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INTRODUCTION

Background

7.1 This Chapter of the Environmental Impact Assessment Report (EIAR) provides a description of the surface water (hydrology) and groundwater (hydrogeology) conditions at the site of the existing soil backfilling / recovery facility operated by Kilsaran Concrete Unlimited Company ('Kilsaran') at Halverstown, Kilcullen, Co. Kildare. It also presents an assessment of the potential effects on surface water and groundwater arising from a proposal to increase the permitted soil and stone intake capacity at the facility and extend its operational life by up to 3 years.

7.2 Sand and gravel extraction began at Halverstown in the early 1940s, predating the 1964 Planning and Development Act. Although the extraction area was fully depleted of reserves by the late 1980s, the area at the northern end has been in continuous use since that time for concrete block manufacturing.

7.3 The application site, the adjoining concrete block plant to the north and a restored sand and gravel pit previously operated by Kilsaran to the north-west are identified on a plan of the area in EIAR Figure 1.4.

Proposed Development

7.4 As noted above, this planning application is being made to extend the life and capacity of the existing soil recovery facility at Halverstown. These activities provide for the backfilling and restoration of the former sand and gravel pit back to / close to surrounding ground level and for the raising and improvement of lands to the north-east, refer to Chapter 1 of this EIAR.

7.5 The existing development and ongoing activities undertaken at the facility are described in detail in Chapter 2 of this EIAR. A detailed description of proposed further development at the facility is also provided in Chapter 2. The key aspects of the proposed development which relate to Land, Soils and Geology are:

(i) an increase in the permitted total intake of soil and stone to the existing soil recovery facility, from 1.2 million tonnes to 2.06 million tonnes. The additional intake to the facility will comprise a mix of soil and stone managed as waste (as heretofore) and as (non-waste) by-product;

(ii) an extension to the permitted life of the existing facility of 3 years (to December 2029) in order to accommodate the additional soil and stone intake;

(iii) continued shared use of existing, co-located site facilities, structures and infrastructure (including the site office, staff welfare facilities, weighbridge (with dedicated office), wheelwash, hardstand areas, fuel storage tanks and site access road);

(iv) continued soil and stone intake at a rate of up to 300,000 tonnes per annum, of which no more than 95,000 tonnes (per annum) will be managed as waste;

(v) continued environmental monitoring of noise, dust and groundwater for the duration of the site recovery and restoration activities and for a short period thereafter (and in accordance with EPA waste licence requirements);

(vi) continued temporary stockpiling of topsoil pending its re-use as cover material for final restoration of the site; and

(vii) ultimate restoration of the modified final landform (entailing harrowing, topsoiling and seeding) to establish a native woodland habitat on the northern side of the access road and grassland habitat on the southern side.

7.6 Ongoing (and continued) backfilling of the lands at Halverstown will progress using only excess soil and stone sourced from pre-approved external construction and development sites. The facility does not, and will not, accept peat, contaminated soils or any non-hazardous waste. The current site layout can be seen in EIAR Figure 2.1.

7.7 At the present time, the facility accepts the soil / particulate waste types identified below (with their corresponding European Waste Code (EWC)):

- 17 05 04: Soil and stones not included in 17 05 03;
- 17 05 06: Dredging spoil not covered by 17 05 05; and
- 20 02 02: Soil and stone from municipal facilities.

7.8 The soil recovery facility currently operates under a Waste Licence (Ref. No. W0300-01) issued by the Environmental Protection Agency (EPA) in July 2020. Following (and subject to) approval for the additional soil waste intake, as provided for in this planning application, Kilsaran will apply to the Agency for a review of its waste licence to facilitate the intake of additional waste, over and above that already sanctioned by the current licence.

7.9 Available information on the surface water and groundwater of the Halverstown area and its surrounds is collated and evaluated in this EIAR Chapter. The potential impacts to surface waters and groundwater of the continued operation of the facility are assessed, mitigation measures to address any identified potential impacts are identified and residual impacts assessed assuming mitigation measures are in place.

Existing Water Management

7.10 The water management system at the existing waste recovery site is relatively simple, rainfall across the site generally percolates naturally to ground and there is no discharge of water off-site to any nearby local surface water course.

7.11 At the present time, as the site is backfilled, there is little surface water run-off generated. Any run-off which does arise across the imported soil and stone placed at the site generally falls to form minor ponds (sumps) at low points or closed depressions in the ground surface and infiltrates to ground within a short time period.

7.12 The water management is a site operational consideration during the placement of material and consequently, no specific surface water management plan has been, or will be, required for the site.

7.13 During the site filling operations, the upper surface of the filled soil is graded so as to ensure that any surface water run-off falling over the existing site footprint falls to low points.

7.14 Given the relatively minor volumes of run-off generated to date at the facility, there has been no requirement to date to develop or implement a surface water management plan to provide for the collection, capture, treatment or control of discharge of surface water run-off at the site. More specifically, no Sustainable Drainage System (SuDS) measures for drainage management have been incorporated into the existing site development at Halverstown. Based on this experience, it is not expected that such system will be required for the proposed further / future activities at the facility.

7.15 The water supply at the existing Halverstown facility for welfare facilities and site processes is from an onsite groundwater borehole, the location of which is indicated in on the site infrastructure layout plan in Figure 7-1.

7.16 No dewatering occurs within the existing backfill / recovery areas and there is therefore no requirement to manage any dewatered groundwater at the facility.

7.17 Wastewater from the site welfare facilities goes to an existing septic tank and is discharged via an existing effluent percolation area to ground, the location of which is also indicated in Figure 7-1. The septic tank and related infrastructure is regularly maintained. The septic tank and related infrastructure is regularly maintained. An assessment of the hydraulic and biological load capacity of the septic tank is provided in Appendix 7-A.

7.18 Site staff, operatives and drivers employed at or travelling to and from the existing soil backfilling / recovery facility share the welfare facilities (toilets, drying rooms, wash facilities etc.) at a co-located site office and canteen which is shared with other Kilsaran staff based at Halverstown who work at the adjoining concrete block plant.

7.19 Water is supplied to the site welfare facilities from the on-site borehole. Bottled water is brought to the site for drinking / personal consumption on an as-need basis.

7.20 There is an existing bunded fuel storage and hard standing refuelling area in place at the existing facility and this will continue in use at the site for the duration of any ongoing or additional backfilling / recovery activities. Mobile plant will continue to be refuelled at the existing refuelling location with associated hardstanding area, at the location indicated in Figure 7-1.

7.21 Oils and lubricants are stored on suitable spill pallets under cover in the workshop at the site. Routine maintenance of plant and machinery is undertaken over the concrete slab adjacent to the bunded fuel tanks to minimise the risk of uncontrolled release of polluting liquids. Any non-routine servicing or maintenance would be undertaken at off-site facilities. A spill kit is kept at the refuelling area to deal with any accidental spillages at the site.

7.22 In order to prevent transport of clay and dust onto the public road network, a wheel wash has been installed along the access road to the site. All HGV and tipper trucks exiting the facility pass through the existing wheel wash, at the location indicated in Figure 7-1. A tractor with bowser is kept at the site and is used for dust suppression, when required.

Waste Inspection and Quarantine Shed

7.23 If any imported waste has been accepted at the backfilling / recovery but is subsequently suspected to be non-compliant with the soil intake acceptance criteria for the facility, then the material is re-loaded onto HGV trucks and transferred to the existing waste inspection and quarantine facility for closer examination and/or testing. The waste inspection facility comprises an existing covered shed over a sealed concrete slab, at the location indicated in Figure 7-1.

7.24 Once under cover in the inspection / quarantine shed the material will not come into contact with incident rainfall. As such, there is no requirement to install drainage infrastructure to provide for the separate collection and storage of potentially contaminated surface water run-off at this location.

7.25 Should subsequent inspection or testing of material held at the inspection and quarantine facility identify non-inert material, which cannot be accepted or reused in the backfilling and restoration of the former pit at Halverstown, it will be temporarily stockpiled (quarantined) pending removal off site by permitted waste collectors to an authorised waste disposal or recovery facility.

7.26 Provision has been made for temporary storage of minor quantities of intermixed non-inert construction and demolition (C&D) waste (including metal, timber, plastic etc.) in skips prior to removal off site to a licenced recovery facility.

7.27 The working scheme will typically require two individuals to be present at active site working areas while backfilling and recovery operations proceed, principally to operate a

front-end loader and to monitor and inspect the quality and suitability of soi land stone materials being imported to the facility. In addition to site-based staff, there will be between 8-10 drivers visiting the site daily on an intermittent basis as they bring material to the facility in haulage trucks from construction and development sites. The HGV drivers visiting the site are additional to those employed at the facility.

Site Water Usage Requirements

7.28 Water is used at the Halverstown site for dust suppression and at staff welfare facilities. Water is required on occasion for dust suppression across the facility (principally over drier spring / summer / autumn months) and to top up the existing wheelwash. No process water is required at the existing facility. As previously noted, bottled water is brought to site for personal consumption.

Scope of Work

7.29 The scope of this EIAR Chapter comprises:

- an assessment of existing surface water and groundwater conditions within the application site;
- an assessment of the potential impact that the additional / continued import of soil and stone across the application site could have on surface water and groundwater; and
- mitigation measures to reduce or eliminate any potential impacts on the receiving environment.

7.30 This EIAR is based on a desk study of the site and surrounding area using published hydrological, hydrogeological and geological data, a site inspection, groundwater monitoring boreholes data (from 2017), available information provided to SLR by Kilsaran and information previously presented in the EIS prepared by SLR which accompanied the earlier planning application for development of a recovery facility at this site.

7.31 Four exploratory boreholes / monitoring wells were installed at the application site in April 2017 to identify the site geology, establish groundwater levels and facilitate ongoing monitoring of groundwater level at the site.

7.32 No additional hydrological or hydrogeological investigations were undertaken at the application site for the purposes of this assessment. The assessment undertaken and presented in this EIAR Chapter is a largely qualitative assessment.

Project Team

7.33 This chapter of the EIAR was prepared by SLR Consulting Ireland. The project team members are

- Nikolina Bozinovic BSc, MSc.
- Dominica Baird BSc, MSc, CGeol, EurGeol; and
- Peter Glanville BA, PhD, PGeo, EurGeol

REGULATORY BACKGROUND

Legislation

7.34 The key European Directives / European Union Legislation which apply to this Chapter of the EIAR and the surface water and groundwater assessment presented herein are:

- Environmental Impact Assessment Directive (2011/92/EU); and
- Directive of the European Parliament and of the Council amending Directive 2011/92/EU on assessment of effects of certain public and private projects on the environment (2014/52/EU).

Other European Directives to which this EIAR makes reference, or has had regard, are listed in Appendix 7-B.

7.35 Irish Government Acts, National Legislation and Regulations which apply to this Chapter of the EIAR and the surface water and groundwater assessment presented herein are also listed in Appendix 7-B.

7.36 Most notably, under Regulation 4 of the Groundwater Regulations 2010, a duty is placed on public authorities to promote compliance with the requirements of the regulations and to take all reasonable steps including, where necessary, the implementation of programmes of measures, to:

(a) prevent or limit, as appropriate, the input of pollutants into groundwater and prevent the deterioration of the status of all bodies of groundwater;

(b) protect, enhance and restore all bodies of groundwater and ensure a balance between abstraction and recharge of groundwater with the aim of achieving good groundwater quantitative status and good groundwater chemical status by 2015 or, at the latest, by 2027;

(c) reverse any significant and sustained upward trend in the concentration of any pollutant resulting from the impact of human activity in order to progressively reduce pollution of groundwater;

(d) achieve compliance with any standards and objectives established for a groundwater dependent protected area included in the register of protected areas established under Regulation 8 of the 2003 Regulations [S.I. No. 722 of 2003] by not later than 2015, unless otherwise specified in the Community legislation under which the individual protected areas have been established.

Planning Policy and Development Control

7.37 The Planning Policy and Development Control relating to water at the site in this EIAR is set out in the Kildare County Development Plan 2023-2029.

Guidelines and Technical Standards

7.38 The following key guidelines apply to this surface water and groundwater assessment:

- Institute of Geologists of Ireland. Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements, April 2013; and
- National Roads Authority, 2008. Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

7.39 Additional guidelines and technical standards which apply to this Chapter of the EIAR and the surface water and groundwater assessment presented herein are also listed in Appendix 7-A.

RECEIVING ENVIRONMENT

Study Area

7.40 The Institute of Geologists of Ireland's (IGI) guidelines (2013) recommend a minimum study area extending 2km from an application site. The guidelines recommend that this minimum distance should be reviewed in the context of the geological / hydrogeological environment as well as the scale of development and, if necessary, should be increased to reflect the sensitivity of the subsurface.

7.41 For the purposes of this assessment, given that the proposed development is already extant, the study area is taken to comprise the application site and the surrounding area within a radius of up to 2 km, in line with IGI guidance.

7.42 The baseline information in respect of surface water and groundwater, presented at a scale of 1:25,000 in Figures 7-2 to 7-5, represent the surrounding geological and hydrogeological environment extending for a distance of approximately 3.5 km from the Halverstown property boundary, in line with the IGI guidelines.

Baseline Study Methodology

7.43 Existing information on the geology, hydrogeology and hydrological features of the Halverstown area and its surrounds was collated and evaluated. The methodology involved in the assessment of the surface water and groundwater at the site can be summarised as follows:

- Desk study, in which existing data and relevant regional data sources for the area were examined;
- Groundwater levels from four on-site groundwater monitoring boreholes; provided by the Applicant;
- Groundwater quality results provided by the Applicant;
- Field visits in which aspects of the surface water management at the site and the sites hydrology and hydrogeology were examined; and
- Analysis and synthesis of the information gathered.

