for Thorntons

FIGURE NO:	9.7		
CLIENT:	Thorntons Recycling		
SCALE:	1:150000	**REVISION:**	0
DATE:	11/08/2022	**PAGE SIZE:**	A3

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Legend

- Site Boundary
- Wells and Springs (50-100m Accuracy)
- Wells and Springs (100-200m Accuracy)
- Wells and Springs (200-500m Accuracy)
- Wells and Springs (500m-1km Accuracy)
- Wells and Springs (10-50m Accuracy)

No Karst Features within Study Area

N
W E
S

0 1 2 4 Kilometers

TITLE:	Groundwater Wells and Springs		
PROJECT:	SID Application, EIAR and IE Licence Application for Thorntons		
FIGURE NO:	9.8		
CLIENT:	Thorntons Recycling		
SCALE:	1:50000	**REVISION:**	0
DATE:	16/08/2022	**PAGE SIZE:**	A3

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9.3.14 Groundwater Quality and Conductivity

Groundwater sampling was undertaken by the applicant in 2021 in two existing boreholes, RC01 and RC02. Analysis was carried out by Fitz Scientific. The boreholes were installed in November 2020. A copy of the laboratory results is in Appendix 9.2 and borehole logs are in Appendix 9.3 in Volume 3 of this EIAR. RC01 and RC02 have been renamed as GW1 and GW2, respectfully by the Applicant.

Groundwater samples were taken by GII from groundwater monitoring wells (BH08, BH09) installed during the site investigation carried out on-site between January and May 2022. These samples were sent to third-party laboratory Element Materials Technology Laboratory in the UK for testing. This monitoring was carried out to establish the baseline condition of groundwater at the development site.

The location of the groundwater monitoring wells, and groundwater levels are presented in Figure 9-9. Groundwater levels in August 2022 ranged from 2.30 to 2.95m BGL. Based on the hydraulic gradient, it is estimated that groundwater across the site flows in an east/southeast direction, generally following topography in the area.

Samples were analysed for a broad suite of parameters including the following:

- Inorganic chemistry
- Heavy metals
- Total Petroleum Hydrocarbons (TPH)
- Pesticides
- Herbicides
- Volatile Organic Compounds (VOCs)
- Semi-Volatile Organic Compounds (SVOCs) including
    - Polycyclic Aromatic Hydrocarbons (PAHs)
    - Phenol

A summary of the groundwater testing results for key, relevant parameters which were reported as above their respective laboratory detection limits is presented in Table 9-12. These monitoring parameters were chosen based on pre-existing contamination risks on-site (e.g. existing waste facility, previous agricultural activities, existing storage of scrap vehicles and private dwellings adjacent and upgradient of proposed development site), and potential contamination risks associated with the proposed development (E.g. waste management related activities, fuel storage), noting the importance of quantifying baseline concentrations of the parameters of interest associated with proposed site activities.

The chemical analysis results were compared to overall threshold value (OTV) from the European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010), as amended, or where appropriate, the interim guideline values (IGVs) from the EPA publication, Towards Setting Guideline Values for the Protection of Groundwater in Ireland (EPA, 2003). It is noted that OTV limits have primacy over IGV limits.

pH values were between 7.12 and 7.75 (within normal range).

Conductivity values were broadly consistent across the proposed development site with values between 0.61mS/cm and 1.22mS/cm recorded. Conductivity values recorded at GW1 (June, September, November) and GW2 (June) were below the acceptable range of 0.8 – 1.875mS/cm for conductivity defined in the groundwater regulations. None of the remaining samples were above the maximum threshold. Published information from the GSI indicates that the Dublin GWB has very hard water with a high alkalinity and has a very high electrical conductivity (0.55-0.90mS/cm). Recorded concentrations at site are likely representative of natural background values.

All but one chloride sample (GW1 in June 2021, 23mg/l) were above the lower OTV limit (24mg/l) but below the upper limit (187.5mg/l). Concentrations may be indicative of natural background levels.

Sulphate concentrations are variable across the site and between monitoring events. For example, at GW1, concentrations for the 2021 quarterly monitoring were 486mg/l, 17mg/l, 2mg/l and 152mg/l. The source of sulphate on-site is unconfirmed but may originate from an off-site upgradient location.

Most ammonia concentrations were above the lower OTV threshold (0.065mg/l). GW2 ammonia concentrations were above the upper OTV (0.175mg/l) and IGV (0.15mg/l) thresholds during all sampling. These concentrations may be linked to potential private dwelling wastewater treatment system(s) located adjacent to and upgradient of GW2. Elevated concentrations of faecal and total coliforms are noted in GW2 and to a lesser extent downgradient in GW1 and are indicative of a wastewater source. Concentrations of ammonia in BH08 and BH09, nitrate, nitrite and orthophosphate in BH09 are likely attributed to surrounding agricultural activities which are upstream of the development site (in terms of groundwater flow).

Elevated concentrations above the OTV/IGV were noted in GW1 and GW2 for arsenic (GW1 only), calcium (GW1 only), aluminium, iron, lead and manganese. Concentrations may be the result of historical and/or current activity upgradient of or within the site.

Concentrations of TPH, pesticides, herbicides, VOCs and SVOCs were all below the laboratory detection limit. The source of sulphate on-site is unconfirmed but may from an off-site location.

Groundwater at the site will not be abstracted for use as part of the proposed development. Water will be supplied to the proposed development via mains and an onsite rainwater harvesting system and storage tank.

Table 9-10: Groundwater Monitoring Results 2021 / 2022

Parameter	Units	OTV / IGV	GW1				GW2				BH08	BH09
			02/03/2021	11/06/2021	13/09/2021	17/11/2021	02/03/2021	11/06/2021	13/09/2021	17/11/2021	23/05/2022	23/05/2022
Ammonia as N	mg/l	0.065 - 0.175/0.15	0.12	<0.02	0.12	0.05	5.29	11.02	12.25	6.65	0.11	0.12
Conductivity @ 20 deg.C	mS/cm	0.8 – 1.875	1,135	609	664	856	736	1064	924	947	1219	899
Nitrite as NO2	mg/l	N/A	<0.01	-	-	-	0.01	-	-	-	<0.02	0.77
pH	pH Units	>6.5 &<9.5	7.75	7.68	7.37	7.23	7.51	7.29	7.25	7.12	7.64	7.42
Sulphate	mg/l	187.5/200	486	17	2	152	204	263	147	173	356.8	96.4
Chloride	mg/l	24 - 187.5/30	33	23	37	43	29	50	42	48	35.5	33.7
Nitrate as N	mg/l	N/A	<0.47	-	-	-	1.15	-	-	-	<0.2	4.7
Phosphate (Ortho as P)	mg/l	0.03	<0.01	-	-	-	0.02	-	-	-	<0.06	0.06
Arsenic	µg/l	7.5/10	9	-	-	-	4	-	-	-	<0.9	1.3
Calcium	mg/L	200	305.6	-	-	-	153.5	-	-	-	196.3	157.5
Aluminium	µg/l	150	937	-	-	-	1375	-	-	-	-	-
Iron	µg/l	200	3,342	-	-	-	4448	-	-	-	30.5	5.9
Lead	µg/l	7.5/10	31	-	-	-	27	-	-	-	<0.4	<0.4
Manganese	µg/l	50	1,138	-	-	-	581	-	-	-	79.4	84.5
Coliforms (Faecal)	cfu/100 ml	0	<10	-	-	-	300	-	-	-	-	-
Coliforms (Total)	cfu/100 ml	0	10	-	-	-	2,400	-	-	-	-	-

