Chapter 9

Water

9.0 WATER

9.1 INTRODUCTION

This chapter of the EIAR was prepared by Niall Mitchell BE, MSc, CEng, MIEI, PGeo. Niall is a Chartered Engineer and Professional Hydrogeologist with Bluerock Environmental Limited. Niall has over 22 years experience in the field of hydrogeology, contaminated land, environmental impact for a range of medium to large-scale infrastructural projects across the island of Ireland. He has extensive experience in the assessment impacts on the water environment from landfills, residential and commercial developments, quarries and proposed groundwater abstractions. This chapter was reviewed by Laura McLoughlin BEng(Hons), CEng, MEI, Associate Civils with DBFL Consulting Engineers. Laura has over 10 years' experience working in civil engineering consultancies managing projects from inception to handover under the NI Framework for Small Sewerage Schemes, infrastructure design and drainage sustainability in residential and commercial developments.

This chapter includes an impact assessment on the hydrogeological and hydrological environments as a result of current/proposed site activities and the proposed development. A site visit was undertaken by BlueRock Environmental Limited and observations recorded are incorporated into the text of this chapter.

This chapter of the EIAR assesses the impact on the hydrogeological and hydrological environments of the proposed development site. The objectives are:

- To describe the baseline hydrogeological and hydrological conditions across the footprint of the site and its general environs;
- To assess the potential impacts of the proposed development on the associated hydrogeological and hydrological regimes; and,
- To provide for appropriate mitigation measures for any identified likely potential significant impacts, if deemed necessary.

9.2 STUDY METHODOLOGY

The assessment was undertaken to evaluate potential environmental impacts on the hydrological and hydrogeological environments by undertaking the following:

- A desk-based study of all available hydrological and hydrogeological information in relation to the site and its general environs;
- A review of the spatial layout and characteristics of the proposed development;
- A review of construction and operational phase activities associated with the proposed development; and,

The assessment also provides appropriate mitigation measures to avoid, prevent or reduce any potential adverse impacts on the hydrological and hydrogeological environments and details residual impacts following mitigation, if any.

The following sources of information were used in the compilation of this assessment:

- Ordnance Survey of Ireland (OSI), Discovery Series, Sheet 43;
- Ordnance Survey of Ireland online historical maps and aerial photographs;
- Geology of Meath, Geological Survey of Ireland (GSI) (1:100,000), Sheet 13;
- GSI - On-line Geology Database. Aquifer Classification, Aquifer Vulnerability;
- GSI - Lusk-Bog of the Ring Groundwater Body (GWB);
- GSI - Groundwater Source Protection Zones - Bog of the Ring;

- Soil Map of Ireland (Second Edition, 1980), National Soil Survey of Ireland, An Foras Talúntais.
- National Parks and Wildlife Service (NPWS) on-line database (www.npws.ie);
- Environmental Protection Agency (EPA) online water quality mapping; (https://gis.epa.ie/EPAMaps/);
- Water Framework Directive (WFD)
- OPW hydro-data (http://www.opw.ie/hydro-data);
- Met Eireann monthly climatological data (https://www.met.ie/);
- Appropriate Assessment Screening & Natura Impact Statement - Information for a Stage 1 (AA Screening) and Stage 2 (Natura Impact Statement) AA for a strategic housing development at a site located at Hacketstown in the townland of Milverton, Skerries, Co. Dublin (Altemar Marine and Environmental Consultancy, 2020).
- Environmental Report for pre-application consultation with An Bord Pleanála, John Spain Associates (JSA, 2020);DBFL Consulting Engineers Construction Drawings (DBFL, 2020);
- Ground Investigations Ireland Waste Classification & Groundwater Assessment Report (GII, 2020);
- Ground Investigations Ireland Ground Investigation Report Southern Greenfield Site (GII, 2020a).

This chapter was undertaken in accordance with the following:

- Guidelines on the information to be contained in Environmental Impact Statements (EPA, 2002),
- Geology in Environmental Impact Statements, A Guide, (IGI, 2002),
- Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, NRA Document.
- Guidelines for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (IGI, 2013),
- Draft EPA revised Guidelines on information to be contained in Environmental Impact Statements; and Advice Notes for preparing EIS, 2015.
- Draft EPA Advice Notes for Preparing Environmental Impact Statements (EPA, 2017).
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (published in August 2018).
- Guidelines on Environmental Impact Assessment issued by the European Commission in 2017.

9.3 THE EXISTING RECEIVING ENVIRONMENT (BASELINE SITUATION)

9.3.1 Site Location and Context

The project site is located to the south of Skerries town centre, Hacketstown, in the townlands of Milverton, Hacketstown and Townparks, Co. Dublin. The lands are bound to the north by residential areas now completed at Ballygossan Park Phase 1 and lands that are proposed for future residential development at Ballygossan Phase 2, to the west by the Dublin – Belfast railway line, to the east by Golf Links Road and to the south which currently comprise agricultural fields. The project lands fall to north towards the existing drainage ditch which traverses the site along the northern boundary west to east.

9.3.2 Proposed Development

The development entails 345 no. residential units comprising of 84 no. 1-bed units, 104 no. 2-bed units (68 no. 2-bed apartments and 36 no. 2-bed duplexes), 157 no. 3-bed units (118 no. 3-bed duplexes and 39 no. 3 - bed houses) ranging in height from 2 no. – 4 no. storeys on a site of 6.7 ha. located at Hacketstown in the townlands of Milverton, Townparks and Hacketstown, Skerries, Co. Dublin. The subject lands are accessed via Golf Links Road to the south and Ballygossan Park Phase 1 to the north. The development entails 345 no. residential units comprising of 84 no. 1-bed units, 93 no. 2-bed units (66 no. 2-bed apartments and 27 no. 2-bed duplexes), 167 no. 3-bed units (128 no. 3-bed duplexes and 39 no. 3 - bed houses) ranging in height from 2 no. – 4 no. storeys on a site of 6.7 ha. located at Hacketstown in the townlands of Milverton, Townparks and Hacketstown, Skerries, Co. Dublin.

All associated site development and infrastructural works including amenity spaces, landscaping, open space, boundary treatments, vehicular parking, bicycle parking, utilities, internal roads, footpaths and shared surfaces, playground, site clearance and temporary construction development.

The proposed development will require alteration of ground levels. Excavation of soil and subsoil, as well as existing made ground will be required for the proposed development in preparation of a suitable sub-formation for road construction, trenching for foul and surface water infrastructure and other services.

9.3.3 Topography

The regional topographical relief is mostly low lying and falls to the east. The subject lands are located on a relatively topographical flat area at approximately 20 meters above ordnance datum (mOD).

Within the subject lands, ground levels fall in a northeasterly direction across the site from between 24.5 and 25.0 mOD along the southern site boundary to the northern boundary at an elevation of approximately 15.0 mOD. The drainage channel lies at 14.8 mOD in the west of the site and 14.1 in the east of the site.

9.3.4 Land Use and Site History

The land cover is currently agricultural and the surrounding lands to the west, south and the east also comprise agricultural land cover. A review of the online OSI historical mapping indicates that the subject lands have comprised of agricultural land cover throughout the 19th and 20th century.

- The 6-inch Cassini map denotes “Rises” in the northwestern region of the site, indicating that a spring was once present in the area. The current GSI wells and spring mapping does not indicate any springs within the site boundary.
- The Historic Map 25 inch (1888-1913) indicates that the closest well to the site was located approximately 120m to the south of the southern site boundary, on the eastern boundary of the rail line.
- All OSI historical mapping outlines a quarry located to the west of the site. This quarry is currently owned by Roadstone Milverton.

9.3.5 2020 Site Investigation

A site investigation was undertaken by Ground Investigations Ireland in June 2020 across the proposed site. The following activities relevant to this chapter were undertaken:

- Excavation of 18 no. trial pits to a maximum depth of 4.0m;
- Drilling of 7 no. Shell & Auger boreholes to a maximum depth of 7.10m;
- Drilling of 3 no. Rotary boreholes to a maximum depth of 17.2m;
- Installation for 4 no. Monitoring wells within selected boreholes;
- Groundwater level monitoring;
- Soil and Groundwater Sampling for chemical testing; and
- Infiltration testing in 5 no. soakaway pits to determine soil infiltration properties.