Sources of Information

7.44 The desk study involved the examination of several datasets to determine the geological and hydrogeological setting of the area, as detailed in Table 7-1 below.

Table 7-1
Regional Data Consultation

Data	Dataset
Soils	Irish Soils Information System - Teagasc
Subsoil Geology	Teagasc/GSI/EPA Subsoil Mapping
Bedrock Geology	GSI Groundwater Data Viewer - Bedrock Geology
Surface Water	OSi Discovery Series mapping; Environmental Protection Agency; Water Framework Directive; OPW CFRAM; and Current County Development Plan.

Data	Dataset
Groundwater	GSI Groundwater Data Viewer - bedrock and gravel aquifers, vulnerability, water supplies, groundwater recharge; GSI Groundwater body description documents; and Environmental Protection Agency water maps.
Climate	Met Eireann
Protected Areas, Environmental Pressures	Environmental Protection Agency, National Parks and Wildlife Service

Field Survey / Site Visit

7.45 Monthly groundwater monitoring has been undertaken at the site by Kilsaran since April 2017, in accordance with waste permit, and subsequently, waste licence requirements . SLR undertook a field survey / site visits in August 2023 for the purposes of this EIAR, which included:

- A walkover survey / inspection of the overall site; and
- An inspection of the existing infrastructure / facilities at the site.

Rainfall and Climate

7.46 The nearest rainfall gauging station to the application site is located at Casement Aerodrome, at Baldonnell in south County Dublin, approximately 30km north-east of the existing backfilling / recovery facility. The Long-Term Average (LTA) annual rainfall recorded at Casement weather station is c. 783.5 mm/year for the period 1991-2020 (Met Eireann, 2021). The LTA monthly rainfall for the period 1991-2020 are shown in Table 7-2 below.

Table 7-2
LTA (1991-2020) Monthly Rainfall (mm) for Casement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
65	55.2	51.8	55.3	59.1	65.7	59.4	71.2	61.6	81.6	81.9	75.7

Soils and Geology

Soils and Subsoils

7.47 The Irish Soil Information System project has developed a national association soil map for Ireland through a project co-funded by Teagasc and the Environmental Protection Agency (EPA). The soils at and around the existing backfilling / recovery facility footprint are identified as fine loamy drift with limestones known as the Elton (1000x) Soil Association, refer to Chapter 6 of this EIAR and Figure 6-1 therein.

7.48 The EPA website publishes subsoil maps created by the Spatial Analysis Unit and Teagasc in collaboration with the Geological Survey Ireland (GSI). Published GSI mapping indicated that the prior subsoils at the application site comprised sands and gravels originating from limestone formations, refer to Chapter 6 of this EIAR and Figure 6-2 therein. GSI mapping indicates these subsoils are characterized by high permeability.

7.49 Published mapping indicates surrounding subsoils are predominately tills derived from limestones. These till subsoils are moderately permeable.

7.50 The application site footprint is overlain by uncontaminated (inert) soil and stone material which has been imported and placed over natural deposits on the floor of the former sand and gravel pit, as provided for under the existing planning permission and waste license.

Local Bedrock Geology

7.51 The GSI online map viewer (1:100,000 geology map) indicates that the Halverstown site is underlain by Calcareous greywacke siltstone and shale of the Carrighill Formation, refer to chapter 6 of this EIAR and Figure 6-3 therein.

7.52 GSI geological mapping indicates that the strike and dip of overturned bedding are 20 degrees to the SE. The site is located on the NW limb, approximately 1.5km north of the synclinal axis. Minor bedrock outcrops are recorded approximately 700m to the SE of the application site.

7.53 Four geological boreholes / wells were installed at the application site in April 2017 to facilitate ongoing monitoring of groundwater levels and quality. The borehole / well locations are identified in Figure 7-1. Copies of the borehole log are provided in an Appendix to Chapter 6 of this EIAR.

7.54 Published GSI mapping indicates that there are no recorded karst features in the vicinity of the application site.

Surface Water - Hydrology

Catchments

7.55 The application site is located in the east marginal part of Barrow Catchment (EPA ID 14), which has a total draining area of 3015.7km^2 and is within the South Eastern River Basin District. This is the relevant Water Framework Directive (WFD) Water Management Unit Catchment, the highest-level catchment unit in Ireland.

7.56 The application site is also located within the Barrow Sub-Catchment (EPA ID 14_18), which covers a total area of 273.4km^2. In total, there are eight river waterbodies within the Barrow (14_18) sub catchment, of which the closest to the Halverstown site is the Kildoon River, approximately 1.5km to the south of site.

Surface Water Bodies

7.57 There are no surface water courses at or in the immediate vicinity of the application site. The application site is located near the top of the Barrow catchment and the closest surface water course within that catchment to the site is the Kildoon River. The headwaters of the Kildoon River are located approximately 1.5km to the south of the site. The river flows in a westerly direction toward the River Barrow north of Athy.

7.58 The adjacent catchment immediately to the east is Liffey and Dublin Bay (EPA ID 09) Catchment. The Kilcullen Stream, as part of Liffey and Dublin Bay catchment flows approximately 1.2 km to the east of the Halverstown site.

Flooding

7.59 The Office of Public Works (OPW) is the Irish Government agency with statutory responsibility for management of flood risk in Ireland. In November 2009, the OPW and Department of the Environment, Heritage and Local Government (DoEHLG) published guidelines for planning authorities addressing the management of flood risk in the planning system[1], referred to as the 'Flood Planning Guidelines'.

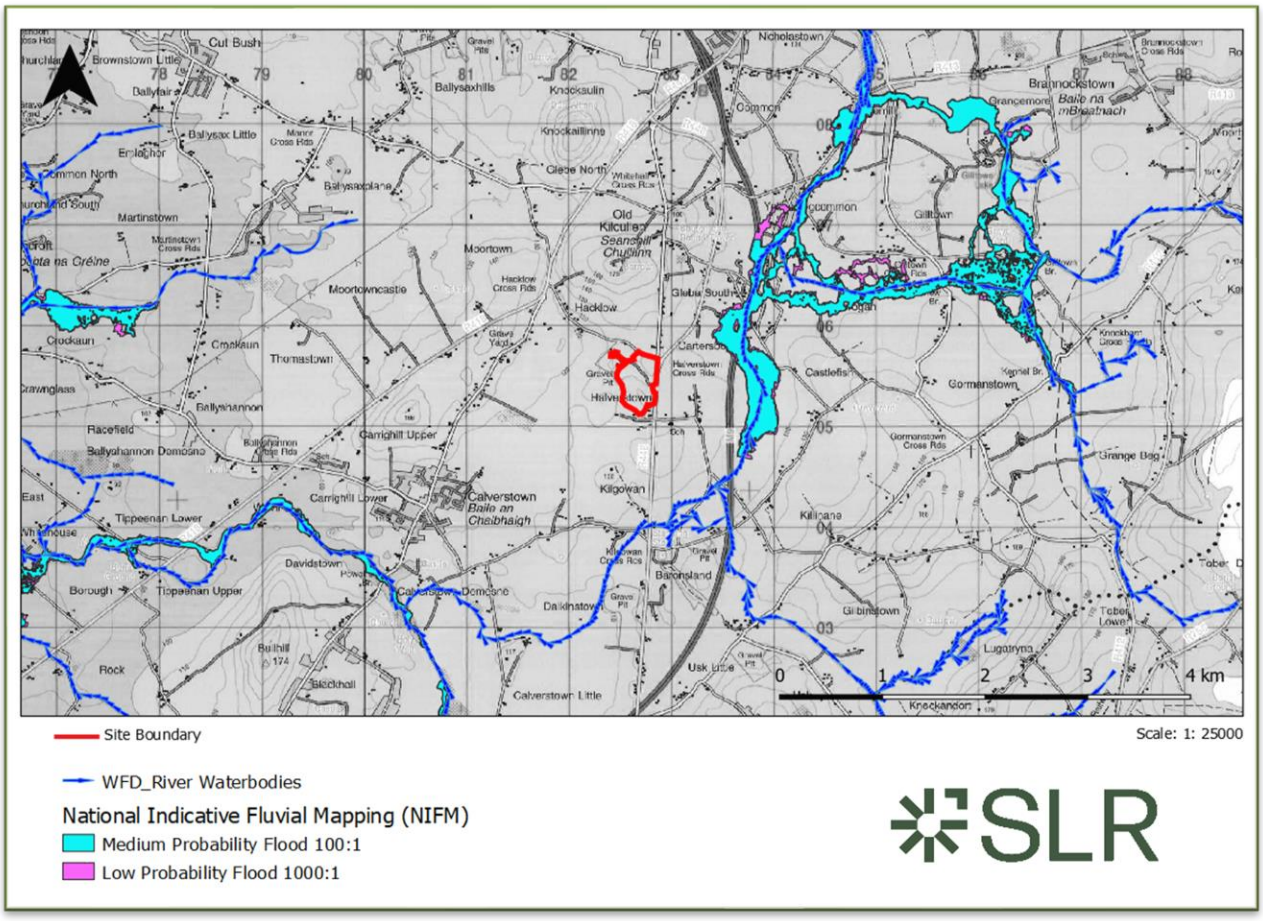
[1] *The Planning System and Flood Risk Management Guidelines for Planning Authorities* (2009): Office of Public Works and the Department of the Environment, Heritage and Local Government.

7.60 These guidelines introduced comprehensive mechanisms for the incorporation of flood risk identification, assessment and management into the planning process. Implementation of the guidelines is to be achieved through actions at national, regional, Local Authority and/or site-specific level, depending on the plan or development project under consideration.

7.61 The OPW National Indicative Fluvial Mapping (NIFM) dataset indicates that the application site is not at risk of fluvial flooding from a river source. The closest area identified on the NIFM dataset as being at risk of fluvial river flooding of medium flood probability is encountered approximately 1 km in the east direction of the Halverstown site, within the adjoining Kilcullen stream (Liffey and Dublin Bay) catchment, refer to the extract from the mapping dataset shown in Plate 7-1 below.

7.62 The term "Medium Flooding Probability" pertains to the likelihood of a significant flood event occurring once in every 100 years, commonly referred to as the flood return period.

Plate 7-1
Extract from OPW National Indicative Fluvial Mapping



7.63 Separately, inspection of the GSI Groundwater Flooding Map indicates that the application site is not at risk of groundwater flooding.

Groundwater - Hydrogeology

Bedrock Aquifer Characteristics

7.64 Groundwater aquifer mapping published by the GSI indicated that the application site is located over a poor aquifer (PU) which is classified as being generally unproductive for supply abstraction purposes, refer to Figure 7-2. The Calverstown gravel aquifer is located to the south and southwest of the site and overlies the poor bedrock aquifer, refer to Figure 7-3.

7.65 The poor bedrock aquifer comprises calcareous greywacke siltstone and shale from the Carrighill Formation. It is likely that the gravel aquifer is in continuity with the underlying bedrock aquifer, although this will be limited to the upper weathered zone of the bedrock as it is classified as a poor aquifer and is generally unproductive for supply purposes.

7.66 The application is located within the Usk Gravel GWB, which is discussed below. It is also located within the New Ross Groundwater Body (GWB) as per the Water Framework Directive (WFD Code IE_SE_G_152).

7.67 The GSI has published a Summary of Initial Characterisation report for New Ross GWB. The characterisation report notes that groundwater flow is probably confined to fractures, fissures, joints, bedding planes and the uppermost part of the bedrock as indicated by a series of inflows in borehole logs. The hydrogeological data show that water levels are generally 4-5 m below ground level. The data suggest that the groundwater flow is to the south. This would support an assumption that regional flow patterns were south-westerly toward the River Barrow. The flow of groundwater in the bedrock will be limited to the upper weathered layer in the rock and its orientation and nature, dominated by the fracturing of the rock on a local scale.

Sand and Gravel Aquifer Characteristics

7.68 The application site is located immediately north of (but not within) the Calverston gravel aquifer, which is classified by the GSI as a locally important gravel aquifer (Lg). Groundwater in the sand and gravel deposits underlying the application site are however likely to be in hydraulic continuity with the Calverston gravel aquifer.

7.69 The GSI groundwater database notes that the Calverstown aquifer is located within a valley setting and has an area of 15.85km^2. Sand and gravel deposits are classified as aquifers where they are more than 10m thick or have a saturated thickness of at least 5m.

7.70 The GSI groundwater database indicates that the application site is underlain by the Usk Gravel Groundwater Body (GWB), which has a different boundary to that of the Calverston gravel aquifer. There is no GSI groundwater body descriptor for the Usk gravel aquifer.

Groundwater Vulnerability

7.71 The GSI have developed a groundwater vulnerability classification for Ireland. The groundwater vulnerability at a particular point can be determined based on the natural geological and hydrogeological characteristics at that point. The vulnerability therefore depends on the nature of the subsoils (permeability), the type of recharge (point or diffuse) and the thickness of the unsaturated zone (depth to groundwater).

7.72 Groundwater vulnerability mapping published by the GSI indicates that the groundwater vulnerability at the application site is classified as High (H), as shown in Figure 7-4. By reference to the GSI vulnerability mapping guidelines reproduced in Table 7-3 below, this would suggest that there is more than 3m of unsaturated permeable sand and gravel above the groundwater table at the application site. The thickness of the sand and gravel deposits would however have been reduced by the extraction activities at the former pit which preceded the more recent backfilling and restoration activities at the site.