Path: R:\Map Production\2021\P21-150\Workspaces\EIAR\P21-150_GIS_Fig9-9_GroundwaterMonitoringLocations_A3.mxd

Legend

- Site Boundary
- Monitoring Well (Groundwater Elevation in mOD)

N
W E
S

0 25 50 100 Meters

TITLE:	Groundwater Monitoring Locations		
PROJECT:	SID Application, EIAR and IE Licence Application for Thorntons		
FIGURE NO:	9.9		
CLIENT:	Thorntons Recycling		
SCALE:	1:2000	**REVISION:**	0
DATE:	15/08/2022	**PAGE SIZE:**	A3

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9.4 Potential Impacts

The potential effects of the proposed development on soils, geology and hydrogeology are individually assessed in this section. Impacts associated with each phase of the proposed development (construction, operation and decommissioning, as described in Chapter 4 of this EIAR) are evaluated.

The potential impacts are assessed in accordance with the evaluation criteria outlined in Section 9.2. The geological potential effects are summarised in Table 9-11. The hydrogeological potential effects are summarised in Table 9-12. The proposed mitigation measures are then assessed to reduce or eliminate potential effects in Section 9.5 and residual effects are identified in Section 9.6.

9.4.1 'Do Nothing' Impacts

If the proposed development did not take place, the development site will remain as it is currently. The existing waste facility operated by the Applicant on the northern section of the development will continue to operate in accordance with the terms of the planning consents and Waste Facility Permit consents for the facility.

Lands to the south of the existing waste facility will remain as grassland/scrubland. There is a risk that continued scrap vehicle storage in this area may result in the discharge of polluting substances to soil and groundwater (e.g., petroleum hydrocarbon, heavy metals).

The 'Do Nothing' scenario will have an **Imperceptible** impact on the receiving soils, geological and hydrogeological environment (i.e., no effect).

9.4.2 Construction Phase Impacts

The construction phase of the proposed development has the potential to impact the receiving soils, geological and hydrogeological environment. An evaluation of these potential impacts has been carried out having regard to the following main construction activities to be carried out during the construction phase of the proposed development:

- Advance works
- Development of temporary construction site compound
- Site clearance
- Site earthworks
- Installation of site services and surface water management systems
- Construction of site hard stand and granular formation surfaces
- Construction of site buildings and structures
- Installation of additional ancillary site infrastructure and elements

Detail regarding these proposed construction activities is contained in Chapter 4 – Existing and Proposed Development of this EIAR.

The potential impacts from these construction phase elements are outlined in the sections below.

9.4.2.1 Advance Works

Advance works will consist of the following three activities:

- Demolition and decommissioning of existing facility elements
- Re-location of existing overhead electrical powerline
- Culverting of the existing open surface water drainage ditch

The Applicant will aim to reutilise material within the confines of the development site as fill material, wherever possible.

Any excess material generated during construction which cannot be reutilised on-site will be subject to waste acceptance criteria (WAC) testing, as appropriate, and sent for recovery at an appropriately authorized Soil / C&D waste recovery facility (in the event WAC testing shows that the material is suitable for this type of recovery).

There is the potential for impact to soils, geology and hydrogeology from the excavation and movement of soils during the construction phase of the proposed development.

Potential geological effects associated with advance works are as follows:

- Soil erosion and disturbance due to earthworks and excavations.
- The use of plant and machinery during advance works activities will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils.
- Temporary rubble stockpiles created from the demolition of existing concrete facility elements may result in the generation of alkaline discharges to ground.
- Removal of material from site will take up available void space at destination soil recovery facility.

The Magnitude of the impact from these works is 'Small Adverse' in nature. The importance of the geology receptors (subsoils, bedrock) is 'Medium'. The significance of these potential effects, prior to mitigation, is therefore considered to be **Slight.**

Potential hydrogeological effects associated with advance works are as follows:

- Overburden will be removed as part of the advance works. The works will increase the vulnerability of the aquifer, i.e., the presence of a thinner layer of overburden increases the risk that groundwater could be contaminated.
- Excavated soils will be exposed in excavations and in temporary stockpiles. These soils will be subject to erosion by wind and rain which could result in the deposition and entrainment of silt in surface water. This surface water may in turn percolate to groundwater and have indirect adverse effect on groundwater quality (i.e., through increasing suspended solid concentration in groundwater).
- Damming, pumping, excavation and backfilling works associated with the culverting of the surface water drainage ditch traversing the site poses a particular risk to surface water quality present in this drainage ditch. This surface water may in turn percolate to groundwater and have indirect adverse effect on groundwater quality.

- Potential for contamination to groundwater from spills/leakages during works. The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer.
- Temporary rubble stockpiles created from the demolition of existing concrete facility elements may result in the generation of alkaline discharges to groundwater.

The Magnitude of the impact from these works is 'Small Adverse' in nature. The importance of the groundwater receptors is 'Medium'. The significance of these potential effects, prior to mitigation is **Slight.**

9.4.2.2 Development of Temporary Construction Site Compound

The construction activities associated with the development of the temporary construction site compound may cause the following effects on the receiving soils and geological environment:

- The use of plant and machinery will require the use of fuels and oils. Materials will be stored at the compound and there will be the use of temporary toilet facilities. Their use and storage present potential for spills and leaks which could contaminate underlying exposed soils.
- Quantities of granular material will be required. This will place a demand on local aggregate extraction facilities.

The Magnitude of the impact from these works is 'Small Adverse' in nature. The importance of the geology receptors (subsoils, bedrock) is 'Medium'. The significance of these potential effects, prior to mitigation, is therefore considered to be **Slight.**

Potential hydrogeological effects associated with the temporary construction site compound are as follows:

- Soil and fill material disturbance associated with the formation of the hardcore surface area for this compound, mobile plant movements and the delivery of construction phase infrastructure represents a potential source of increased sediment in surface water runoff. This surface water may in turn percolate to groundwater and have indirect adverse effect on groundwater quality (i.e., through increasing suspended solid concentration in groundwater).
- Potential for contamination to groundwater from spills/leakages during works. The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer.