9.3.6 Subsoils and Bedrock

A detailed description of the underlying subsoils and bedrock is provided in Chapter 8. In summary, the GSI maps indicate that the site is underlain by Gravels derived from Lower Palaeozoic sandstones and shales. These subsoils are mapped as having High permeability. Alluvium is mapped along the course of the adjacent ditch on the northern boundary of the site.

Ground Investigation Report (GII, 2020a) indicates that the cohesive subsoils under a layer of topsoil (0.5 metres in thickness) are comprised of brown sandy gravelly CLAY or silty CLAY with occasional cobbles and boulders. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. Granular deposits were encountered within the cohesive deposits and typically described as grey or brown clayey sandy sub rounded to sub angular fine to coarse GRAVEL or gravelly fine to coarse SAND.

Made Ground deposits were not prominent and were only encountered in TPI17 and TP10 to a maximum depth of 1m BGL that was described generally as brown slightly sandy slightly gravelly Clay.

The closest bedrock outcrop is mapped at approximately 300m to west and north of the site respectively.

The Ground Investigation Report (GII, 2020a) recorded depth to bedrock across the site within 3 no. rotary core boreholes (i.e. RC08, RC09 and RC10) was 9.8, 13.2 and 17.2 mbgl respectively, with possible weathered rock recorded at 14.6 mbgl in RC10.

9.3.7 Regional Aquifer Classification

The GSI has devised a system for classifying the aquifers in Ireland based on the hydrogeological characteristics, size and productivity of the groundwater resource into the National Draft Bedrock Aquifer Map. The three main classifications are Regionally Important Aquifers, Locally Important Aquifers, and Poor Aquifers. Each of these types of aquifer is further subdivided and has a specific range of criteria associated with it, such as the transmissivity (m^2/day), productivity, yield, and the potential for springs.

According to the GSI Aquifer Map the subject lands and surrounding area is underlain by a Locally Important Karstified Aquifer (Lk) (Figure 9.1). This aquifer classification indicates a smaller continuous area than regional karstified aquifers (<c.25m^2). The aquifer can supply ‘excellent’ yields but the small area limits the amount of recharge available to meet abstractions.

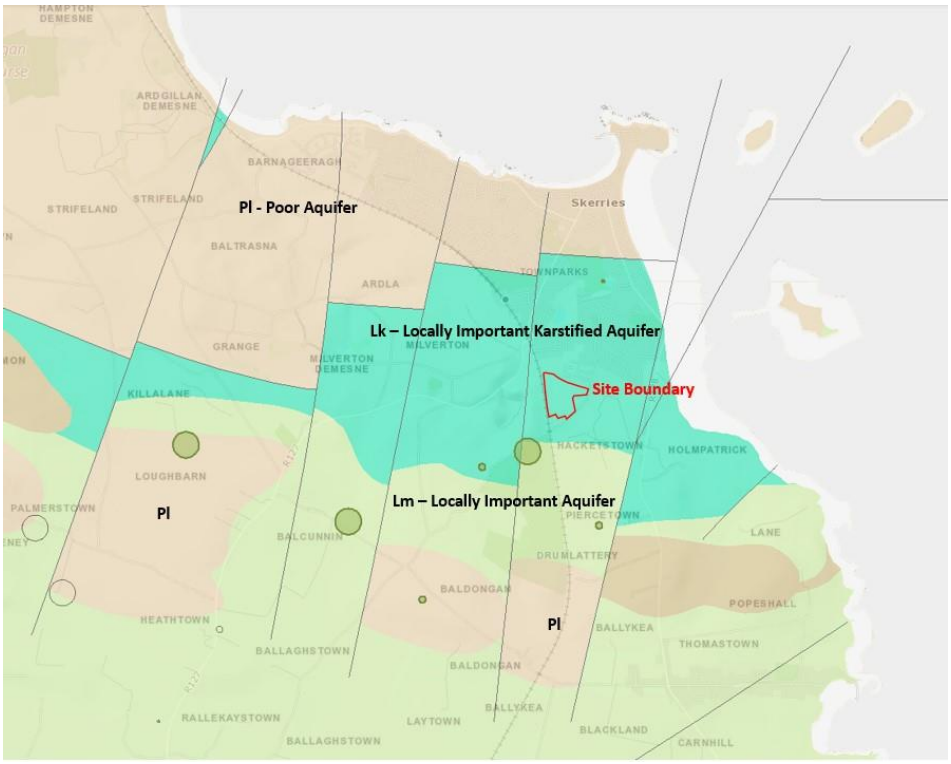

Figure 9.1 Aquifer Classification

9.3.8 Aquifer Characteristics

There are no Groundwater Protection Scheme summary reports or Groundwater Quality reports for Co. Dublin. There is a GSI source protection zone report for the Bog of the Ring public water supply wells, located between 6.4 and 10km west-northwest of the site and any salient information from this report is included in this assessment. It is noted that the Bog of the Ring public water supply wells outer source protection zone is 3.5km to the west of the western site boundary, and the inner source protection zone is 6.9km northwest of the western site boundary.

The site is located within the Lusk Groundwater Body (GWB). This GWB extends east from Dunshaughlin in Meath towards the coast of north Dublin. The hydrogeology reported to be strongly related to the structural deformation associated with the faulting in the area. Along the northern boundary of the GWB, there is a large fault that runs east-west and separates the Lower Palaeozoic Rocks of the Balbriggan Inlier to the north from the limestones to the south. The faulting has fractured the limestones in the area, making them susceptible to karstification.

There are no karst features mapped by the GSI within the Hacketstown area. The GSI groundwater well data base indicates that the wells within 3km of the site are capable of good to excellent yields (109 to 1091 m^3/d). The subject lands are underlain by Dinantian Pure Bedded Limestones which make up only 5.7% of the Lusk GWB.

9.3.9 Aquifer Vulnerability

The GSI classify aquifer vulnerability as the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities. The vulnerability of groundwater depends on the ability of contaminants to migrate to the underlying aquifer which is dependant predominantly on the permeability and thickness of the subsoils overlying the groundwater body and the types of recharge source (i.e. diffuse or point source). Under the GSI groundwater vulnerability classification scheme the mapped vulnerability at a location applies to the shallowest groundwater target (i.e. aquifer) at the location.

Aquifer vulnerability is largely dependent on overburden thickness and the inherent permeability of the bedrock. If bedrock is near or exposed at the surface the groundwater classification will be extreme. A detailed description of the groundwater vulnerability categories can be found in the Groundwater Protection Schemes document (DELG / EPA / GSI, 1999) (Table 9.1) and in the draft GSI Guidelines for Assessment and Mapping of Groundwater Vulnerability to Contamination (Fitzsimons et al, 2003).

The GSI maps indicate that the groundwater vulnerability at the site and the surrounding area is rated as **H (High)** due to the high permeability of the overlying subsoil (Figure 9.2). The area to the northwest of the site has an Extreme vulnerability rating.