7.73 With the placement of between 3m and 5m of imported , lower permeability soil across much of the application site in recent years, and having regard to Table 7-3 below, it is more likely that groundwater vulnerability to potential pollution at the site can be classified as 'Moderate' to 'High' at the current time.

7.74 Aquifer vulnerability mapping published by the GSI indicates that the vulnerability of the aquifer in the area surrounding the application site is Moderate (M) to High (H). This rating is suggestive of the fact that the high permeability sand and gravel material is >3m in thickness, refer to Table 7-3 below.

Table 7-3
GSI Vulnerability Mapping Guidelines

VULNERABILITY RATING	HYDROGEOLOGICAL CONDITIONS				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand / gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/Gravel aquifers only)	(< 30 m radius)
Extreme (E)	0-3.0m	0-3.0m	0-3.0m	0-3.0m	-
High (H)	>3.0m	3.0-10.0m	3.0-5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0-10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

Notes: (1) N/A= not applicable
(2) Precise permeability value cannot be given at present.
(3) Release point of contaminants is assumed to be 1-2 m below ground surface.

Recharge Mechanisms

7.75 Rain falling at the application site infiltrates into the ground and percolates downward through an unsaturated zone to the underlying groundwater system. There is no surface water management system at the site as incident rainfall percolates directly to the ground.

7.76 The GSI National Groundwater Recharge Map indicates for areas covered by vegetation the effective rainfall (total precipitation – evapotranspiration) in the area around the application site is about 475 mm/year.

7.77 The GSI recharge mapping also indicates an average groundwater recharge figure of 404 mm/year for sand and gravels in the immediate vicinity of the site, with a recharge coefficient of up to 85% (i.e. 85% of the effective rainfall would percolate to the water table as groundwater recharge).

7.78 At the existing backfill facility, where soil cover and vegetation has been removed, there is no evapotranspiration and it would be expected that the majority of rainfall recharges to the underlying aquifer.

Groundwater Monitoring Boreholes

7.79 Four boreholes (GW01 - GW04) were drilled in April 2017 by Ellis Water Well Drilling Services Ltd., at the locations indicated in Figure 7-1. The boreholes were drilled into Glacial till (GW01) and sand and gravel to a maximum depth of 19m bgl (GW02 to

GW04). As noted above, the sand and gravel deposit underlying the site is not classified as an aquifer, although the mapped extent of the Calverston gravel aquifer does extend close to the south and south-western site boundaries.

7.80 Details of boreholes / groundwater well installations are summarised in Table 7-4 below**.** For more details, refer to the borehole logs reproduced in an Appendix to Chapter 6 of this EIAR.

Table 7-4
Details of Groundwater Monitoring Boreholes

	GW01	GW02	GW03	GW04
Location	Upgradient NW Boundary	Upgradient N Boundary, close to water supply well	Downgradient SE Boundary,	Downgradient W Boundary
Grid Reference (ITM)	682359, 705595	682569, 705763	682727, 705373	682453, 705422
Top of Casing Elevation (mAOD)	126.65	127.48	123.76	119.22
BH Depth (m bgl)	19	19	16	9
Water Strikes (m bgl)	11	11	8.9	4

Groundwater Levels

7.81 Groundwater levels in boreholes GW01 to GW04 have been monitored on a quarterly basis at the application site since April 2017. The data for groundwater levels recorded between September 2020 and January 2023 is presented in Plate 7-2 below and summarised in Table 7-5.

7.82 In March 2021, the highest recorded groundwater level reached 116.95 m above Ordnance Datum (AOD) in borehole GW02. This borehole is situated along the northern boundary and is in close proximity to a water supply well. The approximate pit level is at 116m AOD, and the maximum groundwater level at GW3 and GW4 which are close to the pit is 115.23m and 115.81m AOD, respectively.

7.83 Since September 2020, the recorded groundwater levels reveal that the lowest groundwater level observed was at 111.45m AOD in GW03 in April 2021.

7.84 In April 2021, borehole GW01 registered the deepest recorded groundwater depth (in metres below top of casing, m btoc) at 10.53m btoc. Borehole GW01 is positioned near the northwestern boundary of the application site.

7.85 The widest range in recorded groundwater levels, amounting to 4.64 meters, was observed at borehole GW02, which is most likely influenced by proximity to the water supply well.

7.86 The daily rainfall data from closest rain gauge station, at Ballymore**,** is also displayed in Plate 7-2 below. The quarterly groundwater level monitoring frequency is not sufficient to identify the groundwater level response to rainfall in the area.

Plate 7-2
Groundwater Levels at On-site Boreholes (2020-2023)

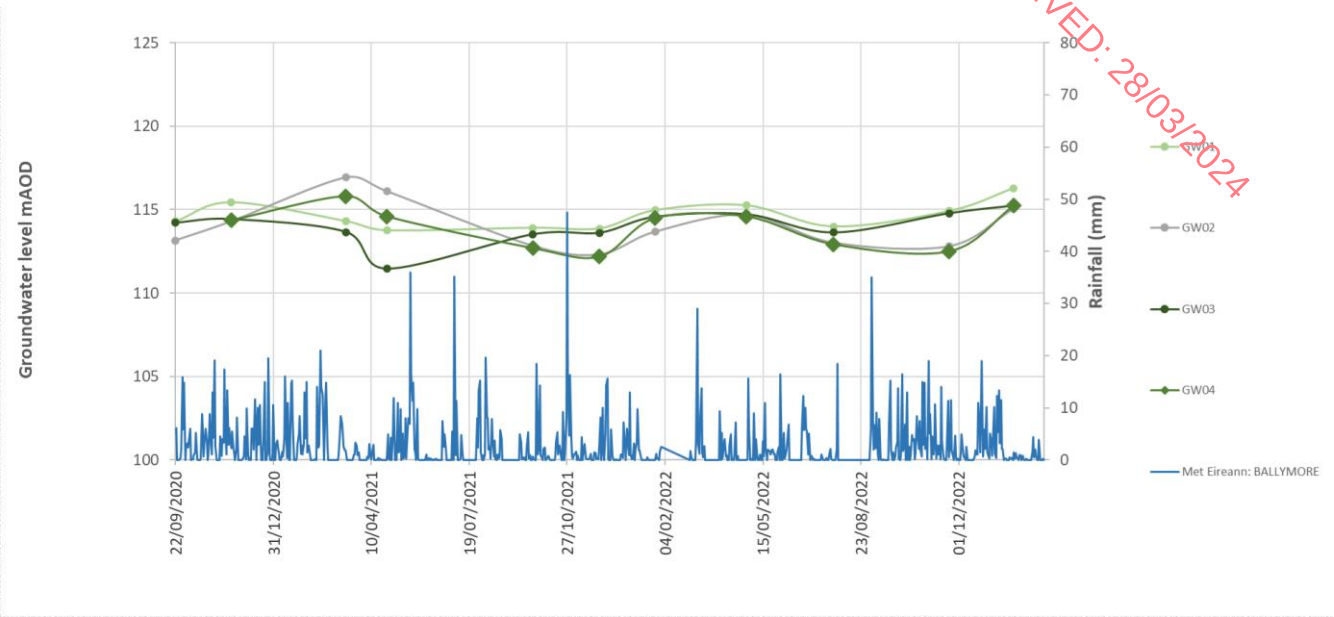


Table 7-5
Summary of GW Levels : September 2020 to January 2023

Unit	Measure	GW01	GW02	GW03	GW04
m AOD	Maximum	116.29	116.95	115.23	115.79
	Minimum	113.76	112.31	111.45	112.19
	Average	114.64	114.08	113.98	113.87
m BToC	Maximum	12.89	15.17	12.31	7.03
	Minimum	10.36	10.53	8.53	3.43
	Average	12.01	13.40	9.78	5.35
m	Annual GW Range 2020 -2023	2.53	4.64	3.78	3.60

Groundwater Flow Direction

7.87 The groundwater level data at the application site indicates that GW1 has the highest groundwater level. It is noted that groundwater monitoring borehole GW2 is located next to a water supply well and there may be localised drawdown associated with the supply well.

7.88 In the area surrounding the sand and gravel pit, there is a topographic high to the north and elevated ground to the east and west of the site. The site is located close to the Calverston gravel aquifer, which extends south and southwest of the site.

7.89 The groundwater flow direction in the wider area of the pit is expected to follow the topography to the south -southwest, with GW1 and GW2 as the upgradient boreholes and GW3 and GW4 as the downgradient boreholes.

7.90 This assessment is in line with the summary detail provided in the New Ross GWB report which indicates that the regional flow patterns in the bedrock aquifer are south-westerly, toward the River Barrow.

Groundwater Quality

7.91 The groundwater quality in the site wells is monitored by the Applicant on a quarterly basis, in line with Waste Licence requirements. The groundwater monitoring boreholes are screened in the underlying sand and gravel deposits.

7.92 Groundwater samples are tested for standard physio chemical parameters as well as a wider range of parameters, including metals. All parameters are tested annually, while inorganic parameters, such as Ammoniacal Nitrogen as NH_3, Phosphate (Ortho as PO4), pH, Conductivity, Nitrite as NO_2, Nitrate as NO_3 and total dissolved solids, are tested on a quarterly basis.

7.93 The laboratory test results for 2021 to 2023 are presented in appendix 7-C in summary format and have been screened against standards / limits in the following order:

- S.I. No 366 of 2016 (Groundwater Regulations);
- S.I. No 122 of 2014 (Drinking Water Regulations); and,
- EPA Interim Guideline Values.

7.94 Groundwater quality parameters that have recorded exceedances of the assessment criteria include ammoniacal nitrogen, nitrate and metals, with very occasional exceedances in pH and conductivity.

7.95 Most of the parameters were elevated in upgradient boreholes GW1 and GW2, as well as in boreholes GW3 and GW4. Cadmium was occasionally elevated in downgradient boreholes GW3 and GW4 only, with a maximum concentration of 78µg/l reported at GW3 on 15th March 2021 compared to the Groundwater Regulations of 3.75µg/l. A single exceedance of magnesium was reported at 66mg/l compared to the EPA IGV of 50mg/l. Neither cadmium nor magnesium was consistently elevated at the pit.

Groundwater Supply Wells

7.96 Geological Survey Ireland (GSI) maintains an online database of wells and springs in Ireland; however, it should be noted this database is not extensive. This database identifies a number of wells within 2km radius of the application site. There are eleven wells mapped within a 1km radius of the site, all are of unknown use with various radius of location accuracy, refer to Figure 7-5. he wells are generally located in either the poor (Pu) bedrock aquifer or the nearby gravel aquifer.

7.97 The closest GSI recorded well is located close to the northern boundary of the application site (GSI Ref. 2619NEW282), with a reported location accuracy of 20m. The well is potentially in gravel deposits and is reportedly 34.8m deep with ‘depth to rock’ at 34.1m. There is another well (GSI Ref. 2619NEW412) located approximately 100 m south of the application site, of unknown use and 12.5m deep. ‘Depth to rock’ is not reported.

7.98 There are no public supply source protection zones identified by GSI / EPA mapping in the vicinity of the application site. The closest Group Water Scheme (GWS) abstraction point is that of the Usk / Gormanstown GWS, located c. 6km to the south-east.

7.99 The closest Public Water Supply (PWS) is that at the Curragh Camp, the outer protection zone of which occurs approximately 2km north-west and upgradient of the site, although the actual abstraction points for the PWS are located approximately 6.7km to the north-west. The majority of the Curragh Camp PWS source protection area is located within the Curragh Gravel Aquifer.

7.100 Investigations undertaken by the Applicant indicate that local residential dwellings in the Halverstown area are connected to a public (mains) water supply. The Halverstown area is located within Irish Water's Poulaphouca Regional Water Supply Zone (WSZ). There is no public sewerage scheme in the area and residential properties maintain individual septic tanks for wastewater treatment.

7.101 As previously noted, there is a groundwater borehole abstraction located within the application site (at ITM coordinates: 682542,705723) which provides water supply for existing on-site activities and staff welfare facilities, refer to Figure 7-1.

Water Framework Directive

7.102 The EU Water Framework Directive[2] (WFD) became EU law in December 2000 and provides for a single European framework to assess water quality (Ecological status) and allows for the comparison of results across Europe. The WFD covers rivers, lakes, estuaries or transitional waters, coastal waters as well as groundwaters.

7.103 Surface waters are classified into five quality classes (Ecological status) under the WFD; High, Good, Moderate, Poor and Bad Ecological status. Groundwater is classified into just two quality classes, Good and Poor Ecological status. High Ecological status is when the water is unpolluted, while at the opposite end of the classification Bad Ecological status is when the water is highly polluted.

7.104 The WFD requires baseline water quality in all waterbodies to be established for biological, chemical and hydromorphology quality. These three quality variables are combined to give the overall Ecological status classification of the waterbody; good or high ecological status and good chemical status for surface waters and good chemical and quantitative status for groundwaters.

7.105 The two principal aims objectives of the WFD are that :

- all water bodies must reach at least 'Good' overall status by 2027, at the latest. For surface waters, good overall status is a combination of good ecological status (or potential) and good chemical status; and
- the status of each water body, including all the quality elements which make up the overall status, must not deteriorate relative to the baseline reported in the relevant River Basin Management Plan (RBMP).