The Magnitude of the impact from these works is 'Small Adverse' in nature. The importance of the groundwater receptors is 'Medium'. The significance of these potential effects, prior to mitigation is **Slight.**

9.4.2.3 Site Clearance

The construction activities associated with the site clearance stage, including stripping of vegetation and topsoil may cause the following effects on the receiving soils and geological environment:

- Soil erosion and disturbance due to clearance activities.

- The use of plant and machinery during site clearance activities will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils.
- Some material excavated from the site during the clearance works may be exported from the site to a soil recovery facility. This will take up available void space at that facility.

The Magnitude of the impact from these works is 'Small Adverse' in nature. The importance of the geology receptors (subsoils, bedrock) is 'Medium'. The significance of these potential effects, prior to mitigation, is therefore considered to be **Slight.**

Potential hydrogeological effects associated with site clearance works are as follows:

- Overburden will be removed as part of the site clearance works. The works will increase the vulnerability of the aquifer, i.e., the presence of a thinner layer of overburden increases the risk that groundwater could be contaminated.
- Excavated soils will be exposed in excavations and in temporary stockpiles. These soils will be subject to erosion by wind and rain which could result in the deposition and entrainment of silt in surface water. This surface water may in turn percolate to groundwater and have indirect adverse effect on groundwater quality (i.e., through increasing suspended solid concentration in groundwater).
- Potential for contamination to groundwater from spills/leakages during works. The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer.

The Magnitude of the impact from these works is 'Small Adverse' in nature. The importance of the groundwater receptors is 'Medium'. The significance of these potential effects, prior to mitigation is **Slight.**

9.4.2.4 Site Earthworks

The construction activities associated with site earthworks, which involve the excavation of overburden to formation levels for foundations, below ground tanks and below ground services may cause the following effects on the receiving soils and geological environment:

- Soil erosion and disturbance due to earthworks and excavations.
- The use of plant and machinery during site earthworks activities will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils.
- Excavated material will be reutilised as backfill on-site, where feasible. Some material excavated from the site during the site earthworks may be exported from the site to a soil recovery facility. This will take up available void space at that facility. Refer to Table 4-4 in Chapter 4 Existing and Proposed Development of Volume 2 of this EIAR for the materials balance.
- Imported granular fill material will be used to augment backfill, as necessary. Refer to Table 4-4 in Chapter 4 Existing and Proposed Development of this EIAR for the materials balance. This will place a demand on local aggregate extraction facilities.

The Magnitude of the impact from these works is 'Small Adverse' in nature. The importance of the geology receptors (subsoils, bedrock) is 'Medium'. The significance of these potential effects, prior to mitigation, is therefore considered to be **Slight.**

Potential hydrogeological effects associated with site earthworks are as follows:

- Overburden will be removed as part of the site earthworks. The works will increase the vulnerability of the aquifer, i.e., the presence of a thinner layer of overburden increases the risk that groundwater could be contaminated.
- Excavated soils will be exposed in excavations and in temporary stockpiles. These soils will be subject to erosion by wind and rain which could result in the deposition and entrainment of silt in surface water. This surface water may in turn percolate to groundwater and have indirect adverse effect on groundwater quality (i.e., through increasing suspended solid concentration in groundwater).
- Potential for contamination to groundwater from spills/leakages during works. The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer.

The Magnitude of the impact from these works is 'Small Adverse' in nature. The importance of the groundwater receptors is 'Medium'. The significance of these potential effects, prior to mitigation is **Slight.**

9.4.2.5 Installation of Site Services and Surface Water Management Systems

The construction activities associated with the installation of site services and surface water management systems may cause the following effects on the receiving soils and geological environment:

- Soil erosion and disturbance due to excavations.
- The use of plant and machinery during site earthworks activities will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils.
- Temporary rubble stockpiles created from the breaking out of the existing hardstanding may result in the generation of alkaline discharges to ground.
- Excavated material will be reutilised as backfill on-site, where feasible. Some material excavated from the site during the excavation of trenches may be exported from the site to a soil recovery facility. This will take up available void space at that facility.
- Imported granular fill material will be used to augment backfill, as necessary. This will place a demand on local aggregate extraction facilities.

The Magnitude of the impact from these works is 'Small Adverse' in nature. The importance of the geology receptors (subsoils, bedrock) is 'Medium'. The significance of these potential effects, prior to mitigation, is therefore considered to be **Slight.**

Potential hydrogeological effects associated with advance works are as follows:

- Overburden will be removed during the excavation of the trenches. The works will increase the vulnerability of the aquifer, i.e., the presence of a thinner layer of overburden increases the risk that groundwater could be contaminated.

- Excavated soils will be exposed in excavations and in temporary stockpiles. These soils will be subject to erosion by wind and rain which could result in the deposition and entrainment of silt in surface water. This surface water may in turn percolate to groundwater and have indirect adverse effect on groundwater quality (i.e., through increasing suspended solid concentration in groundwater).
- Potential for contamination to groundwater from spills/leakages during works. The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer.
- Temporary rubble stockpiles created from the demolition of existing hardstanding may result in the generation of alkaline discharges to groundwater.

The Magnitude of the impact from these works is 'Small Adverse' in nature. The importance of the groundwater receptors is 'Medium'. The significance of these potential effects, prior to mitigation is **Slight.**

9.4.2.6 Construction of Site Hard Stand and Granular Formation Surfaces

The construction activities associated with the site hardstand and granular formation surfaces may cause the following effects on the receiving soils and geological environment:

- Concrete/cement works required for the proposed hardstand may result in the generation of alkaline discharges to ground.
- The use of plant and machinery during site earthworks activities will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils.
- Imported concrete and granular fill material will place a demand on local aggregate extraction facilities.

The Magnitude of the impact from these works is 'Small Adverse' in nature. The importance of the geology receptors (subsoils, bedrock) is 'Medium'. The significance of these potential effects, prior to mitigation, is therefore considered to be **Slight.**

Potential hydrogeological effects associated with advance works are as follows:

- Potential for contamination to groundwater from spills/leakages during works. The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer.
- Concrete/cement works required for the proposed structures/buildings on-site may result in the generation of alkaline discharges to groundwater.

The Magnitude of the impact from these works is 'Small Adverse' in nature. The importance of the groundwater receptors is 'Medium'. The significance of these potential effects, prior to mitigation is **Slight.**

9.4.2.7 Construction of Site Buildings and Structures

The construction activities associated with the site buildings and structures may cause the following effects on the receiving soils and geological environment:

- Soil erosion and disturbance due to excavations.
- The use of plant and machinery during construction activities will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils.
- Excavated material will be reutilised as backfill on-site, where feasible. Some material excavated from the site during the excavation of trenches may be exported from the site to a soil recovery facility. This will take up available void space at that facility.
- Concrete/cement works required for the building foundations and floors may result in the generation of alkaline discharges to ground.
- Imported engineering fill and concrete will place a demand on local aggregate extraction facilities.