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)**	**(<30m 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 values cannot be given at present (3) Release point of contaminants is assumed to be 1-2m below ground surface					

Table 9.1 Vulnerability Mapping Criteria (adapted from DELG / EPA / GSI, 1999)

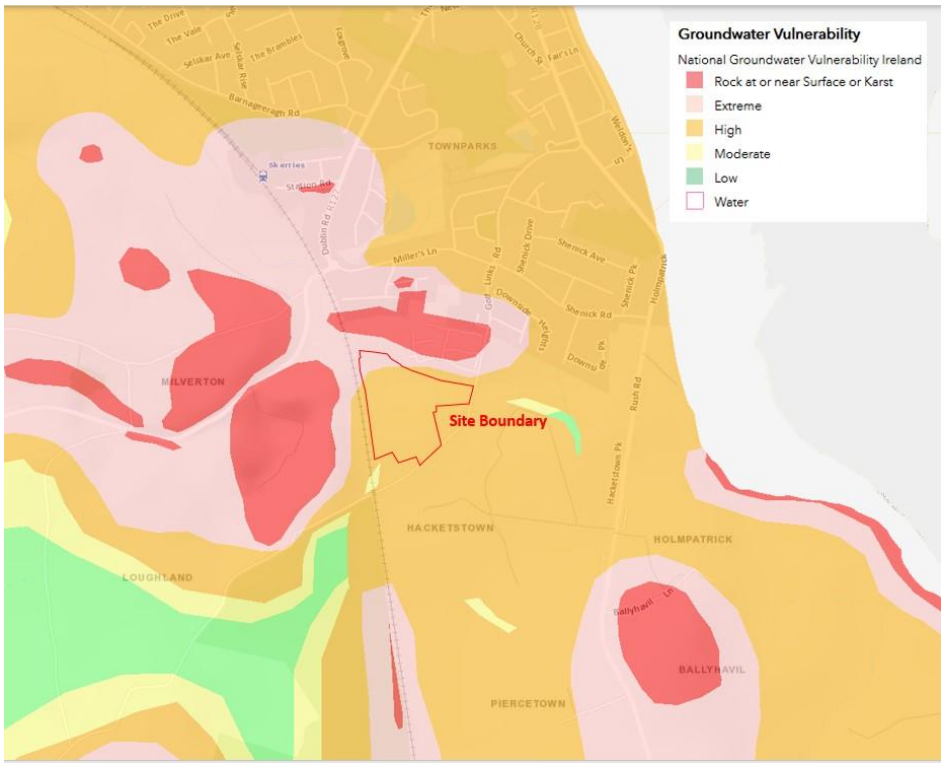

Figure 9.2 Groundwater Vulnerability Mapping

9.3.10 Water Framework Directive (WFD) Status – Groundwater

The ground waterbody WFD status (2013 – 2018) results are based on the assessment of groundwater chemical and quantitative figures in Ireland. This is drawn from representative monitoring points selected specifically for the WFD groundwater monitoring programme. The Lusk GWB (IE_EA_G_014) overall ground waterbody status is 'Good' and the ground waterbody risk classification is 'Not at risk' of deviating from the overall environmental objectives.

9.3.11 Groundwater Levels and Flow Direction

The nature of groundwater flow in this aquifer within the Lusk GWB will be determined by the degree of karstification and fracturing and the purity of the limestones. Where there is a highly karstified limestone flow will be concentrated into conduits, which may draw water very deep underground. Where the limestone is not as karstified the flow systems will be shallower and more diffuse. Although groundwater will still flow mainly along fractures, there will not have been the large-scale dissolution of the rocks to convert these into large conduits and groundwater flow will be less likely to take place at depths below 30m. In most of the area groundwater flow will be unconfined.

The Ground Investigation Report borehole logs (GII, 2020a) indicate that groundwater strikes occurred in the majority of the boreholes both in the clay and on encountering, or within, granular deposits of gravel or sand. The groundwater strikes were recorded within 6 no. of wells located within the site boundary, at depths of between 2.1 and 2.9 mbgl (16.9 and 13.5 mOD). The water strikes within all wells rose up by between 0.1 and 0.4m after 20 minutes.

Groundwater monitoring wells were installed within 4 no. of wells across the site, these included wells BH03, BH05, BH07 and RC09 (Figure 9.3). Manual dip water levels suggest that groundwater is flowing from south to north across the site based on one round of monitoring data (Table 9.2). The groundwater levels within BH03 (15.4 mOD),

the closest monitoring well to the adjacent ditch, are at a slightly higher level to the surface elevation of the ditch (approximately 14.8 mOD) and appear to indicate that groundwater is hydraulically connected to the ditch (Figure 9.3).

Two (2 no.) monitoring wells in the site to the north of the subject lands (BH102 and BH103) are insufficient for interpreting groundwater flow direction to the north of the drain. However, the levels recorded within these wells suggest that that groundwater flow to the north of the subject site is flowing in a southerly direction towards the ditch suggesting that the ditch is a localised sink or groundwater divide.

Monitoring Well	Ground Elevation (mOD)	Groundwater (mBGL)[1]	Groundwater (mOD)
BH03	16.41	0.97	15.4
BH05A	20.94	2.66	18.3
BH07	19.02	0.97	18.1
RC09	25.01	5.15	19.9

[1]Groundwater manual dips taken on 20/05/2020 Ground Investigations Ltd, dry weather for several weeks prior to recorded dips.

Table 9.2 Groundwater Levels

Figure 9.3 Groundwater Levels 20th May 2020

9.3.12 Groundwater Recharge

The GSI groundwater recharge map provides an estimate of the average amount of rainwater that percolates down through the subsoils to the water table over a year. The groundwater recharge map is derived from existing hydrogeological and meteorological spatial datasets. The main hydrogeological controls on groundwater recharge include the permeability and thickness of superficial deposits, the presence of saturated soils, and the ability of the

underlying aquifer to accept percolating waters. Combinations of these factors are assessed, and a 'recharge coefficient' established for different hydrogeological scenarios.

The GSI recharge map indicates the average recharge from the subject lands is 327 mm/year with a recharge coefficient of 85% (due to high permeability subsoil overlain by well-drained soil). The recharge will be diffuse in nature due to the permeability of the topsoil and subsoil.

Soil infiltration rates were assessed as part of the site investigation, the assessment was undertaken by excavating trial pits based on the requirements of BRE Digest 365 and CIRIA SuDS Manual C753.

The infiltration tests were used to determine the infiltration rate applicable to SuDS features for the calculation of interception storage. An infiltration rate of 29.52 mm/hr was calculated for the soakaway location TPI16, on the subject site. For all other soakaway locations, the infiltration rate could not be calculated due to the water level drop being too slow. Therefore the surface water design strategy incorporates partial infiltration design on all SuDS features.

9.3.13 Regional Groundwater Quality

The hydrochemical analyses of groundwater within the Lusk GWB, as reported by the Geological Survey of Ireland (GSI) indicate a very hard water (355 - 435 mg/l (CaCO3)), with a high alkalinity (310 - 325 mg/l (CaCO3)). Electrical conductivities are also elevated ranging between 520 and 810 µS/cm. Alkalinity values range from 200 to 350mg/l with the majority of values around 300mg/l. This groundwater can be classed as a calcium bicarbonate water. Information gathered from Catchments.ie - waterbody chemistry data.

9.3.14 Local Groundwater Quality

Groundwater samples were collected on the 20th May 2020 from two wells on-site i.e. BH07 and RC09. The field records did not observe any odour or visual evidence of contamination. The laboratory analytical results for the two wells did not indicate any contamination of the underlying aquifer. The following elevated level were noted:

- The level of Manganese recorded within BH07 (161 µg/l) exceed the EPA IGV[1] (50 µg/l). The elevated level of Manganese is anticipated to be naturally occurring.
- Trace levels of Pyrene (0.03 µg/l) were detected within BH07 (no threshold). The source of the trace levels of Pyrene is unclear.

9.3.15 Water Abstraction

It is understood that the development will be connected to the public water mains. During the Ballygossan Park Development construction, a watermain spur was installed for future connection. The 150mm diameter water connection provided was deemed to be suitable for the development by Irish Water (JSA, 2020). Therefore, no abstraction from groundwater for water supply purposes is anticipated during the construction or operational phase of the development.

9.3.16 GSI Well Database

Groundwater wells and springs within 3km of the site are outlined in Table 9.3 and presented on Figure 9.4. These data indicate that good to excellent yields are possible from wells constructed in the Locally Important Karstified Bedrock Aquifer (Lk), the Bedrock Aquifer, Generally Moderately Productive (Lm), and the Poor Bedrock Aquifer, Moderately Productive only in Local Zones (Pl).