7.106 The WFD identifies where actions are required to achieve Good Ecological status or maintain waterbodies which are already Good or High Ecological status. Waterbodies can be restored to Good and High Ecological status by using targeted actions and measures to reduce the impact of human activities on them.

7.107 For heavily modified or artificial water bodies, which are incapable of achieving Good Ecological status without impairing an existing specified water use, the environmental objective is to achieve good ecological potential.

7.108 The WFD requires that management plans are prepared on a river basin basis and specifies a structured method for developing these plans.

River Basin Management Plans

7.109 The River Basin Management Plans (RBMP) provide a single system of water management based on the natural delineation of river catchments and is the method by which the aims of the WFD are achieved.

[2] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

7.110 For each river basin district in Ireland, a RBMP needs to be established and updated every six years, to provide the context for the co-ordination requirements of the WFD key aims which are to:

- provide for protection to all waters, surface waters and groundwater;
- achieving Good Ecological status for all waters by 2027;
- establish water management measures based on river basin catchment areas;
- establish a combined approach of emission limit values and quality standards for waters;
- involving citizen more closely in the WFD and RBMP; and
- streamlining and aligning national legislation.

7.111 The RBMP provides a detailed account of how the objectives set for each river basin in terms of ecological status, quantitative status, chemical status and protected area objectives are to be reached within the timescale of the plan. The plans include the results of the catchment analysis including the river basin's characteristics, a review of the impact of human activity on the status of waters in the basin, estimation of the effect of existing legislation and the remaining gap to meeting these objectives; and establish a set of measures designed to meet the objectives.

River Basin Management Plan for Ireland 2022-2027

7.112 The current RMBP report for Ireland is at the draft stage[3]. The draft report states that while substantial progress has been made in the management of water services and how stakeholders work together to protect, restore and improve water quality with the improvement in some areas and aspects of water quality, many waterbodies are still subject to mounting environmental pressures and, overall, water quality is in decline, primarily due to nutrient pollution.

7.113 The RMBP states that on account of the overall decline in water quality, stronger measures are now required which will improve overall water quality; the sustainable management of water resources is important to address and adapt to the impacts of climate change, with many of the required measures having co-benefits for climate mitigation and biodiversity. Protecting and restoring water quality in Ireland will most of all need measures to address:

- the loss of agricultural nutrients to water;
- continue to improve waste water treatment; and
- to re-establish natural free-flowing conditions in more rivers.

7.114 The plan states that Ireland's water resources and services face challenges on a number of fronts including a continued need for investment in infrastructure and an ever-increasing demand for water services due to urbanisation, population and economic growth. These challenges are set against a backdrop of widespread, rapid, and intensifying climate change.

Kildoon River and WFD Third-Cycle

7.115 The Kildoon River has received a classification of Moderate Ecological status for the period spanning the Second-Cycle of the WFD (2016-2021). This classification is based on both its physio-chemical and biological quality. The Kildoon River does not fall within the category of a drinking water protected river as defined by the Water Framework Directive (WFD).

[3] Draft River Basin Management Plan for Ireland 2022-2027, Government of Ireland

7.116 The WFD Third-Cycle Barrow Catchment Report (August 2021) states that the Kildoon River is under review for status and risk, therefore, significant pressures are not identified in the Third Cycle report.

7.117 In summary, based on the Water Framework Directive information presented above, it is considered that the proposed increased intake and continuation of activities at Halverstown will not be contrary to the objectives of the WFD to achieve Good Ecological Status in the Kildoon River by 2027. There will be no indirect impact on the WFD objectives arising from the proposed further / future development.

Groundwater Body and WFD Third-Cycle

7.118 The application site is underlain by the Usk Gravel GWB which is classified as being of good status with regards to Groundwater Quality under the WFD for the period 2016 – 2021 and is assessed as not being at risk of failing to achieve its objectives by the year 2027.

7.119 The New Ross GWB which underlies the gravel waterbody at the application site is also classified as being of good status with regards to Groundwater Quality and is also assessed as not being at risk of failing to achieve its objectives by the year 2027.

Protected Areas

7.120 There are no protected areas within 2km of the application site. None of the local rivers in the vicinity of the site are drinking water protected rivers under the Water Framework Directive (WFD).

7.121 Protected areas at distance from the site include Dunlavin Marshes proposed Natural Heritage Area (pNHA) approximately 3km south-east of the site (NPWS Site Code 001772). The Curragh (Kildare) which is also a pNHA (NPWS Site Code 000392), is located approximately 3.5km north-west of the site at its closest point.

Water Environment Receptors

7.122 From the baseline study findings presented herein, the following water environment sensitive receptors have been identified in the receiving environment:

- Calverston gravel aquifer (Lg) : groundwater in the sand and gravel deposits within the application site is likely to be in lateral hydraulic continuity with the Calverston gravel aquifer;
- Poorly productive bedrock aquifer, which underlies the sand and gravel deposits at the application site;
- Groundwater supply wells on lands down-gradient of the application site.

7.123 For each identified receptor, the significance and sensitivity of the receptor is assessed in Tale 7-6 below and a rating (High / Medium / Low / Negligible) applied, based on the methodology outlined in existing guidance (reproduced in Appendix 7-D).

Table 7-6
Existing Environment - Significance and Sensitivity / Importance

No.	Existing Environment	Significance	Sensitivity	Existing Environment Significance / Sensitivity Rating (H/M/L/N)
1	Calverstown gravel aquifer, expected to be in lateral hydraulic continuity with groundwater in sand and gravel deposits at the former pit / application site	Locally important gravel aquifer. Good status (WFD 2016-2021).	Good status under WFD. Located within Usk GWB which is not considered to be at risk of meeting its objectives by 2027 (WFD)	**Medium** - Attribute has a medium quality or value on a local scale – locally important aquifer
2	Poorly productive bedrock aquifer, may be in vertical hydraulic continuity with groundwater in sand and gravel deposits at the application site	Generally unproductive for supply and abstraction purposes. Good status (WFD 2016-2021).	Good status under WFD. New Ross GWB is not considered to be at risk of meeting its objectives by 2027 (WFD)	**Low** - Attribute has a low quality or value on a local scale - poor and generally unproductive aquifer.
3	Groundwater supply wells on lands downgradient of the application site	Most of these GSI registered wells are of unknown use and yield class.	Local groundwater abstractions for drinking water supplies.	**Low** - Attribute has a low quality or value on a local scale - potable water source supplying <50 homes

Receiving Environment - Baseline Summary

7.124 The application site area comprises an existing backfill and recovery facility where excess soil and stone material generated by construction activity has been imported and used to restore a former pit back to / close to surrounding ground level.

7.125 Prior to commencement of backfilling and recovery activities, soil (topsoil) cover and some granular subsoils had been removed by former extractive activities.

7.126 The application site is located over calcareous greywacke siltstone and shale belonging to the Carrighill Formation.

7.127 The site falls within the boundaries of the Water Framework Directive (WFD) Barrow Catchment and Barrow Sub-Catchment. The closest surface water body to the application site within the Barrow Sub-Catchment is the Kildoon River, which flows approximately 1.5 kilometres south of the site. The Kilcullen Stream flows approximately 1.2 kilometres east of the application site, but it is within a separate catchment (the Liffey and Dublin Bay catchment).

7.128 Under the Water Framework Directive, the Kildoon River is classified as being of moderate status based on its physio-chemical and biological quality.

7.129 There have been no recorded flood events at or near the application site, and the potential for river flooding in the vicinity of the site is negligible. There are no streams or rivers in the immediate vicinity of the site.

7.130 Approximately 3m to 5m of lower permeability soil material has been placed at the application site and its groundwater vulnerability is assessed as being Moderate or High.

7.131 The groundwater in the sand and gravel deposits at the application site is not classified by the GSI as a gravel aquifer. The site is underlain by a poorly productive bedrock aquifer (Pu) and the bedrock comprises calcareous greywacke siltstone and shale.

7.132 The Calverston gravel aquifer (Lg) is located to the south of the site. Groundwater in the sand and gravel deposits underlying the application site are likely to be in lateral hydraulic continuity with the Calverston gravel aquifer.

7.133 The groundwater levels and quality in the superficial deposits are monitored on an ongoing basis in four boreholes at the application site (GW01, GW02, GW03, and GW04). Groundwater level data from the site suggest that groundwater flow direction in the vicinity of the application site is likely to follow the ground surface topography which falls to the south - southwest.

7.134 Groundwater quality results spanning from March 2021 to January 2023 found that most parameters exceeding assessment criteria. were elevated in upgradient boreholes GW1 and GW2, as well as at boreholes GW3 and GW4, with the exception of occasionally elevated cadmium and a single exceedance of magnesium in the downgradient boreholes.

7.135 Groundwater quality parameters that have recorded upgradient exceedances of the assessment criteria include ammoniacal nitrogen, nitrate and metals. Neither cadmium nor magnesium are consistently elevated at the site.

7.136 Local residences are connected to a public (mains) water supply and maintain individual septic tanks for wastewater treatment.

IMPACT ASSESSMENT

Evaluation Methodology

7.137 The potential direct and indirect impacts to surface water and groundwater associated with the proposed further / future development at the application site at Halverstown are discussed below.

7.138 The methodology applied here is a qualitative risk assessment methodology in which the nature of the potential impacts is described in terms of the character, magnitude, duration, probability and consequence of the impact and whether they are direct or indirect impacts. The terms used to describe potential hydrological and hydrogeological impacts or effects are explained in tables reproduced in Appendix 7-E. The cumulative impact of any potential impacts is also assessed.

7.139 The description of the potential impact is then screened against the significance and sensitivity of the receiving environment to establish the overall significance of the potential impact (without mitigation). The classification of the impact significance is determined using the matrix from the EPA Guidelines (2022) which is reproduced in Appendix 7-F.

7.140 The potential impact is then screened against the sensitivity of the receiving environment to establish the overall significance of the potential impact (without mitigation). Appropriate mitigation measures for the potential impacts identified are discussed, and the identified potential impacts reassessed assuming the identified mitigation measures are implemented and in place.

Construction Stage Impacts (No Mitigation)

7.141 All of the site infrastructure required to service the proposed extension (to the life and capacity) of the existing development at Halverstown is already in place. As such there is no construction or development phase associated with the proposed development and no requirement to consider construction phase impacts.

Direct Impacts

Surface Water

7.142 No impacts, as the construction stage of the facility has already been completed.

Groundwater

7.143 No impacts, as the construction stage of the facility has already been completed.

Indirect Impacts

7.144 No impacts, as the construction stage of the facility has already been completed.

Operational Stage Impacts – Continuation of Activities (No Mitigation)

7.145 During the operational stage, uncontaminated (inert) soil and stone material will continue to be imported to the application site and will be placed across the existing filled areas to complete the proposed amended landform. The potential direct and indirect impacts to surface waters and groundwater from continued site activities (without mitigation) are considered below and summarised in Table 7-7.

Direct Impacts

Surface Water

7.146 There are no surface water courses on or in the immediate vicinity of the application site, and there is no discharge from the site to surface watercourses. There are therefore no direct impacts on surface water quality or flow quantity during this stage.

Groundwater

7.147 The application site has previously been worked dry above the winter groundwater table level in the sand and gravel superficial deposits, and the ongoing (a planned future) soil backfilling and recovery activities continue to take place above the groundwater level. There will therefore be no impacts on groundwater quantity within the superficial deposits.

7.148 The groundwater table at the application site occurs within superficial deposits of sand and gravel which are not classified as an aquifer. Therefore, any impacts on groundwater quality will be by indirect impact and are considered below.

Indirect Impacts

Surface Water

7.149 There are no surface water courses on or in the immediate vicinity of the application site, and there is no discharge from the site to surface watercourses. There are therefore no indirect impacts on surface water quality or quantity during this stage.

Groundwater

7.150 As noted above, the groundwater table underlying the application site occurs in sand and gravel deposits which are not classified as an aquifer. Any impact on the quality of the groundwater in the sand and gravel could cause an indirect impact on groundwater quality in nearby aquifers.

7.151 Impacted groundwater in the sand and gravel deposits could migrate vertically within the application site and indirectly impact groundwater quality within the underlying poorly productive bedrock aquifer. Impacted groundwater in the sand and gravel deposits could also migrate laterally beyond the application site and impact on the locally important Calverston gravel aquifer to the south of the site, as well as local well supplies.

7.152 The ongoing backfilling and recovery activities and undertaken using only imported uncontaminated (inert) soil and stone materials. However, in the event that some slightly contaminated non-inert soil or particulate materials are unintentionally imported to site and placed in-situ, there is the potential to impact on the groundwater quality of the sand and gravel deposits at the application site and indirectly impact on the underlying bedrock aquifer, adjacent gravel aquifer and local well supplies.

7.153 The accidental leaking or spillage of fuels and other petroleum-based products (lubricating oils, greases etc.) during refuelling or maintenance of plant and machinery, or the storage of such materials, as well as increased suspended solids, has the potential to impact on groundwater quality of the sand and gravel deposits in the application site also, and indirectly impact on the underlying bedrock aquifer, adjacent gravel aquifer and local well supplies.

7.154 Without mitigation, the potential indirect impact on groundwater quality during continued future backfilling and recovery activities is considered to be Low during the operational stage.

7.155 The backfilling of the application site with imported soil and stone materials has increased the thickness of unsaturated material above the underlying groundwater table. This has and will continue to afford an additional level of protection to groundwater from potential pollutant leaks or spills associated with human activities at the ground surface, thereby reducing the groundwater vulnerability at the application site. This impact is considered to be a potential slight positive impact for groundwater quality in the underlying bedrock aquifer, adjacent gravel aquifer and local well supplies.