The Magnitude of the impact from these works is 'Small Adverse' in nature. The importance of the geology receptors (subsoils, bedrock) is 'Medium'. The significance of these potential effects, prior to mitigation, is therefore considered to be **Slight.**

Potential hydrogeological effects associated with advance works are as follows:

- Overburden will be removed during the excavation of the building foundations. The works will increase the vulnerability of the aquifer, i.e., the presence of a thinner layer of overburden increases the risk that groundwater could be contaminated.
- Excavated soils will be exposed in excavations and in temporary stockpiles. These soils will be subject to erosion by wind and rain which could result in the deposition and entrainment of silt in surface water. This surface water may in turn percolate to groundwater and have indirect adverse effect on groundwater quality (i.e., through increasing suspended solid concentration in groundwater).
- Potential for contamination to groundwater from spills/leakages during works. The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer.
- Concrete/cement works required for the building foundations and floors may result in the generation of alkaline discharges to groundwater.

The Magnitude of the impact from these works is 'Small Adverse' in nature. The importance of the groundwater receptors is 'Medium'. The significance of these potential effects, prior to mitigation is **Slight.**

9.4.2.8 Installation of Additional Ancillary Site Infrastructure and Elements

The construction activities associated with the installation of additional ancillary site infrastructure and elements may cause the following effects on the receiving soils, geological and hydrogeological environment:

- The use of plant and machinery during construction activities will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils and could result in contamination of the underlying aquifer.

The Magnitude of the impact from the installation of additional ancillary site infrastructure and elements is 'Small Adverse' in nature, having regard to the design of the proposed facility.

The importance of the soils and geology receptors (subsoils, bedrock) is 'Medium'. The significance of these potential effects, prior to mitigation, is **Slight**.

The importance of the groundwater receptors is 'Medium'. The significance of these potential effects, prior to mitigation is **Slight.**

9.4.3 Operational Phase Impacts

The potential effects on soils, geology and hydrogeology from the operation of the proposed development are outlined hereunder.

9.4.3.1 Potential Direct Effects

Very few potential effects are envisaged during the operational phase of the development. Potential direct effects of the proposed development's operation on soils, geology and hydrogeology during this phase would mainly be related to potential contamination from spills/leakages. The sources for potential impacts will be:

- Normal operational traffic and other traffic necessary for the maintenance of the proposed development may result in minor accidental leaks or spills of fuel/oil;
- Storage of fuel on site and refuelling of mobile plant.
- Risk of accidents which could include the following:
    - Uncontrolled spillages of dirty water / washwater or wastewater arising from the accidental release from the below ground tanks;
    - Spills/leaks of oil from the transformers in the substation;
    - Release of contaminated firewater during a fire event.

The Magnitude of the impact from these operational phase activities is Negligible in nature, having regard to the design of the proposed facility.

The importance of the soils and geology receptors (subsoils, bedrock) is 'Medium'. The significance of these potential effects, prior to mitigation, is **Imperceptible**.

The importance of the groundwater receptors is 'Medium'. The significance of these potential effects, prior to mitigation is **Imperceptible.**

9.4.3.2 Potential Indirect Effects

Operations at the proposed facility have the potential to result in the accidental discharge of polluting material (e.g., fuels, oils) to receiving surface water drainage within the site. Such a discharge may indirectly impact groundwater in the receiving environment via surface water infiltration to groundwater.

The Magnitude of this indirect effect is Negligible in nature, having regard to the design of the proposed facility. The importance of the groundwater receptors is 'Medium'. The significance of these potential effects, prior to mitigation is **Imperceptible.**

9.4.4 Decommissioning Phase Impacts

Decommissioning activities are described in Chapter 4 Existing and Proposed Development of this EIAR. Decommissioning will be carried out in accordance with a Closure, Restoration and Aftercare Management Plan (CRAMP) for the facility, in accordance with the conditions of the prospective Industrial Emissions (IE) licence for the proposed facility.

Impacts associated with decommissioning are likely to be of a much smaller magnitude than impacts associated with the construction of the proposed development.

It is intended to wind the operation down gradually until such time the vast majority of wastes and materials are removed from the site.

All built infrastructural elements of the site will remain as they are in-situ. As such, there will be no disturbance of soils, earthworks or demolition activities during the decommissioning phase of the proposed development.

All hard-standing areas and drainage systems including interceptors will be cleaned and washed down. Residual materials including wastes, interceptor sludges, diesel fuel, and hazardous liquids stored in the vehicle maintenance building, and any 'dirty water' present in the underground storage tank on-site, will be removed from the site and disposed of at an appropriately authorized waste management facility. Residual materials will be managed in accordance with the CRAMP for the proposed facility and will be classified before being dispatched off-site.

The Magnitude of the impact from decommissioning works is Negligible in nature.

The importance of the soils and geology receptors (subsoils, bedrock) is 'Medium'. The significance of these potential effects, prior to mitigation, is **Imperceptible**.

The importance of the groundwater receptors is 'Medium'. The significance of these potential effects, prior to mitigation is **Imperceptible.**

9.4.5 Cumulative Impacts

Various industrial land uses in the local area may potentially create polluting discharges to the receiving soils, geological and hydrogeological environment. Several industrial land uses are located to the northeast of the site along the Cappagh Road including a Materials Recovery Facility, Huntstown Quarry, and a concrete batching plant. Dunsink Landfill is situated south of the site on the opposite side of the M50.

Potential exists for above and below ground water discharges from the proposed development and polluting discharges in the wider Dublin GWB area combining and having a cumulative impact on the receiving geological and hydrogeological environment.

The construction phase of the proposed development may also coincide with the construction of a warehouse / lighthouse industrial complex by Shannonside Enterprises Ltd at a site ca. 200 metres northeast of the development site (Planning Reference: FW21A/0149, Planning Permission granted on 26/05/2022).

Above and below ground water discharges during construction activities at both developments may combine and have a cumulative impact on the soils, geological and hydrogeological environment.

During both the construction and operational phases of the proposed development the potential cumulative effect on soils, geology and hydrogeology from construction and operational phase activities, in combination with other current land uses and committed development in the study area, is 'Small Adverse' in nature (prior to mitigation). The importance of the receiving soils, geological and hydrogeological environment is 'Medium'. The significance of these potential effects, prior to mitigation, is **Slight.**

During the construction of the proposed development there will be the requirement for the importation of engineered fill from source quarries and potential for consignment of excess material to a Soil Recovery Facility. There will be an **Imperceptible** cumulative impact in terms of demands placed on local quarries for aggregate and available void space at a receiving Soil Recovery Facility during the construction phase of the development.

The proposed development will only have an imperceptible impact on receiving soils, geology and hydrogeology during its operational and decommissioning phase. As such, the proposed development is not expected to contribute to any significant cumulative effect on soils, geology or hydrogeology contained in the receiving environment.

9.4.6 Summary of Potential Effects

A summary of unmitigated potential effects on geology attributes from the proposed development is provided in Table 9-11. The potential unmitigated effects on hydrogeological attributes from the proposed development is provided in Table 9-12.