[1] Environmental Protection Agency Interim Guideline Values (2003)

GSI Name	Well Type	Depth (m)	Bedrock depth (m)	Well Use	Yield Class	Yield m^3d
3225NWW005	Spring	n/a	n/a	Unknown	Unknown	Unknown
3225SWW001	Borehole	31.4	7	Agri & domestic	Excellent	440
3225SWW002	Borehole	43.6		Agri & domestic	Good	109
3225SWW015	Borehole	91	13.7	Unknown	Excellent	1091
3225SWW016	Borehole	91.4	18.2	Unknown	Excellent	490
3225SWW033	Borehole	57	24	Bog of the Ring Public water supply*	Excellent	540
3225SWW036	Borehole	104	8.5	Agri & domestic use	Unknown	Unknown
* The GSI records indicate this well is 3.7km west-southwest of the site outside the Bog of Ring source protection zone. The Bog of Ring Source Protection Zone report indicates this is a trial well.						

Table 9.3 GSI Well Database within 3km of the site

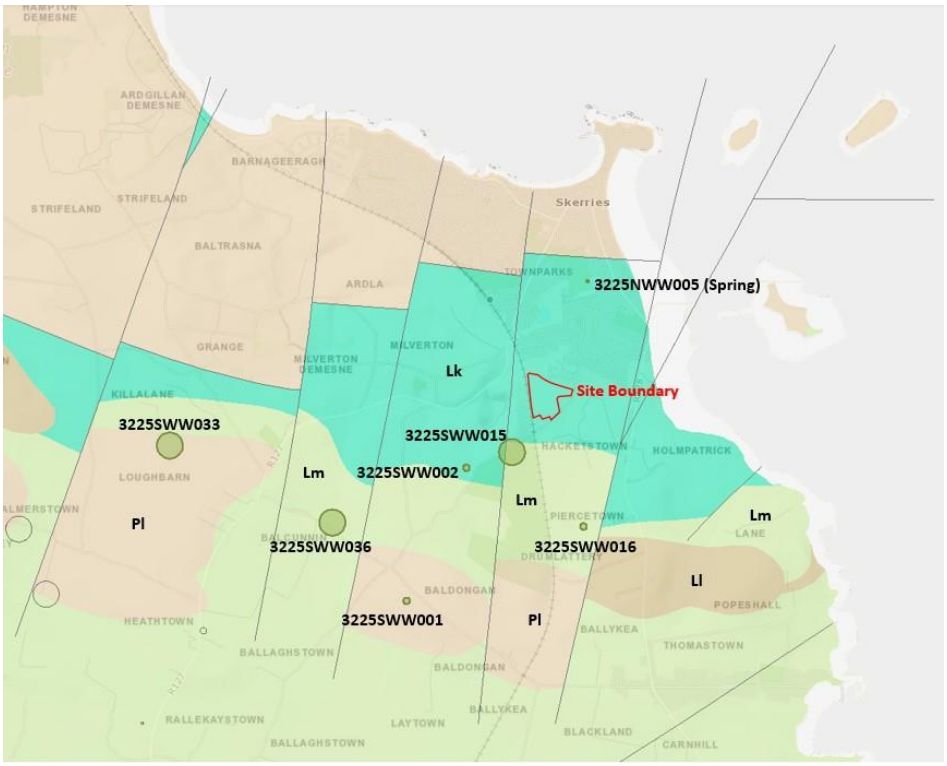

Figure 9.4 GSI Wells and Springs within 3km of the site in the Lusk GWB

9.3.17 EPA/GSI Source Protection Zones

As reported by the EPA and GSI, groundwater sources, particularly public, group scheme and industrial supplies, are of critical importance in many regions. Consequently, the objective of source protection zones is to provide protection by placing tighter controls on activities within all or part of the zone of contribution (ZOC) of the source.

There are two main elements to source protection land surface zoning:

1. Areas surrounding individual groundwater sources; these are termed source protection areas (SPAs); and,

2. Division of the SPAs on the basis of the vulnerability of the underlying groundwater to contamination.

These elements are integrated to give the source protection zones. Two source protection areas are recommended for delineation:

1. Inner Protection Zone (SI). This area is designed to protect against the effects of human activities that might have an immediate effect on the source and, in particular, against microbial pollution. The area is defined by a 100-day time of travel (TOT) from any point below the water table to the source. In karst areas, it will not usually be feasible to delineate 100-day TOT boundaries, as there are large variations in permeability, high flow velocities and a low level of predictability. In these areas, the total catchment area of the source will frequently be classed as SI.
2. Outer Protection Zone (SO), encompassing the remainder of the groundwater source catchment area or Zone of Contribution (ZOC). It is defined as the area needed to support an abstraction from long-term groundwater recharge i.e. the proportion of effective rainfall that infiltrates to the water table.

The Bog of the Ring Public Water Supply comprises 4 no. abstraction wells. The combined abstractions have delineated SI and SO protection zones, with the SO located 3.5km to the west, and the SI located 6.9km northwest, from the subject site development (Figure 9.5)

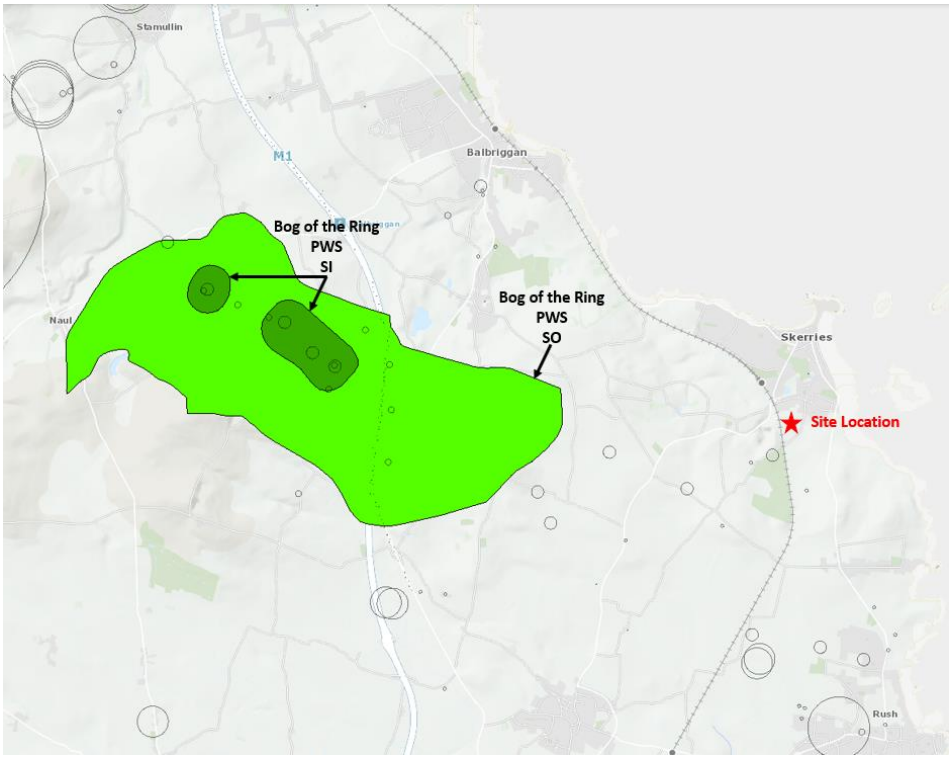

Figure 9.5 Bog of the Ring Public Water Supply Protection Zones

9.3.18 Hydrology

The subject lands are located within the Nanny-Delvin Catchment in Hydrometric Area 08. This catchment includes the area drained by the Rivers Nanny and Delvin and by all streams entering tidal water between Mornington Point and Sea Mount, Co. Dublin, draining a total area of 711km². The largest urban centre in the catchment is Swords. The other main urban centres in this catchment include Skerries and the nearby Lusk and Balbriggan. The total population of the catchment is approximately 159,230 with a population density of 224 people per km². This catchment is characterised by an undulating landscape, underlain for the most part by impure limestones and shales

with metamorphic bedrock underlying the northern part of the catchment. There are no significant sand or gravel aquifers in the catchment (https://catchments.ie).