Post Operational Stage (No Mitigation)

7.156 Following the completion of the restoration, the site will be restored to native woodland and grassland. All relevant site equipment and machinery will be removed from the site once the final restoration is complete.

7.157 As noted above, groundwater recharge at the application site is largely diffuse and infiltrates to ground. There is no concentrated or point recharge of rainwater run-off to the underlying groundwater table and no surface water discharge off-site. As a consequence, to date there has been no requirement for any specific surface water management measures at the existing facility.

7.158 Notwithstanding this, it is proposed that once on-site activities have ceased and restoration works have been completed, perimeter drainage channels will be installed around the backfilled areas to

- capture any overground run-off from the site which may arise following extended or intense rainfall events using infiltration swales which effectively facilitate infiltration and recharge to ground through their base and sides (particularly where they are in contact with any more permeable in-situ sand and gravel deposits); and
- channel any excess run-off to collect at ephemeral ponds / closed depressions developed at low points at the end of the swale channel run, whereon it will naturally and slowly infiltrate to ground.

7.159 This section assesses the potential impact on the hydrology and hydrogeology following closure of the site.

Direct Impacts

7.160 In the absence of any ongoing site activities and with the establishment of woodland and grassland habitats, there will be no direct impacts on surface water or groundwater following restoration works at the application site.

7.161 All plant, equipment and infrastructure will be removed from the site as well as any fuels and oils which could be potential harmful to the receiving environment.

Indirect Impacts

7.162 There are no indirect impacts on surface water or groundwater following restoration works at the application site.

Table 7-7
Classification of Significance of Impacts (No Mitigation)

No.	Potential Impacts	Impact Rating (No Mitigation)	Significance of Impact (No Mitigation)
Operational Stage – Direct - Groundwater			
1	The continued infilling activities are above the groundwater level.	**Negligible.** The continued infilling process will result in a greater thickness of unsaturated material above the water table at the site, which is seen as a beneficial aspect since it provides added protection for groundwater.	**Slight Positive**
Operational Stage – Indirect - Groundwater			
2	Reduction in groundwater quality in underlying bedrock aquifer or nearby gravel aquifer from accidental fuel leakage / spillage (or increase in suspended solids) impacting on groundwater in sand and gravel deposits	**Low.** Potential to affect groundwater quality in sand and gravel deposits which could vertically migrate to the underlying bedrock aquifer or laterally migrate outside the application aquifer to the gravel aquifer. Any fuel leakage / spillage would be accidental only and of limited volume.	**Slight**
3	Impact on groundwater quality in private water supplies	**Low.** Potential to affect groundwater quality (fuel / suspended solids) in private water supplies through vertical or lateral migration of impacted groundwater in the sand and gravel deposits. Any leakage / spillage would be accidental only and of limited volume. Local residents are understood to be connected to a public (mains) water supply.	**Slight**
4	Reduction in groundwater quality from non-inert imported material.	**Medium - Low.** Potential to affect groundwater quality in sand and gravel deposits which could vertically migrate to the underlying bedrock aquifer or laterally migrate outside the application aquifer to the gravel aquifer.	**Slight Moderate**

Unplanned Events

7.163 Accidents, malfunctions and unplanned events refer to events or upset conditions that are not part of any activity or normal operation of the planned development. Even with the best planning and the implementation of preventative measures, the potential exists for accidents, malfunctions or unplanned events to occur during ongoing and any future backfilling and recovery operations.

7.164 Many accidents, malfunctions and unplanned events are, however, preventable and can be readily addressed or prevented by good planning, design, emergency response planning, and mitigation. In terms of hydrological or hydrogeological related impacts, the following unplanned events could have an effect on the local water environment;

- Accidental spillage of fuel when refuelling or as a result of vehicle collisions;
- Leakage of hydrocarbon / oils / greases from plant and equipment; and
- Importation and placement of contaminated materials.

7.165 If these unplanned events were to occur and were not then mitigated, they could give rise to impacts on the local water environment. However, these events have been considered previously in this assessment and the potential impacts arising therefrom are addressed through the mitigation measures outlined below.

'Do-nothing Scenario'

7.166 In a 'do-nothing scenario', it would not be possible to complete the approved backfilling of the worked-out pit or the restoration of the site to the approved landform and surrounding ground levels (in view of the in-situ density of soil placed at the site being 20% higher than initially assumed at the time the previous planning application was submitted). This would however have no significant implications for surface water and groundwater as rainfall would continue to infiltrate to ground through backfilled materials.

Mitigation Measures

7.167 The ongoing mitigation measures currently in place at the site for the existing operations are designed to reduce the potential impacts associated with the operational stage to acceptable levels with a low risk to the receiving environment, are identified in this section. These measures are designed to either reduce the likelihood of an event occurring or reduce the magnitude of the consequences if the event does occur.

Operational Stage – Continuation of Activities

7.168 During the Operational Stage potential impacts have been identified on groundwater quality from suspended solids, the accidental leakage or spillage of fuels and petroleum-based products during refuelling and maintenance and the accidental importation of non-inert materials to site.

7.169 The following mitigation measures will continue to be implemented at the application site during ongoing and planned further / future backfilling and recovery activities over the operational stage:

- surface water runoff will be allowed to infiltrate naturally to ground across the site through backfilled soils or local sumps / depressions in the backfilled ground surface;
- during extended or intense rainfall events, run-off will be directed to channels / swales where it will either infiltrate to ground through the underlying sand and gravel or flow to ephemeral ponds / closed depressions developed at low points at the end of the channel run, whereon it will infiltrate slowly to ground.

- refuelling will take place at the designated paved refuelling area. No refuelling will take place within the backfill / recovery area;
- plant / machinery maintenance and repairs will take place on the hardstand area at the refuelling point. No servicing or maintenance of mobile plant and machinery will be undertaken within the backfill / recovery area;
- fuel storage will continue at the existing storage facility. There is no fuel storage within the backfilling and restoration areas;
- all plant will be regularly maintained and inspected daily for leaks of fuels, lubricating oil or other contaminating liquids;
- all petroleum-based products (lubricating oils, waste oils, etc.) are stored on drip trays under cover in the workshop to prevent pollution due to accidental spills and leakages;
- a spill kit and drip trays will be kept on site and will be deployed if there is an accidental spillage from plant / machinery; and
- plant operators will be briefed during 'toolbox' talks and site induction on where the spill kit is kept and how and when it is deployed.

7.170 The following measures will also continue to be implemented at the facility to mitigate against the unintended importation and placement of contaminated or impacted soils in the backfilling and restoration works;

- operating procedures at the facility require all soil and stones forwarded for backfilling and/or recovery purposes to be pre-sorted at source, uncontaminated and largely free of construction or demolition (C&D) waste or any non-hazardous / hazardous domestic, commercial or industrial wastes.
- any materials that are deemed unacceptable for backfilling and/or recovery at the facility on the basis of a visual inspection at the weighbridge are immediately rejected and directed to an appropriately authorised waste facility.
- all soil and stone imported to the facility is unloaded (end-tipped) from trucks at active filling areas. It is visually inspected by site personnel at that point to ensure that there is no intermixed construction or demolition (C&D), non-hazardous or hazardous waste within it. Any consignments forwarded to site which are found to have excessive quantities of these materials intermixed within them are immediately rejected, reloaded onto HGVs and directed to leave site.
- any minor inclusions of non-inert construction and demolition waste (principally metal, timber, PVC pipes and plastic) inadvertently imported to the site are separated out and temporarily stored in skips at the waste quarantine area prior to being transferred off-site to appropriately authorised waste disposal or recovery facilities.
- any imported soil which is accepted at the facility but subsequently suspected / found to be non-compliant with acceptance criteria for the facility will be re-loaded onto HGV trucks and transferred to the existing waste inspection and quarantine facility for closer examination and/or testing;
- the waste inspection facility comprises a covered shed over a sealed concrete slab and incident rainfall will not therefore come into contact with any consignments of suspected contaminated waste stored at this location;
- should any subsequent inspection or testing of suspect soil waste at the inspection and quarantine facility identify any non-inert material which cannot be accepted or reused in the backfilling or restoration of this site, it will be quarantined pending removal off site by permitted waste collectors to an authorised waste disposal or recovery facility.

7.171 Taken together, it is considered that these mitigation measures reduce the potential impact of importing of non-inert material which could impact on groundwater quality in sand and gravel deposits, which could vertically migrate to the underlying bedrock aquifer or laterally migrate outside the application aquifer to the gravel aquifer from "Medium – Low" to "Low".

Post Operational Stage

7.172 Once the importation and recovery of material is completed at the site it will be restored to a native woodland and grassland habitat. In the absence of any ongoing site activities and with the establishment of woodland and grassland habitats, there will be no direct impacts on surface water or groundwater,. As there will be no activities at the site, no mitigation measures are required.

RESIDUAL IMPACT ASSESSMENT

Operational Stage

7.173 With the above mitigation measures in place at the application site during the operational stage, it is considered that there will be no residual significant negative impacts on the receiving water environment.

Post Operational Stage

7.174 With the establishment of woodland and grassland habitats, there will be no direct impacts on surface water or groundwater following the restoration works at the application site.

MONITORING

7.175 The following programme of groundwater water monitoring is implemented by the Applicant at the existing backfilling / recovery facility under the terms of the existing EPA Waste Licence (Ref No. W0300-01).

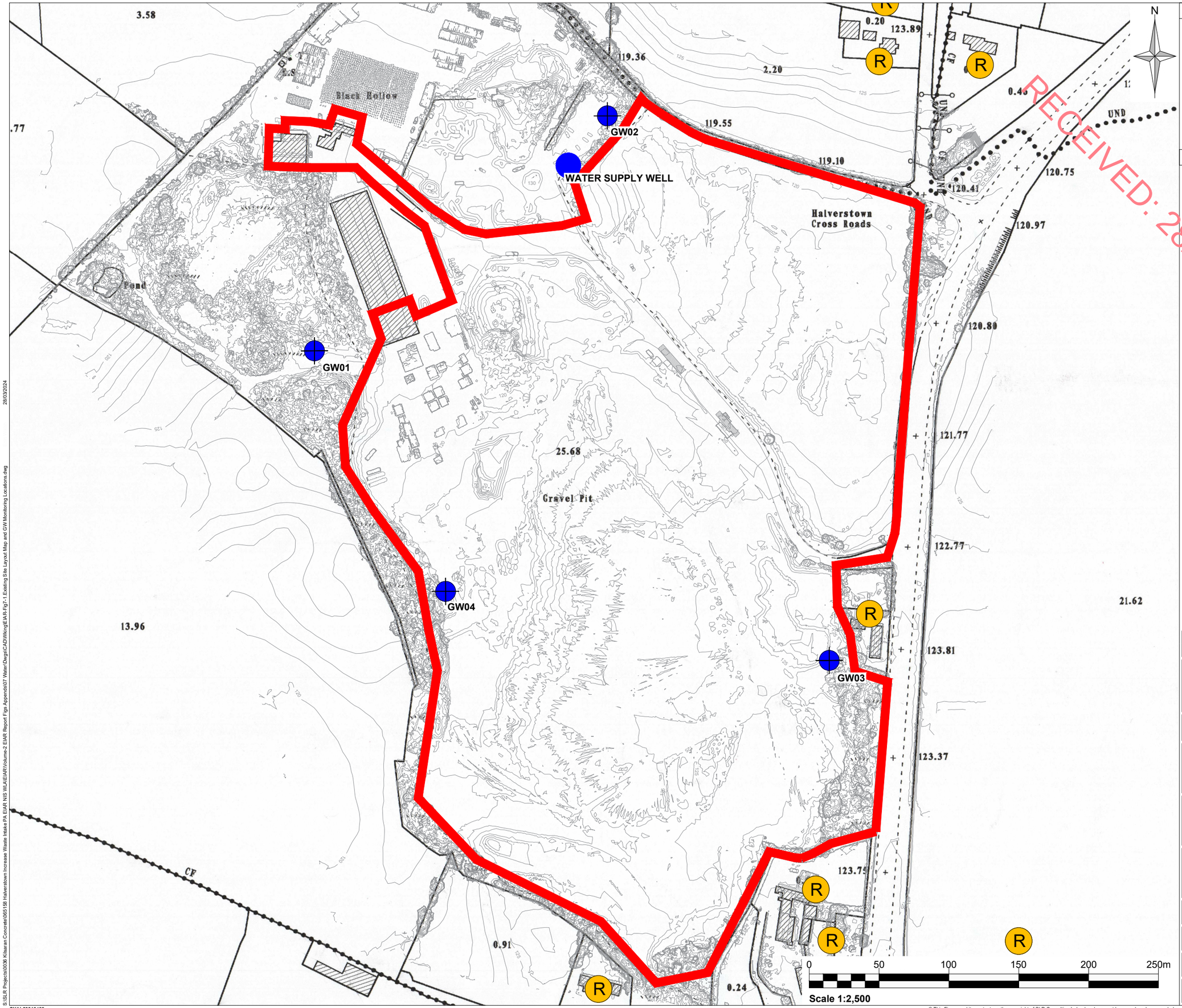
7.176 For the planned further / future development, groundwater levels at GW1, GW2, GW3 and GW4 will continue to be monitored on a quarterly basis in line with Schedule C4 of the existing EPA waste licence. Groundwater sampling and water quality testing / monitoring will also be carried out at the four monitoring wells as per licence requirements, set out in Table 7-8 below;

Table 7-8
Groundwater Monitoring Schedule

Parameter	Monitoring Frequency
Visual Inspection	Quarterly
pH	Quarterly
Conductivity	Quarterly
Ammonia as N	Biannually
Nitrate	Biannually
Nitrite	Biannually
Orthophosphate as P	Biannually

Parameter	Monitoring Frequency
Total Dissolved Solids	Biannually
Dissolved Metals	Annually
Total Petroleum Hydrocarbons	Annually
Diesel Range Organics	Annually
Petrol Range Organics	Annually

FIGURES



Notes:

1. BASED ON ORDNANCE SURVEY MAPPING :

KE028-15 (25 Inch);
3778-C; 3778-D and 3836-B (1:2,500).
2.