Table 9-11: Summary of Potential Unmitigated Impact Significance on Geology Attributes

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Construction Phase					
Advance Works	Soil erosion and disturbance due to earthworks and excavations. The use of plant and machinery during demolition and site clearance activities will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils. Temporary rubble stockpiles created from the demolition of existing concrete facility elements may result in the generation of alkaline discharges to ground. Removal of surplus material from site will take up available void space at destination soil recovery facility.	Local overburden deposits Bedrock Receiving soil recovery facility	Medium	Small Adverse	Slight
Development of Temporary Construction Site Compound	The use of plant and machinery during construction will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils. Importation of engineering fill products.	Local overburden deposits Bedrock Local quarries	Medium	Small Adverse	Slight

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Site Clearance	Soil erosion and disturbance due to clearance activities. The use of plant and machinery during construction will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils. Removal of surplus material from site will take up available void space at destination soil recovery facility.	Local overburden deposits Bedrock Receiving soil recovery facility	Medium	Small Adverse	Slight
Site Earthworks	Soil erosion and disturbance due to earthworks and excavations. The use of plant and machinery during construction will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils. Removal of surplus material from site will take up available void space at destination soil recovery facility. Importation of engineering fill products.	Local overburden deposits Bedrock Receiving soil recovery facility Local quarries	Medium	Small Adverse	Slight

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Installation of Site Services and Surface Water Management Systems	Soil erosion and disturbance due to excavations. The use of plant and machinery during construction will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils. Temporary rubble stockpiles created from the breaking out of the existing hardstanding may result in the generation of alkaline discharges to ground. Removal of surplus material from site will take up available void space at destination soil recovery facility. Importation of engineering fill products.	Local overburden deposits Bedrock Receiving soil recovery facility Local quarries	Medium	Small Adverse	Slight
Construction of Site Hard Stand and Granular Formation Surfaces	The use of plant and machinery during construction will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils. Concrete/cement works required for the proposed hardstand may result in the generation of alkaline discharges to ground. Importation of engineering fill and concrete products.	Local overburden deposits Bedrock Receiving soil recovery facility Local quarries	Medium	Small Adverse	Slight

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Construction of Site Buildings and Structures	Soil erosion and disturbance due to excavations. The use of plant and machinery during construction will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils. Removal of surplus material from site will take up available void space at destination soil recovery facility. Importation of engineering fill and concrete products. Concrete/cement works required for the building foundations and floors may result in the generation of alkaline discharges to ground.	Local overburden deposits Bedrock Receiving soil recovery facility Local quarries	Medium	Small Adverse	Slight
Installation of Additional Ancillary Site Infrastructure and Elements	The use of plant and machinery during construction will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils.	Local overburden deposits Bedrock	Medium	Small Adverse	Slight
Operational Phase					
Facility Traffic and refuelling	Release of hydrocarbons or fuel spill, with potential for soil contamination.	Local overburden deposits Bedrock	Medium	Negligible	Imperceptible
Accidents	Uncontrolled spillages arising from the accidental release from the underground tanks, with potential for soil contamination. Spills/leaks of oil from the transformers in the substation, with potential for contamination. Release of contaminated firewater during fire event.	Local overburden deposits Bedrock	Medium	Negligible	Imperceptible

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Cumulative Impacts					
Construction of the Materials Recovery Facility	Construction phase of the proposed development may also coincide with Planning Reference FW21A/0149. Above and below ground water discharges during construction activities at both developments may combine and have a cumulative impact on the soils and geological environment.	Local overburden deposits Bedrock	Medium	Small Adverse	Slight
Construction of the Materials Recovery Facility	Cumulative impacts on local quarries from extraction of fill for proposed development. Removal of surplus material from site will take up available void space at destination soil recovery facility.	Local quarries Receiving soil recovery facility	Medium	Negligible	Imperceptible
Operation of the Materials Recovery Facility	Above and below ground water discharges from the proposed development and polluting discharges in the wider Dublin GWB area combining and having a cumulative impact on the receiving soils and geological environment.	Local overburden deposits Bedrock	Medium	Small Adverse	Slight

Table 9-12: Summary of Potential Unmitigated Impact Significance on Hydrogeology Attributes

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Construction Phase					
Advance Works	Increased risk to groundwater due to overburden removal. Entrainment of silt in surface water, which may in turn percolate to groundwater, and have indirect adverse effect on groundwater quality (i.e., through increasing suspended solid concentration in groundwater). Damming, pumping, excavation and backfilling works associated with the culverting of the surface water drainage ditch traversing the site poses a particular risk to surface water quality present in this drainage ditch, which may percolate to groundwater. The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer. Temporary rubble stockpiles created from the demolition of existing concrete facility elements may result in the generation of alkaline discharges to groundwater.	Dublin GWB Bedrock Aquifer	Medium	Small Adverse	Slight

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Development of Temporary Construction Site Compound	Entrainment of silt and fill material in surface water, which may in turn percolate to groundwater, and have indirect adverse effect on groundwater quality (i.e., through increasing suspended solid concentration in groundwater). The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer.	Dublin GWB Bedrock Aquifer	Medium	Small Adverse	Slight
Site Clearance	Increased risk to groundwater due to overburden removal. Entrainment of silt in surface water, which may in turn percolate to groundwater, and have indirect adverse effect on groundwater quality (i.e., through increasing suspended solid concentration in groundwater). The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer.	Dublin GWB Bedrock Aquifer	Medium	Small Adverse	Slight

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Site Earthworks	Increased risk to groundwater due to overburden removal. Entrainment of silt in surface water, which may in turn percolate to groundwater, and have indirect adverse effect on groundwater quality (i.e., through increasing suspended solid concentration in groundwater). The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer.	Dublin GWB Bedrock Aquifer	Medium	Small Adverse	Slight
Installation of Site Services and Surface Water Management Systems	Increased risk to groundwater due to overburden removal. Entrainment of silt in surface water, which may in turn percolate to groundwater, and have indirect adverse effect on groundwater quality (i.e., through increasing suspended solid concentration in groundwater). The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer. Temporary rubble stockpiles created from the demolition of existing hardstanding may result in the generation of alkaline discharges to groundwater.	Dublin GWB Bedrock Aquifer	Medium	Small Adverse	Slight

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Construction of Site Hard Stand and Granular Formation Surfaces	The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer. Concrete/cement works required for the proposed structures/buildings on-site may result in the generation of alkaline discharges to groundwater.	Dublin GWB Bedrock Aquifer	Medium	Small Adverse	Slight
Construction of Site Buildings and Structures	Increased risk to groundwater due to overburden removal. Entrainment of silt in surface water, which may in turn percolate to groundwater, and have indirect adverse effect on groundwater quality (i.e., through increasing suspended solid concentration in groundwater). The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer. Concrete/cement works required for the building foundations and floors may result in the generation of alkaline discharges to groundwater.	Dublin GWB Bedrock Aquifer	Medium	Small Adverse	Slight
Installation of Additional Ancillary Site Infrastructure and Elements	The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer.	Dublin GWB Bedrock Aquifer	Medium	Small Adverse	Slight