The subject lands are located within the subcatchment Palmerstown_SC_010 (Code 08_2). The subject site is drained by a ditch which is located along the norther boundary of the site. All surface water runs off to this watercourse which comprises an open agricultural ditch that varies in depth to a maximum depth of 1.8 metres.

This watercourse drains eastwards to an existing unnamed stream before discharging to the Irish Sea approximately 700m to the east of the subject lands. The head of the drain commences to the east of the railway embankment and flows in an easterly direction before eventually discharging to the Irish Sea at Skerries South beach. Mill Stream rises approximately 3km to the west of the site and flows eastwards discharging to the Irish Sea at Skerries South Beach. The land drain and Mill Stream are not hydraulically connected with the railway embankment acts as a high point between both surface water bodies.

9.3.19 Water Framework Directive (WFD) Status – Surface Water

The River Waterbody WFD Status 2013-2018 represents all the River Waterbody Status results recorded in accordance with European Communities (Water Policy) Regulations 2003 (SI no. 722/2003). The regulation objectives include the attainment of good status in waterbodies that are of lesser status at present and retaining good status or better where such status exists.

The WFD River Waterbodies Risk represents the risk for each waterbody of failing to meet their Water Framework Directive (WFD) objectives by 2027. It is noted that the ditch/land drain along the northern boundary of the site is not mapped as a water body.

The following information in relation to the surface waterbodies in proximity to the site is available at catchments.ie database:

- The River Waterbody WFD Status of the Mill Stream (SKERRIES)_010 European Code (IE_EA_08M030500) is classified as a water body with a ‘Poor’ Status. .

- The Coastal Waterbody WFD Status 2013-2018 for the Northwestern Irish Sea (HA 08) European Code (IE_EA_020_0000) is ‘High’ and the Coastal Waterbodies Risk is ‘Not at Risk’.

9.3.20 Site Drainage

The site is drained by a ditch which is located along the northern boundary of the site. This drain is not hydraulically linked with the Mill Stream. The ditch drains eastwards to an existing stream that drains northwards to the Downside Park neighbourhood (Figure 9.6). The stream is in culvert (1050mm diameter) through Downside Park and the adjacent public open space. From Rush Road (R128), the stream passes through a 1500mm diameter culvert before discharging to the Irish Sea approximately 700m to the east of the subject lands.

There is a watershed at the eastern edge of the rail embankment. A culvert extends under the railway embankment and drains the eastern embankment. This eastern rail embankment drain flows to the west of the railway (Figure 9.6) from the subject lands and joins the Mill Stream (JSA, 2020).

The adjacent Ballygossan Park residential development undertook a Surface Water Management investigation which included for the provision of a Regional Drainage Facility (RDF) in a detention basin comprising the linear open space located to the north of the subject lands, along the route of the minor watercourse. A swale in the middle of the detention basin acts as a low-flow and a drain-down channel to ensure adequate drainage of the basin following rainfall events. This RDF has been designed to accommodate run off from development of all of the Hackettstown lands within the now expired Hackettstown local area plan. The surface water runoff from the subject site will drain into this RDF (JSA, 2020).

Figure 9.6 Site Drainage

9.3.21 Groundwater Surface Water Interaction

Groundwater in the Lusk GWB is likely to discharge directly to the Irish sea to the east and to the north and south via base flow to rivers. The groundwater levels recorded on-site appear to indicate that groundwater is hydraulically connected to the adjacent stream.

9.3.22 Designated Protected Areas

The closest designated site to the subject lands is Skerries Islands Special Protection Area (SPA) and National Heritage Area (NHA). JSA (2020) noted that at low tide the discharges to the Irish Sea from the ditch adjacent to the site and the Mill Stream are a potential direct hydrological pathway to the downstream Skerries Islands SPA. Mitigation measures will be put in place to protect local biodiversity and to ensure compliance with Water Pollution Acts and that the proposed works do not impact on the integrity of Skerries Island SPA.

The following Natura 2000 sites (Special Area of Conservation (SAC) and Special Protection Area (SPA)) and nationally designated sites (NHA and pNHA) are located within 10km of the site (Figure 9.7). Based on the Appropriate Assessment Screening & Natura Impact Statement, these sites have no known hydrological or hydrogeological connection with the subject site:

- Rockabill to Dalkey Island SAC – 2.8km
- Rodgerstown Estuary SAC & SPA & pNHA – 5.4km
- Lambay Island SAC & SPA – 9.3km
- Malahide Estuary SAC & SPA & pNHA – 9.7km
- Rockabill SPA – 3.3km
- Bog of the Ring pNHA – 6.3km
- Rockabill Island pNHA – 7.4km
- Knock Lake pNHA – 5.8km
- Loughshinny Coast pNHA – 1.5km
- Lambay Island pNHA – 9.3km
- Portraine Shore pNHA – 8.0km

Adapted from Altemar Marine and Environmental Consultancy (2020)

Figure 9.7 Designated Protected Areas

9.3.23 Flood Risk

The GSI groundwater flood probability map indicates there is no risk to the subject lands from seasonal groundwater flooding.

However Ground Investigations Ireland (GII) (report under separate heading) determined groundwater levels across the site varied between 1m and 1.5m below ground level. Therefore there is a possible risk of flooding as result of groundwater rising. In addition, there will be a moderate risk of pluvial flooding as a result of human/mechanical error and overland flows.

The OPW Flood Maps indicates that the Skerries area is currently under review (https://www.floodinfo.ie/map/floodmaps/). The coastal flood / tidal flooding extent does not encroach into the Hacketstown area or the subject site. A site specific flood risk assessment report is included as part of this planning application, under separate cover.

9.3.24 Wastewater Treatment

During the development of the adjacent Ballygossan Park Phase 1 development, a suitable foul discharge point was left for the proposed development. The foul sewer infrastructure provided i.e. a 225mm diameter foul pipeline, has been deemed suitable by Irish Water (JSA, 2020). The existing foul line connects to a 375mm diameter foul sewer located approximately 265m to the east of the site in the Downside Park neighbourhood, before discharging to a 450mm diameter foul sewer in Holmpatrick. These sewers drain southwards along Holmpatrick/Rush Road, increasing to a 600mm diameter before discharging to the municipal pumping station. The foul sewage is then pumped to the Barnageeragh Wastewater Treatment Works (JSA, 2020). No discharge of wastewater to ground is proposed for the proposed development.

9.4 LIKELIHOOD OF IMPACTS

It is anticipated that the main environmental factors associated with the hydrogeology and hydrology across the site and within its immediate environs are not likely to be significantly affected by the proposed project.

Without mitigation, the main environmental factors associated with the risk to the hydrogeological and hydrological environments relate to general construction activities within the footprint of the site including uncontrolled sediment runoff from exposed soils, fuel and chemical storage and localised excavation of subsoils increasing the vulnerability of the aquifer to pollution events.

Contaminated soils/groundwater or buried waste material, which could pose a risk to the underlying aquifer and surface waters, have not been identified at the site nor are anticipated based on the Waste Classification Report (GII, 2020) and the site history. If any unexpected contaminated soils/groundwater or buried waste material are encountered during the excavation works, they are anticipated to be localised and will be appropriately mitigated as detailed in Section 9.8.1.

9.5 DESCRIPTION AND SIGNIFICANCE OF IMPACTS

ASSESSMENT CRITERIA

The significance of potential impacts on hydrogeological receptors was estimated by implementing a National Roads Authority (NRA) Design Manual for Roads and Bridges (DMRB) and IGI Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (2013) style of assessment using hydrogeological type attributes and measures to determine the magnitude of the impact on the attribute.