Legend:

- PLANNING APPLICATION AREA (c. 18.0 Ha.)
- RESIDENTIAL LOCATIONS
- WATER SUPPLY WELL
- GROUNDWATER MONITORING WELL

Rev	Amendments	Date	By	Chk	Auth

SLR

www.slrconsulting.com

Client
KILSARAN CONCRETE

Project
INCREASED INTAKE TO EXISTING
SOIL RECOVERY FACILITY
HALVERSTOWN, KILCULLEN, CO. KILDARE.

Figure Title
EXISTING SITE LAYOUT MAP WITH GROUNDWATER MONITORING, WATER TREATMENT AND WATER SUPPLY LOCATIONS

Scale	SLR Project No.
1:2,500 @ A3	065158.00001

Designed	Drawn	Checked	Authorised
NB	EW	PG	PG
Date: 08/23	Date: 08/23	Date: 03/24	Date: 03/24

Figure Number
FIGURE 7.1

Rev.
1

S:\SLR Projects\065158 Kilsaran Concrete\065158 Halverstown Increase Waste Intake PA EIAR NIS WLA\EIAR\Volume-2 EIAR Report Figs Appends\07 Water\Dwgs\CAD\Wking\EIAR-Fig7-1 Existing Site Layout Map and GW Monitoring Locations.dwg

28/03/2024

CYAL50316488

Notes:

1. Extract from Ordnance Survey Discovery Series Map No. 55 and from Bedrock Aquifer Data Mapping © GSI

Legend:

- KILSARAN CONCRETE LAND INTEREST (c.26.3 Ha)
- SITE LAYOUT
- PU-POOR AQUIFER-BEDROCK WHICH IS GENERALLY UNPRODUCTIVE
- PL-POOR AQUIFER-BEDROCK WHICH IS GENERALLY UNPRODUCTIVE EXCEPT FOR LOCAL ZONES
- LI-LOCALLY IMPORTANT AQUIFER- BEDROCK WHICH IS MODERATELY PRODUCTIVE ONLY IN LOCAL ZONES

Rev	Amendments	Date	By	Chk	Auth

SLR

www.slrconsulting.com

Client: KILSARAN CONCRETE

Project: INCREASED INTAKE TO EXISTING SOIL RECOVERY FACILITY HALVERSTOWN, KILCULLEN, CO. KILDARE.

Figure Title: BEDROCK AQUIFER MAP

Scale	SLR Project No.
1:25,000 @ A3	065158.00001

Designed	Drawn	Checked	Authorised
NB	NB	PG	PG
Date: 07/23	Date: 07/23	Date: 02/24	Date: 02/24

Figure Number: **FIGURE 7.2** Rev.: **0**

0 500 1000 1500 2000 2500m

Scale 1:25,000

S:\SLR Projects\065158 Halverstown Increase Waste Intake PA EIAR NIS WLA\EIAR\Volume-2 EIAR Report Figs Appendix\07 Water\Dwgs\CADWking\065158 Halverstown EIAR-Fig7-2 Bedrock Aquifer Map.dwg 21/02/2024

CYAL5016488

Notes:

1. Extract from Ordnance Survey Discovery Series Map No. 55 and from Sand and Gravel Aquifer Data Mapping © GSI.

Legend:

- KILSARAN CONCRETE LAND INTEREST (c.26.3 Ha)
- SITE LAYOUT
- REGIONALLY IMPORTANT GRAVEL AQUIFER
- LOCALLY IMPORTANT GRAVEL AQUIFER

Rev	Amendments	Date	By	Chk	Auth

SLR

www.slrconsulting.com

Client: KILSARAN CONCRETE

Project: INCREASED INTAKE TO EXISTING SOIL RECOVERY FACILITY HALVERSTOWN, KILCULLEN, CO. KILDARE

Figure Title: GRAVEL AQUIFER MAP

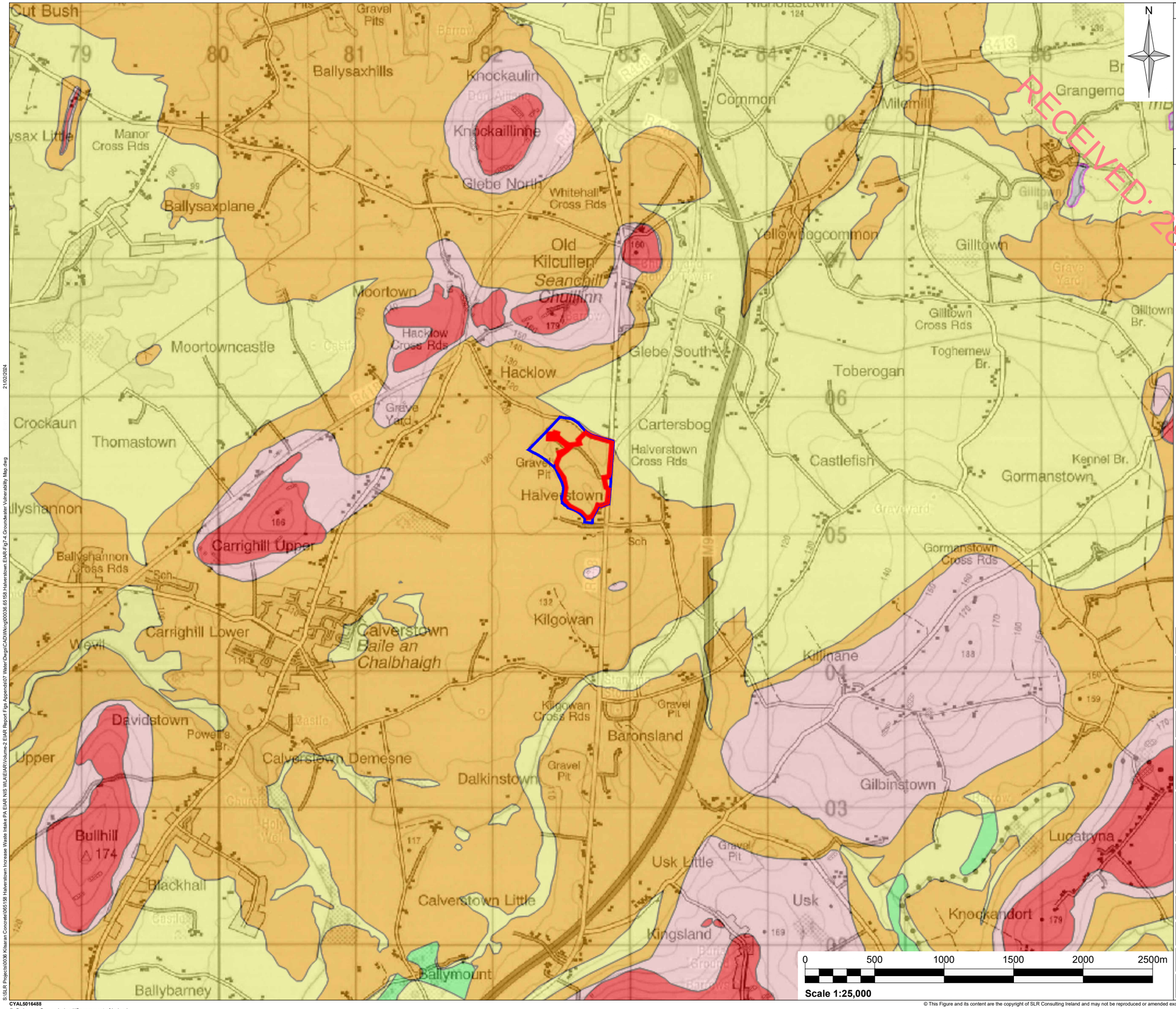
Scale	SLR Project No.
1:25000 @ A3	065158.00001

Designed	Drawn	Checked	Authorised
NB	NB	PG	PG
Date: 07/23	Date: 07/23	Date: 02/24	Date: 02/24

Figure Number: **FIGURE 7.3** Rev.: **0**

Scale 1:25,000

S:\SLR Projects\00036 Kilsaran Concrete\065158 Halverstown Increase Waste Intake PA EIAR NIS WLA\EIAR\Volume-2 EIAR Report Figs Appends\07 Water\Dwgs\CAD\Wking\00036.65158.Halverstown.EIAR-Fig7-3.Gravel Aquifer Map.dwg 21/02/2024



RECEIVED: 28/03/2024

Notes:

1. Extract from Ordnance Survey Discovery Series Map No. 55 and from Groundwater Vulnerability Data Mapping © GSI.

Legend:

- KILSARAN CONCRETE LAND INTEREST (c.26.3 Ha)
- SITE LAYOUT
- LOW GROUNDWATER VULNERABILITY
- MODERATE GROUNDWATER VULNERABILITY
- HIGH GROUNDWATER VULNERABILITY
- EXTREME GROUNDWATER VULNERABILITY
- ROCK AT OR NEAR THE SURFACE

Rev	Amendments	Date	By	Chk	Auth

SLR

www.slrconsulting.com

Client: KILSARAN CONCRETE

Project: INCREASED INTAKE TO EXISTING SOIL RECOVERY FACILITY HALVERSTOWN, KILCULLEN, CO. KILDARE

Figure Title: GROUNDWATER VULNERABILITY MAP

Scale		SLR Project No.
1:25,000	@ A3	065158.00001

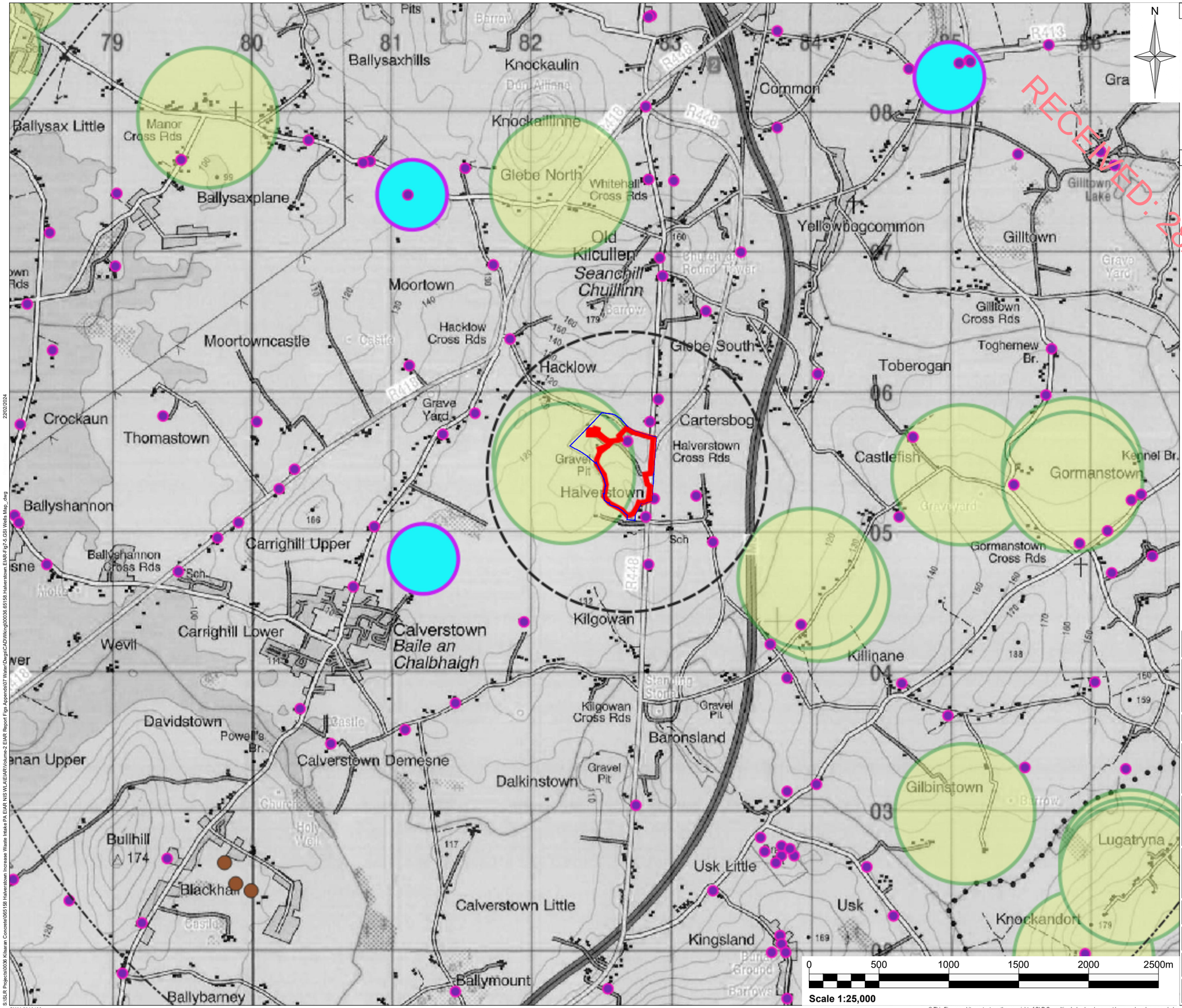
Designed	Drawn	Checked	Authorised
NB	NB	PG	PG
Date 07/23	Date 07/23	Date 02/24	Date 02/24

Figure Number: **FIGURE 7.4** Rev. **0**

S:\SLR Projects\0036 Kilsaran Concrete\065158 Halverstown Increase Waste Intake PA EIAR NIS WLA\EIAR\Volume-2 EIAR Report Figs Appends\07 Water\Dwgs\CAD\Wking\00036_65158 Halverstown EIAR-Fig7-4 Groundwater Vulnerability Map.dwg

21/02/2024

CYAL5016488



RECEIVED: 26/09/2024

Notes:

1. Extract from Ordnance Survey Discovery Series Map No. 55 and from Wells and Springs Data Mapping © GSI.

Legend:

- KILSARAN CONCRETE LAND INTEREST (c.26.3 Ha)
- SITE LAYOUT
- WELLS- UP TO 50m OF LOCATION ACCURACY
- WELLS- UP TO 100m OF LOCATION ACCURACY
- WELLS- UP TO 500m OF LOCATION ACCURACY
- WELLS- UP TO 1km OF LOCATION ACCURACY
- 1km FROM SITE BOUNDARY (FOR INFORMATION ONLY)

Rev	Amendments	Date	By	Chk	Auth

SLR

www.slrconsulting.com

Client: KILSARAN CONCRETE

Project: INCREASED INTAKE TO EXISTING SOIL RECOVERY FACILITY HALVERSTOWN, KILCULLEN, CO. KILDARE.