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Operation					
Facility Traffic and refuelling of vehicles	Some operational traffic will be necessary for maintenance plus normal operational traffic which could result in minor accidental leaks or spills of fuel/oil. Storage of fuel on site and refuelling of vehicles with potential for contamination from spills/leakages.	Dublin GWB Bedrock Aquifer	Medium	Negligible	Imperceptible
Accidents	Uncontrolled spillages from the underground tanks or substation with potential for contamination. Release of contaminated firewater during fire event.	Dublin GWB Bedrock Aquifer	Medium	Negligible	Imperceptible
Facility Traffic and refuelling of vehicles / Accidents	Uncontrolled release to surface water impacting connected groundwater.	Dublin GWB Bedrock Aquifer	Medium	Negligible	Imperceptible
Cumulative Impacts					
Construction of the Materials Recovery Facility	Construction phase of the proposed development may also coincide with Planning Reference FW21A/0149. Above and below ground water discharges during construction activities at both developments may combine and have a cumulative impact on the hydrogeological environment.	Dublin GWB Bedrock Aquifer	Medium	Small Adverse	Slight
Operation of the Materials Recovery Facility	Above and below ground water discharges from the proposed development and polluting discharges in the wider Dublin GWB area combining and having a cumulative impact on the receiving soils and geological environment.	Dublin GWB Bedrock Aquifer	Medium	Small Adverse	Slight

9.5 Mitigation Measures

The following section outlines appropriate mitigation measures to by design and best practice to avoid or reduce the potential impact of the proposed development.

9.5.1 Mitigation by Design and Best Practice

With regard to the construction phase of the proposed development, the following design and best practice measures will be implemented to protect the receiving soils, geology and hydrogeology environment:

- The construction works will be designed, overseen and checked by geotechnical and/or civil engineers, suitably qualified and experienced in excavation and earthworks design and construction methodologies.
- A method statement for each element of the works will be prepared by the Contractor prior to any element of the work being carried out.
- Given that the works comprises a significant proportion of excavation and earthworks, suitably qualified and experienced geotechnical personnel will be required on site to supervise the works.
- The Contract will require programming of the works such that earthworks are not scheduled during severe weather conditions. Where such weather is forecast, suitable measures will be taken to secure the works. The Project Manager is the person responsible for determining when works are to be stopped due to weather.
- To mitigate against erosion of exposed soils, all excavations will be constructed and backfilled as quickly as possible. Excavations will stop during or prior to heavy rainfall events.
- All excavations will be carried out such that they are stable or adequately supported. Unstable excavations will not be left unsupported. Where appropriate and necessary, excavations will be protected against the ingress of water or erosion.
- Where necessary, material which is required to be removed from site during demolition activities and earthworks will be taken to an appropriately authorised and regulated waste management facility for recovery.

Regarding the operational phase of the proposed development, the following design and best practice measures will be implemented to protect the receiving soils, geology and hydrogeology environment:

- To ensure the highest standards of environmental protection, the proposed development has been designed to operate in accordance with the following environmental protection standards:
    - European Commission (2018) BREF on Waste Treatment.
    - European Commission (2018) BATC on Waste Treatment.
    - EPA (2011) BAT Guidance Note on the Waste Sector.
- The site has been designed to ensure that sufficient contaminated firewater retention capacity has been provided on-site, if required.

9.5.2 Construction Phase Mitigation

9.5.2.1 Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) has been prepared for the proposed development and is included in Appendix 4.2 of Volume 3 of this EIAR. Measures for the protection of soils, geology and hydrogeology are defined in this CEMP. The CEMP defines the work practices, environmental management procedures and management responsibilities relating to the construction phase of the proposed development. The CEMP describes how the Contractor for the main construction works will implement a site Environmental Management System (EMS) to meet the specified contractual, regulatory and statutory requirements including the requirements identified as part of the environmental impact assessment process.

The CEMP will be updated prior to construction to take account of any amendments arising during the consenting process and relevant conditions attached to the planning permission and will be implemented for the duration of the construction phase of the project. The CEMP will be a live document and will be reviewed and updated as required.

9.5.2.2 Sediment Control Measures

Control and mitigation measures for the protection of surface water from sediment laden run-off are defined in the Chapter 10 Hydrology and Surface Water Quality of this EIAR. These measures will prevent the accidental discharge of sediment laden run-off generated during construction to groundwater.

9.5.2.3 Measures for Preventing Hydrocarbons Spills

Control and mitigation measures for the protection of surface water from oil and fuel spills are defined in the Chapter 10 Hydrology and Surface Water Quality of this EIAR. These measures will also prevent the accidental discharge of oil or fuel used during construction to groundwater.

9.5.2.4 Measure for Preventing the Release of Cement Based Products

Control and mitigation measures for the protection of surface water from the discharge of cement-based products are defined in the Chapter 10 Hydrology and Surface Water Quality of this EIAR. These measures will also prevent the accidental discharge of cement-based products to groundwater.

9.5.2.5 Measures to Protect the Surface Waters during Culverting Works

Control and mitigation measures for the protection of surface water from culverting works are defined in the Chapter 10 Hydrology and Surface Water Quality of this EIAR. These measures will also prevent the accidental discharge of polluting material to groundwater during culverting works.

9.5.3 Operational Phase Mitigation

It is not envisaged that the operation of the proposed facility will result in significant impacts on the soils, geology and hydrogeology within the study area, as there will be no further disturbance of overburden post construction.

The main potential residual impact during the operation phase will be the risk to the soils, bedrock and aquifer from contamination from fuel or oil spills or loss of containment of polluting material such dirty stormwater, wash water or wastewater. The proposed development will be designed, constructed and operated in accordance with best practice to prevent such spills / loss of containment.

The following mitigation measures will in place to prevent spills/loss of containment/pollution of ground or groundwater:

- Washwater from wash down of waste process and storage areas on-site will be directed to and stored in a below ground 'dirty water' storage tank situated at the south-east corner of building MRF 3. Discharges to foul sewer from this tank will be via a submersible pump and a rising main into the proposed new foul sewer connection. The underground storage tank and connected pipelines will be integrity tested prior to commencement of operations at the site and once every three years in accordance with the conditions of the prospective IE licence. These tests will need to be part hydrostatic and part visual inspection by chartered engineer. Yard integrity testing (through visual inspection) will also be undertaken once every three years also, to ensure the yard area is impermeable, as designed. A programme for maintenance of infrastructure/retention systems will be developed.
- Fuel stored on-site during facility operations will be stored in a bunded double skinned diesel tank.
- Oils stored on-site will be stored in indoor locations on sump pallet bunds.
- Transformer oil will be stored in a specially designed, bunded container in the ESB sub-station on-site.
- Spill kits will be made available on-site. Staff will be trained in the use of spill kits.
- Good housekeeping will be adopted to prevent improper storage/generation of waste in outdoor locations (I.e. Regular inspection and clean up, yard sweeping etc.).