Table 9.4 illustrates the criteria for determining the importance of sensitive receptors at the site, Table 9.5 demonstrates the criteria for estimating the magnitude of the impact on an attribute and Table 9.6 presents the resulting estimation of the significance of potential impacts.

Importance	Criterion	Typical Examples
Very High	Attribute has a high quality and rarity on regional or national scale	River, wetland or surface water or groundwater body ecosystem protected by EU legislation. Aquifer providing a regionally important drinking water resource or supporting site protected under wildlife legislation
High	Attribute has a high quality and rarity on local scale	Aquifer providing locally important resource or supporting peat ecosystem (undesignated)
Medium	Attribute has a medium quality and rarity on local scale	Aquifer providing water for agricultural or industrial use with limited connection to surface water. Eroding bog
Low	Attribute has a low quality and rarity on local scale	Non-aquifer. Cutover blanket bog.

Table 9.4 Estimation of Importance of Sensitive Attributes

Magnitude	Criterion	Typical Example
Major Adverse	Results in loss of attribute and/or quality and integrity of attribute. Severe.	Loss of aquifer water supply by dewatering or major contamination event. Potential high risk of pollution to groundwater from routine run-off.
Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute. Major.	Partial loss or change to aquifer characteristics Potential medium risk of pollution to groundwater from routine run-off. Loss in peat margins or loss in recharge to a potential SAC Annex 1 habitat.
Minor Adverse	Results in some measurable change in attributes quality or vulnerability. Minor.	Potential low risk of pollution to groundwater from routine run-off Risk of pollution from accidental spillages Localised peat extraction on bog
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity. Not significant.	No measurable impact upon aquifer and no perceivable risk of pollution from accidental spillages Slight impact on peat by animal hoofs etc
Minor Beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring.	Insignificant risk of contamination to groundwater due to surface sealing.

Table 9.5 Estimation of the Magnitude of a Potential Impact on an Attribute

A qualitative approach was used in this evaluation, generally following the significance classification in Table 9.6 and through professional judgement. The significance of a predicted impact is based on a combination of the sensitivity or importance of the attribute and the predicted magnitude of any effect.

Importance of Attribute	Magnitude of Potential Impact			
	Negligible	Minor Adverse	Moderate Adverse	Major Adverse
Extremely High	Imperceptible	Significant	Profound	Profound
Very high	Imperceptible	Significant / Moderate	Profound/ Significant	Very Large
High	Imperceptible	Moderate / Slight	Significant/ Moderate	Profound/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

Table 9.6 Estimation of the Significance of Potential Impact

Examples of the categories of impact significance are outlined below in accordance with Guidelines on Environmental Impact Assessment issued by the European Commission in 2017.

- Imperceptible - An effect capable of measurement 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.
- Profound Effects An effect which obliterates sensitive characteristics.

Terms relating to the duration of impacts are as described in the EPA's guidelines on the information to be contained in Environmental Impact Assessment Reports draft (August 2017) as:

- Momentary Effects - Effects lasting from seconds to minutes
- Brief Effects - Effects lasting less than a day
- 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

The prediction of potential impacts by the proposed development are summarised in the following sections and tables. The impacts are separated into construction stage impacts and operational stage impacts.

9.6 POTENTIAL CUMULATIVE IMPACTS

The EU Guidelines[2] define cumulative impacts as:

> *"Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project. For example:*
>
> - *Incremental noise from a number of separate developments;*
> - *Combined effect of individual impacts, e.g. noise, dust and visual, from one development on a particular receptor; and,*
> - *Several developments with insignificant impacts individually but which together have a cumulative effect*."

The EPA Guidelines on the Information to be contained in Environmental Impact Statements mirrors this approach and defines cumulative impacts as "The addition of many small impacts to create one larger, more significant, impact".

Therefore, the assessment of cumulative impacts considers the total impact associated with the proposed development when combined with other past, present, and reasonably foreseeable future developments.

Increased hardstanding across the site will also potentially reduce the natural infiltration for rainwater to the underlying gravel aquifer. However, with appropriately designed construction work mitigation measures and suitably designed sustainable urban drainage systems for the proposed development, it is considered that the overall development will have a long-term but imperceptible cumulative impact on the underlying hydrogeology and hydrology.

The proposed SHD that this document addresses has been reviewed in conjunction with the following to assess any cumulative impacts:

- The 'advanced infrastructure works' is subject of a Section 34 application, and that which is currently under consideration by ABP (Ref. ABP-312189-21)
- 'Ballygossan Phase 2' lands to the north in the ownership of Noonan Construction which has been the subject of an SHD pre-application to the Board (Ref. ABP 308583-20). This is included as the cumulative impacts from this project have been assessed with the Advance Infrastructure application.
- Off-site road improvements which were granted by ABP and FCC (ABP Reg. Ref. 309409; FCC Reg. Ref. F20A/0324) to provide the necessary upgrades to local road network.

These developments have been considered and are considered likely to have similar impacts during the construction phase in relation to the water environment. During the operational phase of the development, increased hardstanding across the site will also potentially reduce the natural infiltration for rainwater to the underlying groundwater body. Should the construction phase of any developments coincide with development of the site, potential cumulative impacts are not anticipated provided similar mitigation measures are implemented as detailed in Table 9.8.1 below. With appropriately designed construction work mitigation measures, the provision of a Regional Drainage Facility (RDF) as described in Chapter 2 and a suitably designed sustainable urban drainage system for the proposed development, it is considered that the overall development will have a long-term but imperceptible cumulative impact on the underlying hydrogeology and hydrology.

9.7 'DO NOTHING' IMPACT

2 Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions, May 2009, EC DG XI Environment, Nuclear Safety & Civil Protection Ref: NE80328/D1/3

If the proposed development did not proceed the site would remain in agricultural use, there would be no impact on the underlying hydrogeology or the adjacent ditch, the Mill Stream and downstream receptors, in particular Skerries Island SPA and NHA. It is envisaged that the land cover would remain unchanged as a greenfield site.

9.8 POTENTIAL IMPACTS

Table 9.7 and Table 9.8 outline the range of potential impacts associated with the construction and operational phases of the proposed development, in the absence of mitigation measures.

9.8.1 Construction Works Potential Impacts

No.	Construction Activity	Attribute	Character of Potential Impact	Importance of Attribute (see Table 9.4)	Magnitude of Potential Impact (see Table 9.5)	Significance of Potential Impact (see Table 9.6)
1	Excavation Activities	Groundwater	It is anticipated that the development site works will involve some excavation of soils/subsoils for the various aspects of the development including foundations, underground services and site drainage. Although the northwest corner of the site is mapped as extreme vulnerability, the vast majority of the site is mapped as high vulnerability. The depth of excavation is anticipated to be limited and therefore the reduced thickness of overburden will not significantly effect the vulnerability of the underlying groundwater in the event of a pollution event such as a fuel spillage during the construction works. In addition, no significant excavation operations are proposed in the northwestern region of the site.	High	Minor Adverse	Moderate/ Slight
		Surface Water	The removal of established vegetative cover and construction work activities (*e.g.* vehicle movements) could lead to the loss of large quantities of soil particles through uncontrolled sediment erosion and silty runoff to the northern boundary ditch which flows to the Irish Sea, particularly during periods of high rainfall. This runoff could cause pollution to surface waters through the generation of suspended solids. As the Mill Stream is not hydraulically connect to the land drain or to the site, this water feature is not considered to be at risk.	High	Moderate Adverse	Significant/ Moderate