Figure Title: GSI WELLS MAP

Scale	SLR Project No.
1:25,000 @ A3	065158.00001

Designed	Drawn	Checked	Authorised
NB	NB	PG	PG
Date: 07/23	Date: 07/23	Date: 02/24	Date: 02/24

Figure Number: **FIGURE 7.5** Rev.: **0**

22/02/2024

S:\SLR Projects\00036 Kilsaran Concrete\065158 Halverstown Increase Waste Intake PA EIAR NIS\VLA\EIAR\Volume-2 EIAR Report Figs Appends\07 Water\Dwgs\CAD\Wking\00036.65158.Halverstown.EIAR-Fig7-5.GSI Wells Map_.dwg

CYAL5016488

APPENDICES

APPENDIX 7-A
Existing Septic Tank System

Trinity Green
Environmental Consultants

Clonfert
Maynooth
Co. Kildare
t: 01-6290616
m: 086-2434828
Vat No. 3251411B

Kildare County Council
Planning Department
Áras Chill Dara,
Devoy Park,
Naas,
Co Kildare.

27/07/2018

Response to Further Information Request: - Item No.12

Re: Planning Application Ref: 18453

Dear Sir/Madam

There is an existing on-site wastewater Treatment system. This caters for the existing facility where there are 8 full time and up to 10 part time workers. When all workers are on site the maximum number is 18 workers. Allowing 40 litres and 25 grams BOD /worker gives 720 litres and 450 grams BOD. If one PE is 150 litres and 60 grams BOD then this equates to 5 PE based on Hydraulic load and 8PE based on the organic load.

Under the current proposal there will be one additional worker on site. This will add 40 litres and 25 grams BOD to give a total of 760 litres and 475 grams BOD – equating to a PE of 6 based on Hydraulic Load and 8 based on Organic .

If a standard septic tank is used to treat this waste then the capacity is given as

C = 2000 + 150 x PE
C = 2000 (150 x 8)
C = 3200 litres

The site was visited and the septic tank inspected.
The Tank is 1.2m wide, 3m long with a working depth of 1.2m.
The capacity of the tank is therefore 4.32m^3

This shows there is more than sufficient capacity to cater for the additional load
The tank is a Block structure. The inlet is fitted with T-piece. The outlet was not visible. Level of water in the tank was at the level of the inlet showing the tank is structurally intact.

From a visual inspection of the area there is no evidence of any malfunction of the percolation area and there were no odours in the area of the tank. The nearest ditch is in excess of 30m away. It was dry on the day of inspection and there was no evidence of any ingress of liquid. It is also noted that the base of the ditch is over 5m below the ground level so the effluent would have to percolate through this depth of subsoil and would likely receive effective treatment

Signed .....
Dr. Eugene Bolton
Senior Consultant
Trinity Green

APPENDIX 7-B
EU Directives / Legislation / Regulations / Guidelines / Technical Standards

EUROPEAN DIRECTIVES

- Environmental Impact Assessment. Directive (2011/92/EU) on the assessment of the effects of certain public and private projects on the environment;
- Environmental Impact Assessment Directive (2014/52/EU) on the assessment of the effects of certain public and private projects on the environment;
- Water Framework Directive (2000/60/EC);
- Groundwater Directive (2006/118/EC);
- Flooding Directive (2007/60/EC)
- Integrated Pollution and Prevention Control Directive (2008/1/EC); and
- The management of waste from extractive industries (2006/21/EC).

IRISH GOVERNMENT ACTS, NATIONAL LEGISLATION AND REGULATIONS

- S.I. No. 349 of 1989, European Communities (Environmental Impact Assessment) Regulations, and subsequent amendments (S.I. No. 84 of 1994, S.I. No. 352 of 1998, S.I. No. 93 of 1999, S.I. No. 450 of 2000 and S.I. No. 538 of 2001);
- The Planning and Development Acts, 2000 to 2009, The Planning and Development (Amendment) Act 2010, S.I. 600 of 2001 Planning and Development Regulations and subsequent amendments including, S.I. No. 364 of 2005 and S.I. 685 of 2006.

National legislation on the protection of the water environment. Since 2000 water management in EU member states has primarily been directed by the Water Framework Directive (2000/60/EC) and the associate 'daughter' Groundwater Directive (2006/118/EC). Irish legislation implementing these, and other relevant directives currently includes:

- S.I. No. 9 of 2010 European Communities Environmental Objectives (Groundwater) Regulations 2010 and amendments (S.I. No. 389 of 2011 and S.I. No. 149 of 2012);
- European Union (Drinking Water) Regulations 2014 (S.I. No. 122 of 2014);
- S.I. No. 278 of 2007 European Communities (Drinking Water) (No. 2) Regulations;
- S.I. No. 272 of 2009 European Communities Environmental Objectives (Surface Waters) Regulations 2009 and amendment (S.I. No. 327 of 2012);
- S.I. No. 684 of 2007 Waste Water Discharge (Authorisation) Regulations, 2007, as amended (S.I. No. 231 of 2010);
- S.I. No. 122 of 2010 European Communities (Assessment and Management of Flood Risks) Regulations 2010;
- S.I. No. 457 of 2008 European Communities (Environmental Liability) Regulations which bring into force the European Liability Directive (2004/35/EC);
- European Union (Planning and Development) (Environmental Impact Assessment) (No. 2) Regulations 2018 (S.I. No. 404 of 2018);
- Local Government (Water Pollution) Acts 1977 to 1998;
- European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293 of 1988);
- European Communities (Quality of Shellfish Waters) Regulations, 2006 (S.I. No. 268 of 2006) and amendments (S.I No. 55 and 464 of 2009), and;

- Bathing Water Quality Regulations, 2008 (S.I. No. 79 of 2008) and amendments (S.I No. 351 of 2011 and S.I. No. 163 of 2016);

GUIDELINES

CIS (2007). Common Implementation Strategy (CIS) for the Water Framework Directive (2000/60/EC) Guidance on preventing or limiting direct and indirect inputs in the context of the Groundwater Directive 2006/118/EC. Guidance Document No. 17.

CIS (2010). Common Implementation Strategy (CIS) for the Water Framework Directive (2000/60/EC). Guidance on risk assessment and the use of conceptual models for groundwater. Guidance document No. 26.

DEHLG (2004). National Urban Waste Water Study. National Report.

DEHLG (2009). Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities.

DELG /EPA / GSI (1999). Groundwater Protection Schemes. Document prepared jointly by the Geological Survey of Ireland (GSI), the Environmental Protection Agency, and the Department of Environment, Heritage and Local Government.

EPA (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.

EPA (2010b). Methodology for Establishing Groundwater Threshold Values and the Assessment of Chemical and Quantitative Status of Groundwater, Including and Assessment of Pollution Trends and Trend Reversal.

EPA (2011). Guidance on the Authorisation of Discharges to Groundwater. Version 1, December 2011.

EPA (2003). Towards Setting Guideline Values for the Protection of groundwater in Ireland. Interim Report.

EPA (2006). Ireland Water Framework Directive Monitoring Programme.

Fitzsimons, V., Daly, D. and Deakin, J. (2003). Draft GSI guidelines for assessment and mapping of groundwater vulnerability to contamination. Groundwater Chapter, Geological Survey of Ireland.

GSI (2006). Criteria used in aquifer classification. Available from http://www.gsi.ie/Programmes/Groundwater/Aquifer+Classification.htm

IGI (2007). Guidelines on Water Well Construction. Available from http://www.igi.ie/assets/files/Water%20Well%20Guidelines/Guidelines.pdf

Kilroy, G., Dunne, F., Ryan, J., O'Connor, A., Daly, D., Craig, M., Coxon, C., Johnston, P. and Moe, H. (2008). A Framework for the Assessment of Groundwater – Dependent Terrestrial Ecosystems under the Water Framework Directive. Environmental Research Centre Report Series No. 12.

Institute of Geologists of Ireland, 2007. Recommended collection, presentation and interpretation of geological and hydrogeological information for quarry developments.

TECHNICAL STANDARDS

British Standards (2015). Code of Practice for Ground Investigations BS5930:2015;.

CIRIA (2007). The SuDS Manual. (C697). CIRIA publication, February 2007.

APPENDIX 7-C
Groundwater Quality Test Results

					2021															
BH ID					GW1				GW2				GW3				GW4			
Lab ID		SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (Drinking Water Regs)	EPA IGVs	195561	197200	207790	211742	195561	197200	207790	211742	195561	197200	207790	211742	195561	197200	207790	211742
Date					15/3/21	26/4/21	22/9/21	29/11/21	15/3/21	26/4/21	22/9/21	29/11/21	15/3/21	26/4/21	22/9/21	29/11/21	15/3/21	26/4/21	22/9/21	29/11/21
Visual Inspection - Field					Cloudy	Sediment	Brown/Cloudy	Brown/Very Turbid	Cloudy	Clear	Brown/Cloudy	Brown/Very Turbid	Sediment	Clear	Dark brown/Cloudy	Brown/Very Turbid	Cloudy	Clear	Pale/Yellow	Yellow/Very Turbid
Inorganics																				
Ammoniacal Nitrogen Low as NH3	mg/l	0.21245		0.1821	0.057		<0.1		0.24		0.25		<0.1		0.11		<0.1		0.13	
Phosphate (Ortho as PO4)	mg/l			0.03	<0.065		<0.065		<0.0065		<0.065		<0.065		<0.065		<0.065		<0.065	
pH	pH Units		6.5 - 9.5	6.5 - 9.5	7.1	7.05	7.47	6.44	7.81	8.22	8.49	8.11	7.3	7.12	7.62	6.72	8.5	8.27	8.41	7.79
Conductivity @ 20 deg.C	µS/cm	1857	2500	1000	593	590	698	753	334	149	177	184	930	895	732	977	121	102	112	138
Nitrite as NO2	mg/l				<0.05		<0.05		<0.05		<0.05		<0.05		<0.05		<0.05		<0.05	
Nitrate as NO3	mg/l	37.5	50	25	0.78		2.8		<0.5		5.8		21		38		0.6		<0.5	
Filtered (Dissolved) Metals																				
Cadmium (diss.filt)	µg/l	3.75	5	5	<5				<5				78				<5			
Chromium (diss.filt)	µg/l	37.5	50	30	<5				<5				9				<5			
Copper (diss.filt)	µg/l	1500	2000	30	<25				<25				86				<25			
Iron (Dis.Filt)	mg/l		0.2	0.2	0.45				1.7				55				2			
Lead (diss.filt)	µg/l	7.5	10	10	<25				<25				140				<25			
Manganese	ug/l		50	50	350				340				3600				92			
Magnesium	mg/l			50	7.4				5.9				30				<2.5			
Mercury (diss.filt)	µg/l	0.75	1	1	<0.25				<0.25				0.3				<0.25			
Nickel (diss.filt)	µg/l	15	20	20	35				<10				310				<10			
Zinc (diss.filt)	µg/l	75		100	<25				<25				550				<25			
Arsenic (diss.filt)	µg/l	7.5	10	10	<2.5				<2.5				13				<2.5			
EPH (Extractable Petroleum Hydrocarbons)																				
Petrol Range Organics (>C_6-C_{10})	µg/l				<10				<10				<10				<10			
Diesel Range Organics (>C_{10}-C_{21})	µg/l				<0.1				<0.1				<0.1				<0.1			
TPH Low Level (G0B)	µg/l	7.5			<0.1				<0.1				<0.1				<0.1			
Other																				
Total disolved solids	mg/l				296		428		182		100		644		440		<100		<100	