9.5.3.1 Regulatory Control

Facility operations will be carried out in accordance with the conditions an IE licence enforced by the EPA. This authorisation will define strict environmental protection standards in relation to the proposed facility. This authorisation will necessitate the development and implementation of an Environmental Management System (EMS) for the proposed facility.

9.5.3.2 Accidents

The facility will be designed and constructed in accordance with best practices to control any potential risk from accidents during the operation phase and associated potential impacts to soils, geology and hydrogeology at the proposed development. A Fire Protection and Mitigation Plan and Emergency Response Procedures will be developed and implemented during the operation phase of the facility to address potential spills. The site has been designed to ensure the retention of contaminated firewater that may arise during a fire event on-site. Therefore, the risk of uncontrolled releases due to accidents impacting receiving soils, geology and hydrogeology is **Negligible.**

9.5.4 Decommissioning Phase Mitigation

Decommissioning of the proposed facility/site will take place in accordance with the terms of a Closure, Restoration and Aftercare Management Plan and the prospective IE licence for the facility. It is intended to wind the operation down gradually until such time the vast majority of residual wastes and materials are removed from the site. Residual materials will be classified before being dispatched to an appropriately authorised waste management facility for treatment.

To prevent the release of fuels or oils during decommissioning, mitigation measures similar to the fuel/oil control measures proposed for the construction phase of the proposed development will be implemented during decommissioning (See Section 9.5.2).

All site washdown and decontamination will take place in accordance with defined method statements. Surface water drainage systems will be sealed shut during washdown / decontamination. Wash water arisings will be retained, taken up and dispatched to an appropriately authorized wastewater treatment facility for final treatment.

9.5.5 Cumulative

During the construction of the proposed development there will be the requirement for the importation of engineered fill from source quarries and potential for consignment of surplus materials generated on-site during construction to a receiving soil recovery facility.

There will be an **Imperceptible** cumulative geological impact in terms of demands placed on local quarries for aggregate and available void space at a receiving soil recovery facility during the construction phase of the development.

No significant, direct negative cumulative geological effects are envisaged during the operation or decommissioning phase of the proposed development. As such no mitigation measures are required with respect to potential geological cumulative impacts of the proposed development.

The proposed development is not expected to contribute to any significant cumulative effects on the existing hydrogeological conditions at the site or the study area during the construction, operation or decommissioning phases; therefore, no specific measures to mitigate against cumulative effects are required.

9.6 Residual Impacts

A summary of residual impacts is presented in Table 9-13, using the impact assessment methodology outlined in Section 9.2.4 and taking account of mitigation measures in Section 9.5 of this document.

The residual significance of the effects of the proposed development on soils and geology is expected to be low taking account of the effective implementation of the mitigation measures as outlined in Section 9.5.

Following the implementation of mitigation measures, the residual impact significance to the receiving geological environment would be **Imperceptible** during the construction period and **Imperceptible** during the operation of the proposed development. There will also be **Imperceptible** residual cumulative impact in terms of demands placed on local quarries for aggregate and available void space at an authorised soil recovery facility during the construction phase of the development.

The residual significance of the impacts of the proposed development on the hydrogeological regime is expected to be **Imperceptible** taking account of the effective implementation of the mitigation measures as outlined in Section 9.5. The residual impact is summarised in Table 9-14, using the impact assessment methodology outlined above in Section 9.2.4 and taking account of mitigation measures in Section 9.5 of this document. There will be an **Imperceptible** residual cumulative impact on the receiving hydrogeological environment with the adoption of the proposed mitigation measures.

Table 9-13: Summary of Residual Impact Significance on Geology Attributes

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation		Post Mitigation	
				Magnitude	Significance	Magnitude	Significance
Construction Phase							
Advance Works	Soil erosion and disturbance due to earthworks and excavations. The use of plant and machinery during demolition and site clearance activities will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils. Temporary rubble stockpiles created from the demolition of existing concrete facility elements may result in the generation of alkaline discharges to ground. Removal of surplus material from site will take up available void space at destination soil recovery facility.	Local overburden deposits Bedrock Receiving soil recovery facility	Medium	Small Adverse	Slight	Negligible	Imperceptible
Development of Temporary Construction Site Compound	The use of plant and machinery during construction will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils. Importation of engineering fill products.	Local overburden deposits Bedrock Local quarries	Medium	Small Adverse	Slight	Negligible	Imperceptible
Site Clearance	Soil erosion and disturbance due to clearance activities. The use of plant and machinery during construction will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils. Removal of surplus material from site will take up available void space at destination soil recovery facility.	Local overburden deposits Bedrock Receiving soil recovery facility	Medium	Small Adverse	Slight	Negligible	Imperceptible
Site Earthworks	Soil erosion and disturbance due to earthworks and excavations. The use of plant and machinery during construction will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils. Removal of surplus material from site will take up available void space at destination soil recovery facility. Importation of engineering fill products.	Local overburden deposits Bedrock Receiving soil recovery facility Local quarries	Medium	Small Adverse	Slight	Negligible	Imperceptible

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation		Post Mitigation	
				Magnitude	Significance	Magnitude	Significance
Installation of Site Services and Surface Water Management Systems	Soil erosion and disturbance due to excavations. The use of plant and machinery during construction will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils. Temporary rubble stockpiles created from the breaking out of the existing hardstanding may result in the generation of alkaline discharges to ground. Removal of surplus material from site will take up available void space at destination soil recovery facility. Importation of engineering fill products.	Local overburden deposits Bedrock Receiving soil recovery facility Local quarries	Medium	Small Adverse	Slight	Negligible	Imperceptible
Construction of Site Hard Stand and Granular Formation Surfaces	The use of plant and machinery during construction will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils. Concrete/cement works required for the proposed hardstand may result in the generation of alkaline discharges to ground. Importation of engineering fill and concrete products.	Local overburden deposits Bedrock Receiving soil recovery facility Local quarries	Medium	Small Adverse	Slight	Negligible	Imperceptible
Construction of Site Buildings and Structures	Soil erosion and disturbance due to excavations. The use of plant and machinery during construction will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils. Removal of surplus material from site will take up available void space at destination soil recovery facility. Importation of engineering fill and concrete products. Concrete/cement works required for the building foundations and floors may result in the generation of alkaline discharges to ground.	Local overburden deposits Bedrock Receiving soil recovery facility Local quarries	Medium	Small Adverse	Slight	Negligible	Imperceptible
Installation of Additional Ancillary Site Infrastructure and Elements	The use of plant and machinery during construction will require the use of fuels and oils. Their use presents potential for spills and leaks which could contaminate underlying exposed soils.	Local overburden deposits Bedrock	Medium	Small Adverse	Slight	Negligible	Imperceptible