No.	Construction Activity	Attribute	Character of Potential Impact	Importance of Attribute (see Table 9.4)	Magnitude of Potential Impact (see Table 9.5)	Significance of Potential Impact (see Table 9.6)
2	Fuel storage/usage on site	Groundwater Surface Water	Accidental spillage of contaminants during construction works may cause short to long term, moderate to significant impacts to groundwater and surface water if not stored and used in an environmentally safe manner.	High	Major Adverse	Profound/ Significant
3	Waste Arisings	Groundwater Surface Water	Waste material generated from construction activities may require disposal off-site if not suitable for reuse on site. Temporary storage on site may be required and impacts to groundwater and surface water from possible contaminated direct runoff during rainfall events could potentially occur.	High	Minor Adverse	Moderate /Slight
4	Contaminated land / buried waste	Groundwater Surface Water	No contaminated material or buried waste has been reported during the site investigation completed across the site. However, it is noted that no site investigation can be thorough enough to investigate every area of the site and therefore in the event of encountering unexpected ground contamination or buried waste material, it is anticipated to be very localised with an associated low level of risk posed to the environment	High	Minor Adverse	Moderate /Slight
5	Vandalism	Groundwater Surface Water	Pollution due to vandalism of stores or plant poses a risk to groundwater and to future site users.	High	Major Adverse	Profound/ Significant
6	Contaminated imported fill	Groundwater Surface Water	The importation of unsuitable or contaminated fill material for the purpose of reinstatement works or access roads may pose a risk to the groundwater aquifer and surface waters in proximity to the site. 4,500 m^3 of imported fill to the site is expected.	High	Moderate Adverse	Significant/ Moderate
7	Construction Traffic	Groundwater Surface Water	There may be a risk of groundwater pollution from site traffic through the accidental release of oils, fuels and other contaminants from vehicles.	High	Minor Adverse	Moderate /Slight

No.	Construction Activity	Attribute	Character of Potential Impact	Importance of Attribute (see Table 9.4)	Magnitude of Potential Impact (see Table 9.5)	Significance of Potential Impact (see Table 9.6)
8	Increased risk of flooding and soil erosion	Surface Water	The creation of hard standing areas and compaction of soil may increase levels of surface water run-off resulting in localised flooding and subsequent soil erosion.	High	Minor Adverse	Moderate /Slight
9	Construction stage dewatering	Groundwater Surface Water	Localised dewatering operations from trenches or excavations may be required during the construction works primarily relating to the build up of rainwater within excavations. Dewatering of the underlying bedrock aquifer is not anticipated. The discharge of sediment laden water to surface water has the potential to impact on surface water quality.	High	Major Adverse	Profound/ Significant

Table 6.7 Potential Impacts during Construction Phase

9.8.2 Potential Operational Impacts

No.	Construction Activity	Attribute	Character of Potential Impact	Importance of Attribute (see Table 9.4)	Magnitude of Potential Impact (see Table 9.5)	Significance of Potential Impact (see Table 9.6)
1	Hydrocarbon laden surface water runoff from roads, carparks and general hardstanding	Groundwater Surface Water	Road surface runoff and poorly designed drainage system being channelled to groundwater and surface water could result in contamination of the water bodies .	High	Minor Adverse	Moderate /Slight
2	Reduced infiltration of rainwater to the underlying aquifer	Groundwater Surface Water	The increased presence of hard standing across a large area could potentially reduce the amount of infiltration of rainwater to the underlying aquifer and potential impact on the hydrogeological and hydrological regime.	High	Moderate Adverse	Significant/ Moderate

No.	Construction Activity	Attribute	Character of Potential Impact	Importance of Attribute (see Table 9.4)	Magnitude of Potential Impact (see Table 9.5)	Significance of Potential Impact (see Table 9.6)
3	Foul water Disposal	Groundwater Surface Water	All foul water is proposed to be discharged to mains sewer network with no discharge to groundwater proposed. Therefore, there is no anticipated impact on groundwater or surface waters..	High	Negligible	Imperceptible
4	Contaminated land / waste	Groundwater	The importation of unsuitable or contaminated fill material for the purpose of reinstatement works or access road may pose a risk to the underlying aquifer.	High	Moderate Adverse	Significant / Moderate
5	Flood Risk	Surface Water	Road surface runoff and poorly designed drainage system failure may result in localised flooding within the site.	High	Minor Adverse	Moderate/Slight

Table 9.8 Potential Operational Impacts

9.9 AVOIDANCE, REMEDIAL & MITIGATION MEASURES

The following mitigation measures (Table 9.9 and Table 9.10) will be implemented to ensure all risks identified are appropriately mitigated.

9.9.1 Construction Activities

No.	Construction Activity	Attribute	Character of Potential Impact	Mitigation	Post Mitigation Impact
1.	Excavation Activities	Groundwater	It is anticipated that the development site works will involve some excavation of soils/subsoils for the various aspects of the development including foundations, underground services and site drainage. Although the northwest corner of the site is mapped as extreme vulnerability, the vast majority of the site is mapped as high vulnerability. The depth of excavation is anticipated to be limited and therefore the reduced thickness of overburden will not significantly effect the vulnerability of the underlying groundwater in the event of a pollution event such as a fuel spillage during the construction works. In addition, no significant excavation operations are proposed in the northwestern region of the site further minimising risks to groundwater.	The limited depth of excavation activities, in particular in the northwestern region of the site, will minimise the risk of increasing groundwater vulnerability at the site. Appropriate groundwater protection/mitigation measures in relation to fuel storage and construction traffic are detailed in the following sections and will ensure the risk posed is low, temporary and neutral.	Imperceptible
		Surface Water	The removal of established vegetative cover and construction work activities (*e.g.* vehicle movements) could lead to the loss of large quantities of soil particles through uncontrolled sediment erosion and silty runoff to the northern boundary ditch which flows to the Irish Sea, particularly during periods of high rainfall. This runoff could cause pollution to surface	Soil removal during the construction phase of the project will be an unavoidable consequence of the development and would apply for virtually any form of site development. Surface water runoff from areas stripped of topsoil and surface water collected in excavations will be directed to on-site settlement ponds where measures will be implemented to capture and treat sediment laden runoff prior to discharge of surface water at a controlled rate.	Imperceptible

No.	Construction Activity	Attribute	Character of Potential Impact	Mitigation	Post Mitigation Impact
			waters through the generation of suspended solids.	To ensure that any surface water runoff from the construction activities is appropriately controlled and treated before discharging into the surface water network. Topsoil will be stored in an appropriate manner on site for the duration of the construction works and protected for re-use on completion of the main site works.	
2	Fuel storage/usage on site Construction Traffic	Groundwater Surface Water	Accidental spillage of contaminants during construction works may cause short to long term, moderate to significant impacts to groundwater and surface water if not stored and used in an environmentally safe manner. There may be a risk of groundwater pollution from site traffic through the accidental release of oils, fuels and other contaminants from vehicles.	Waste fuels and materials will be stored in designated areas that are isolated from surface water drains or open waters (*e.g.* excavations). Skips will be closed or covered to prevent materials being blown or washed away and to reduce the likelihood of contaminated water leakage. Hazardous wastes such as waste oil, chemicals and preservatives, will be stored in sealed containers and kept separate from other waste materials while awaiting collection by a registered waste carrier. Fuelling, lubrication and storage areas and site offices will not be located within 25m of drainage ditches, surface waters or open excavations. All waste containers (including all ancillary equipment such as vent pipes and refuelling hoses) will be stored within a secondary containment system (*e.g.* a bund for static tanks or a drip tray for mobile stores and drums). The bunds will be capable of storing 110% of the tank	Imperceptible

No.	Construction Activity	Attribute	Character of Potential Impact	Mitigation	Post Mitigation Impact
				capacity. Where more than one tank is stored, the bund must be capable of holding 110% of the largest tank of 25% of the aggregate capacity (whichever is greater). Drip trays used for drum storage must be capable of holding at least 25% of the drum capacity. Where more than one drum is stored the drip tray must be capable of holding 25% of the aggregate capacity of the drums stored. Regular monitoring of water levels within drip trays and bunds due to rainfall will be undertaken to ensure sufficient capacity is maintained at all times. A bunded hardstanding area for refuelling will be constructed at the site. Surface water runoff from this concrete surface will discharge to a drain via a full retention petrol interceptor or to the on-site WWTP. Prior to the interceptor, a silt trap will be installed in order to remove the majority of suspended solids. The provision of wheel wash facilities close to the site entrance shall reduce the deposition of mud, soils and other substances on the surrounding road network. Oil which accumulates within the petrol interceptor shall be regularly removed by an appropriately licensed contractor. In addition, the petrol interceptor shall be appropriately maintained in accordance with the manufacturer's specification.	