					2022													
BH ID					GW1				GW2				GW3				GW4			
Lab ID		SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (Drinking Water Regs)	EPA IGVs	214277	220867	227493	239764	214277	220867	227493	23964	214277	220867	227493	239764	214277	220867	227493	239764
Date					25/1/22	9/5/22	26/7/22	21/11/22	25/1/22	9/5/22	26/7/22	21/11/22	25/1/22	9/5/22	26/7/22	21/11/22	25/1/22	9/5/22	26/7/22	21/11/22
Visual Inspection - Field					Slight Turbidity	Light Brown/High Turbidity	Light Brown/Turbid	Dark Brown/Very Turbid	Turbid	Brown/High Turbidity	Brown/Very Turbid	Light Brown/Very Turbid	Very Turbid	Dark Brown/High Turbidity	Dark Brown/Very Turbid	Brown/Very Turbid	Turbid	Brown/High Turbidity	Light Brown/Very Turbid	Brown/Very Turbid
Inorganics																				
Ammoniacal Nitrogen Low as NH3	mg/l	0.21245		0.1821	<0.1		<0.1		0.11		0.16		<0.1		<0.1		0.12		0.15	
Phosphate (Ortho as PO4)	mg/l			0.03	0.011		<0.065		<0.01		<0.065		0.026		<0.065		<0.01		<0.065	
pH	pH Units		6.5 - 9.5	6.5 - 9.5	7	7.15	6.97	8.31	8.97	9.85	8.52	6.86	7.11	7.07	7.13	8.99	7.5	9.12	8.54	6.84
Conductivity @ 20 deg.C	µS/cm	1857	2500	1000	700	574	547	617	189	136	157	221	1206	745	684	1126	418	197	117	184
Nitrite as NO2	mg/l				<0.05		<0.05		<0.05		<0.05		<0.04		<0.05		<0.05		<0.05	
Nitrate as NO3	mg/l	37.5	50	25	2		6.6		9.5		1.2		34		33		1.1		0.73	
Filtered (Dissolved) Metals																				
Cadmium (diss.filt)	µg/l	3.75	5	5	<5				<5				36				6			
Chromium (diss.filt)	µg/l	37.5	50	30	<5				54				370				64			
Copper (diss.filt)	µg/l	1500	2000	30	<25				75				430				49			
Iron (Dis.Filt)	mg/l		0.2	0.2	2				61				259				53			
Lead (diss.filt)	µg/l	7.5	10	10	<25				52				570				48			
Manganese	ug/l		50	50	8800				1400				17000				2200			
Magnesium	mg/l			50	0.88				10				66				18			
Mercury (diss.filt)	µg/l	0.75	1	1	<0.25				0.53				<0.25				<0.25			
Nickel (diss.filt)	µg/l	15	20	20	35				230				990				210			
Zinc (diss.filt)	µg/l	75		100	62				350				2700				290			
Arsenic (diss.filt)	µg/l	7.5	10	10	8.9				14				<2.5				11			
EPH (Extractable Petroleum Hydrocarbons)																				
Petrol Range Organics (>C_6-C_{10})	µg/l				<10				<10				<10				<10			
Diesel Range Organics (>C_{10}-C_{21})	µg/l				<0.1				<0.1				<0.1				<0.1			
TPH Low Level (G0B)	µg/l	7.5			<0.1				<0.1				<0.1				<0.1			
Other																				
Total disolved solids	mg/l				432		336		136		112		932		480		280		<100	

					2023															
BH ID					GW1				GW2				GW3				GW4			
Lab ID		SI No 366 of 2016 (GW Regs)	SI No 122 of 2014 (Drinking Water Regs)	EPA IGVs	247082	257718	267366	270171	247082	257718	267366	270171	247082	257718	267366	270171	247082	257718	267366	270171
Date					26/1/23	22/5/23	28/9/23	24/10/23	26/1/23	22/5/23	28/9/23	24/10/23	26/1/23	22/5/23	28/9/23	24/10/23	26/1/23	22/5/23	28/9/23	24/10/23
Visual Inspection - Field					Light Brown, High Turbidity	Yellow/brown, SS present, High Turbidity	Clear/Sand	Clear	Light Brown, High Turbidity	Yellow/brown, SS present, High Turbidity	Brown/Very Turbid	Cloudy, Yellow, High Turbidity	Brown, High turbidity	Light brown, SS present, High Turbidity	Cloudy/Slightly Turbid	Cloudy, Medium Turbidity, No Solids	Brown, Medium turbidity	Dark brown, SS present, High Turbidity	Cloudy/Slightly Turbid	Cloudy, Medium Turbidity, No Solids
Inorganics																				
Ammoniacal Nitrogen Low as NH3	mg/l	0.21245		0.1821	<0.1		0.13		0.28		0.16		<0.1		<0.1		<0.1		0.32	
Phosphate (Ortho as PO4)	mg/l			0.03	<0.065		<0.065		<0.065		<0.065		<0.065		<0.065		<0.065		<0.065	
pH	pH Units		6.5 - 9.5	6.5 - 9.5	6.89	7.22	6.7	6.9	7.75	9.9	7.8	7.7	7.24	7.13	7	7.1	8.57	8.54	8	8.3
Conductivity @ 20 deg.C	µS/cm	1857	2500	1000	657	1068	724	730	385	210	262	268	1104	1217	1071	609	119	185	132	142
Nitrite as NO2	mg/l				<0.05		<0.05		<0.05		<0.05		<0.05		0.16		0.082		<0.05	
Nitrate as NO3	mg/l	37.5	50	25	0.69		2		<0.5		<0.5		27		30		1.1		<0.5	
Filtered (Dissolved) Metals																				
Cadmium (diss.filt)	µg/l	3.75	5	5	<5				<5				<5				<5			
Chromium (diss.filt)	µg/l	37.5	50	30	<5				<5				<5				<5			
Copper (diss.filt)	µg/l	1500	2000	30	<25				<25				<25				<25			
Iron (Dis.Filt)	mg/l		0.2	0.2	0.053				0.42				<0.1				<0.1			
Lead (diss.filt)	µg/l	7.5	10	10	<2.5				<2				<2.5				<2.5			
Manganese	ug/l		50	50	<10				580				<10				<10			
Magnesium	mg/l			50	7.2				11				14				<2.5			
Mercury (diss.filt)	µg/l	0.75	1	1	<0.25				<0.25				<0.25				<0.25			
Nickel (diss.filt)	µg/l	15	20	20	22				<10				22				<10			
Zinc (diss.filt)	µg/l	75		100	<25				<25				<25				<25			
Arsenic (diss.filt)	µg/l	7.5	10	10	<2.5				<2.5				<2.5				<2.5			
EPH (Extractable Petroleum Hydrocarbons)																				
Petrol Range Organics (>C_6-C_{10})	µg/l				<10				<10				<10				<10			
Diesel Range Organics (>C_{10}-C_{21})	µg/l				<0.1				<0.1				<0.1				<0.1			
TPH Low Level (G0B)	µg/l	7.5			<0.1				<0.1				<0.1				<0.1			
Other																				
Total disolved solids	mg/l				396		424		228		164		744		808		100		404	

APPENDIX 7-D
Rating of Existing Environment Significance / Sensitivity

RATING OF EXISTING ENVIRONMENT SIGNIFICANCE / SENSITIVITY

(IGI, 2013 GUIDELINES)

Importance	Criteria	Typical Example
High	Attribute has a high quality or value on an international scale	Groundwater/ Surface Water supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status
	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 >2,500 homes Inner source protection area for regionally important water source. Drinking water supply from river. Amenity use of waterbody
	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. No specific recreational use of waterbody
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer. Potable water source supplying <50 homes. No water supply from surface water, no abstraction designation for watercourse No amenity value of waterbody
Negligible	Attribute has negligible quality or value on a local site scale	No groundwater supply from a bedrock aquifer inn vicinity of site. Surface water not used for any specific purpose.

APPENDIX 7-E
Descriptions of Effects (EPA, 2022)

DESCRIPTIONS OF EFFECTS (EPA, 2022)

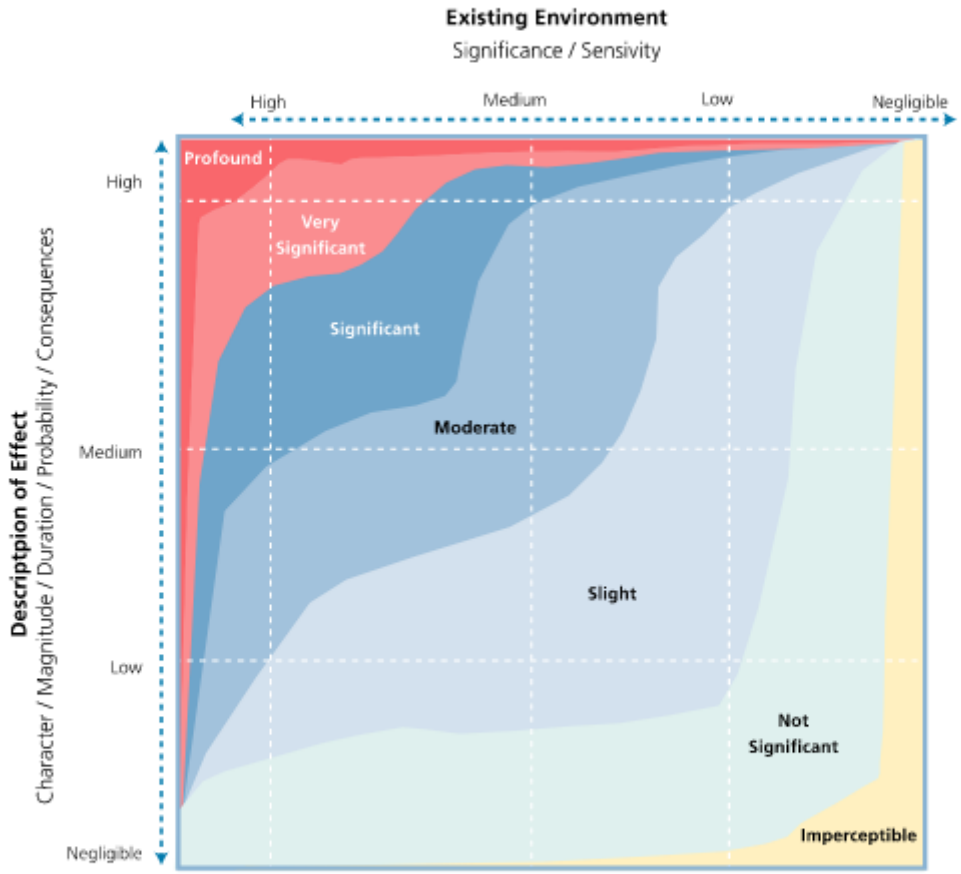
Impact Characteristic	Term	Description
Quality of Effects	Positive Effects	A change which improves the quality of the environment
	Neutral Effects	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error
	Negative / Adverse Effects	A change which reduces the quality of the environment
Describing the Significance of Effects	Imperceptible	An effect capable of measurement but without significant consequences
	Not significant	An effect which causes noticeable2 changes in the character of the environment but without significant consequences.
	Slight Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
	Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
	Significant Effects	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
	Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
	Profound Effects	An effect which obliterates sensitive characteristics
Describing the Extent and Context of Effects	Extent	Describe the size of the area, the number of sites, and the proportion of a population affected by an effect
	Context	Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions (is it the biggest, longest effect ever?)
Describing the Probability of Effects	Likely Effects	Describe the size of the area, the number of sites, and the proportion of a population affected by an effect.
	Unlikely Effects	Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions (is it the biggest, longest effect ever?)
Describing the Duration and	Momentary Effects	Effects lasting from seconds to minutes
	Brief Effects	Effects lasting less than a day

Impact Characteristic	Term	Description
Frequency of Effects	Temporary Effects	Effects lasting less than a year
	Short-term Effects	Effects lasting one to seven years
	Medium-term Effects	Effects lasting seven to fifteen years
	Long-term Effects	Effects lasting fifteen to sixty years
	Permanent Effects	Effects lasting over sixty years
	Reversible Effects	Effects that can be undone, for example through remediation or restoration
	Frequency of Effects	Describe how often the effect will occur. (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually.
Describing the Types of Effects	Indirect / Secondary Effects	Likely, significant effects on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway.
	Cumulative Effects	The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects.
	Do-Nothing Effects	The environment as it would be in the future should the subject project not be carried out.
	Worst Case Effects	The effects arising from a project in the case where mitigation measures substantially fail.
	Indeterminable Effects	When the full consequences of a change in the environment cannot be described.
	Irreversible Effects	When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.
	Residual Effects	The degree of environmental change that will occur after the proposed mitigation measures have taken effect.
	Synergistic Effects	Where the resultant effect is of greater significance than the sum of its constituents, (e.g. combination of SOx and NOx to produce smog).

APPENDIX 7-F
Classification of the Significance of Impacts

Determining Significance

Figure 3.4 shows how comparing the character of the predicted effect to the sensitivity of the receiving environment can determine the significance of the effect.



There are seven generalised degrees of effect significance that are commonly used in EIA. Imperceptible, Not Significant, Slight, Moderate, Significant, Very Significant and Profound. Generalised definitions of each of these are provided in Table 3.4. When more specific definitions exist within a specialised factor or topic, e.g. biodiversity, these should be used in preference to these generalised definitions. (ref. Advice Notes[68].)

(Source: Figure 3.4 Environmental Protection Agency (May 2022), *'Guidelines on the Information to be contained in Environmental Impact Assessment Reports'*).