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation		Post Mitigation	
				Magnitude	Significance	Magnitude	Significance
Cumulative Impacts							
Construction of the Materials Recovery Facility	Construction phase of the proposed development may also coincide with Planning Reference FW21A/0149. Above and below ground water discharges during construction activities at both developments may combine and have a cumulative impact on the soils and geological environment.	Local overburden deposits Bedrock	Medium	Small Adverse	Slight	Negligible	Imperceptible
Operation of the Materials Recovery Facility	Above and below ground water discharges from the proposed development and polluting discharges in the wider Dublin GWB area combining and having a cumulative impact on the receiving soils and geological environment.	Local overburden deposits Bedrock	Medium	Small Adverse	Slight	Negligible	Imperceptible

Table 9-14: Summary of Residual Impact Significance on Hydrogeology

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation		Post Mitigation	
				Magnitude	Significance	Magnitude	Significance
Construction Phase							
Advance Works	Increased risk to groundwater due to overburden removal. Entrainment of silt in surface water, which may in turn percolate to groundwater, and have indirect adverse effect on groundwater quality (i.e., through increasing suspended solid concentration in groundwater). Damming, pumping, excavation and backfilling works associated with the culverting of the surface water drainage ditch traversing the site poses a particular risk to surface water quality present in this drainage ditch, which may percolate to groundwater. The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer. Temporary rubble stockpiles created from the demolition of existing concrete facility elements may result in the generation of alkaline discharges to groundwater.	Dublin GWB Bedrock Aquifer	Medium	Small Adverse	Slight	Negligible	Imperceptible
Development of Temporary Construction Site Compound	Entrainment of silt and fill material in surface water, which may in turn percolate to groundwater, and have indirect adverse effect on groundwater quality (i.e., through increasing suspended solid concentration in groundwater). The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer.	Dublin GWB Bedrock Aquifer	Medium	Small Adverse	Slight	Negligible	Imperceptible
Site Clearance	Increased risk to groundwater due to overburden removal. Entrainment of silt in surface water, which may in turn percolate to groundwater, and have indirect adverse effect on groundwater quality (i.e., through increasing suspended solid concentration in groundwater). The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer.	Dublin GWB Bedrock Aquifer	Medium	Small Adverse	Slight	Negligible	Imperceptible

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation		Post Mitigation	
				Magnitude	Significance	Magnitude	Significance
Site Earthworks	Increased risk to groundwater due to overburden removal. Entrainment of silt in surface water, which may in turn percolate to groundwater, and have indirect adverse effect on groundwater quality (i.e., through increasing suspended solid concentration in groundwater). The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer.	Dublin GWB Bedrock Aquifer	Medium	Small Adverse	Slight	Negligible	Imperceptible
Installation of Site Services and Surface Water Management Systems	Increased risk to groundwater due to overburden removal. Entrainment of silt in surface water, which may in turn percolate to groundwater, and have indirect adverse effect on groundwater quality (i.e., through increasing suspended solid concentration in groundwater). The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer. Temporary rubble stockpiles created from the demolition of existing hardstanding may result in the generation of alkaline discharges to groundwater.	Dublin GWB Bedrock Aquifer	Medium	Small Adverse	Slight	Negligible	Imperceptible
Construction of Site Hard Stand and Granular Formation Surfaces	The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer. Concrete/cement works required for the proposed structures/buildings on-site may result in the generation of alkaline discharges to groundwater.	Dublin GWB Bedrock Aquifer	Medium	Small Adverse	Slight	Negligible	Imperceptible
Construction of Site Buildings and Structures	Increased risk to groundwater due to overburden removal. Entrainment of silt in surface water, which may in turn percolate to groundwater, and have indirect adverse effect on groundwater quality (i.e., through increasing suspended solid concentration in groundwater). The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer. Concrete/cement works required for the building foundations and floors may result in the generation of alkaline discharges to groundwater.	Dublin GWB Bedrock Aquifer	Medium	Small Adverse	Slight	Negligible	Imperceptible

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation		Post Mitigation	
				Magnitude	Significance	Magnitude	Significance
Installation of Additional Ancillary Site Infrastructure and Elements	The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifer.	Dublin GWB Bedrock Aquifer	Medium	Small Adverse	Slight	Negligible	Imperceptible

9.7 Interactions

9.7.1 Geology

Geology interacts with other environmental attributes as follows:

Population and Human Health (Chapter 7) – the development of land and soils and the mitigation of potential effects is closely linked to population and human health.

Biodiversity (Chapter 8) – the protection of biodiversity is integral to the development of land and soils. The prevention of potential effects to the biodiversity are directly linked to the maintenance of mitigation measures for geology.

Hydrology and Surface Water Quality (Chapter 10) – the development and disturbance of the underlying geology and potential effects are directly linked to the existing hydrological regime and surface water quality. The prevention of potential effects to the hydrological regime are directly linked to the maintenance of mitigation measures for geology.

Hydrogeology (Chapter 9) – the development of land and soils is integral to the underlying hydrogeological regime. The prevention of potential effects associated with land and soils are directly linked to the protection of the hydrogeological regime.

It has been concluded in this EIAR that the proposed development will not have any significant effect on population and human health, biodiversity, hydrology and surface water quality or hydrogeology, respectively. There will therefore be no potential for these environmental topics interacting with geological elements and having a significant impact on geology.

Conversely, impacts on geology associated with the proposed development are deemed to be imperceptible. These geological impacts will not result in the creation of an interacting significant effect on any of the above environmental topics.

9.7.2 Hydrogeology

Hydrogeology interacts with other environmental attributes as follows:

Population and Human Health (Chapter 7) – the protection of the hydrogeological regime and the mitigation of potential effects is directly linked to population and human health.

Biodiversity (Chapter 8) – the prevention of potential effects to the biodiversity are directly linked to the protection and maintenance of mitigation measures for hydrogeology.

Hydrology and Surface Water Quality (Chapter 10) – the existing hydrogeological regime and potential effects are directly linked to hydrological features and surface water quality. The prevention of potential effects to the hydrological regime are directly linked to the maintenance of mitigation measures for hydrogeology.

Geology (Chapter 9) – the development of land and soils is integral to the underlying hydrogeological regime. The prevention of potential effects associated with land and soils are directly linked to the protection of the hydrogeological regime.

It has been concluded in this EIAR that the proposed development will not have any significant effect on population and human health, biodiversity, hydrology and surface water quality or hydrogeology, respectively. There will therefore be no potential for these environmental topics interacting with hydrogeological elements and having a significant impact on hydrogeology.

Conversely, impacts on hydrogeology associated with the proposed development are deemed to be imperceptible. These hydrogeological impacts will not result in the creation of an interacting, significant effect on any of the above environmental topics.

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