No.	Construction Activity	Attribute	Character of Potential Impact	Mitigation	Post Mitigation Impact
				Monitoring prior to, during and post construction works of surface water quality shall be undertaken to ensure minimum disturbance of water quality in the boundary ditch. No monitoring of the Mill Stream is deemed necessary as the site is not hydraulically connected with this water feature. During the construction phase, the monitoring programme will include daily checks, weekly inspections and monthly audits to ensure compliance with the Construction Environmental Management Plan. Hazardous waste shall be dealt with in accordance with the Waste Management (Hazardous Waste) Regulations. An Emergency Operating Plan (EOP) to deal with the possibility of contamination or fuel spills, *e.g.,* pumping of wells or sumps to collect contaminated groundwater or surface water for treatment will be developed and incorporated into an overall Construction & Waste Management Plan (CWMP) for the development. The CIRIA document (2001) recommendations for developing a contingency plan for pollution emergencies will be implemented and include the following: • Containment measures. • Emergency discharge routes. • List of appropriate equipment and clean-up materials.	

No.	Construction Activity	Attribute	Character of Potential Impact	Mitigation	Post Mitigation Impact
				• Maintenance schedule of equipment. • Details of trained staff. • Details of staff responsibilities. • Notification procedures to inform the relevant environmental protection authority. • Audit and review schedule; and, • List of specialist pollution clean-up companies and their telephone numbers. Any vehicles utilised during the operational phase shall be maintained on a weekly basis and checked daily to ensure any damage or leakages are corrected. The potential impacts are limited by the size of the fuel tank of the largest plant / vehicles used on the site. Precautions shall be taken to avoid spillages. These include: • Use of secondary containment e.g. bunds around oil storage tanks; • Use of drip trays around mobile plant; • Supervising all deliveries and refuelling activities; and, • Designating and using specific impermeable refuelling areas isolated from surface water drains. The implementation of the above-described mitigation measures will ensure the risk posed by the identified potential impact will be low, temporary and neutral.	

No.	Construction Activity	Attribute	Character of Potential Impact	Mitigation	Post Mitigation Impact
3.	Waste Arisings	Groundwater Surface Water	Waste material generated from construction activities may require disposal off-site. Temporary storage on site may be required and impacts to groundwater and surface water from possible contaminated direct runoff during rainfall events could potentially occur.	Appropriate safe storage of all and waste materials shall be implemented during the construction works in accordance with the Construction Waste Management Plan (CWMP) for the works. Measures include: • Covering of stockpiles to minimise surface water runoff, • Creation of berms around stockpiles to contain runoff during heavy rainfall events. • Waste segregation and storage in dedicated sealed skips The implementation of the above-described mitigation measures will ensure the risk posed by the identified potential impact will be low, temporary and neutral.	Imperceptible
4.	Contaminated land / buried waste / waste soils	Groundwater Surface Water	No contaminated material or buried waste has been reported during the site investigation completed across the site. However, it is noted that no site investigation can be thorough enough to investigate every area of the site and therefore in the event of encountering unexpected ground contamination or buried waste material, it is anticipated to be very localised with an associated low level of risk posed to the environment	Special environmental and human health contingency plans and procedures, following best-practice guidance, will be developed for the unexpected discovery of contaminated or illegally deposited waste materials. In the event of encountering contaminated ground or buried waste, an appropriately scoped contaminated land site investigation will be undertaken by a contaminated land consultant comprising soil monitoring, water monitoring, gas and vapour monitoring and groundwater level monitoring. All works will be undertaken in accordance with best practice and EPA Guidance On The Management Of Contaminated Land And Groundwater At EPA Licensed Sites, 2013.	Imperceptible

No.	Construction Activity	Attribute	Character of Potential Impact	Mitigation	Post Mitigation Impact
				On completion of the above, a suitably detailed remediation program of works will be undertaken under the direction and supervision of a contaminated land consultant. The outcome of the investigation will dictate the most appropriate remedial solution for the development. The implementation of the above-described mitigation measures will ensure the risk posed by the identified potential impact will be low, temporary and neutral.	
5.	Vandalism	Groundwater Surface Water	Pollution due to vandalism of stores or plant poses a risk to groundwater and to future site users.	Adequate security measures shall be installed on the construction site. Security measures will include secure fencing, secure site access, securing site plant and equipment, secure storage of materials and sufficient warning signage. The implementation of the above-described mitigation measures will ensure the risk posed by the identified potential impact will be low, temporary and neutral.	Imperceptible
6.	Contaminated imported fill	Groundwater Surface Water	The importation of unsuitable or contaminated fill material for the purpose of reinstatement works or access roads may pose a risk to the groundwater aquifer and surface waters in proximity to the site. 4,500 m^3 of imported fill to the site is expected.	All imported fill material shall be sourced from approved sources and appropriately certified and fit for purpose. All fill material will be confirmed to be inert prior to importation to the site including confirmation of the chemical testing and a visual assessment. Fill sourced from non-licenced/non-permitted facilities will require prior authorisation under Article 27 legislation.	Imperceptible

No.	Construction Activity	Attribute	Character of Potential Impact	Mitigation	Post Mitigation Impact
8.	Increased risk of flooding and soil erosion	Surface Water	The creation of hard standing areas (access roads) will be minimal as will the compaction of soil which increases the levels of surface water run-off resulting in flooding and/or soil erosion.	The risk of flooding on-site is very low based on the OPW flood maps. An appropriately designed site drainage system for the construction stage will be developed across the site to ensure that any surface water runoff from the site is appropriately controlled and treated before discharging into the northern boundary land drain. Settlement ponds and will be established. Trenched double silt fencing shall be put in place along boundary of the proposed development site with 10m buffer from the onsite drainage ditch. This fencing shall be in place as one of the first stages on site and prior to the full site clearance. The silt fencing shall act as a temporary sediment control device to protect the watercourse from sediment and potential site water runoff. The fencing shall be inspected twice daily, based on site and weather conditions, for any signs of contamination or excessive silt deposits. Concrete trucks, cement mixers or drums/bins are only permitted to wash out in designated wash out area greater than 50m from sensitive receptors including drains and drainage ditches. Abstraction of water from watercourses will not be permitted. Water quality monitoring within the land drain will be undertaken by the contractor during the period of the construction phase of works. The monitoring	Imperceptible

No.	Construction Activity	Attribute	Character of Potential Impact	Mitigation	Post Mitigation Impact
				will be undertaken on a daily, bimonthly, and monthly basis to ensure compliance with the 2009 Surface Water Regulations and with any conditions set by the planning authority. Daily monitoring will comprise visual and on-site monitoring (e.g. pH, Electrical Conductivity, Temperature and Total Dissolved Solids). Bimonthly monitoring will involve samples collected for laboratory testing including Total Suspend Solids (TSS), Total Dissolved Solids (TDS), pH, Electrical Conductivity, Chloride and Ammoniacal Nitrogen. Monthly monitoring will include heavy metals, nitrate, nitrite, ORP and total hydrocarbons. Baseline monitoring of the land drain will be undertaken to determine the condition of the drain prior to commencement of the construction works. Any exceedances of baseline conditions attributed to the construction operations will be immediately assessed by the contractor and identification of the source of the impact identified to facilitate appropriate measures to prevent any further potential impacts. The implementation of the above-described mitigation measures will ensure the risk posed by the identified potential impact will be low, temporary and neutral.	
9.	Construction stage dewatering	Surface Water	Localised dewatering operations from trenches or excavations may be required during the construction works primarily relating to the build up of rainwater within excavations. Dewatering of the underlying	The temporary disposal and treatment of any water pumped from any excavations will be carefully managed. All waters from excavations will be passed through an on-site construction stage drainage	Imperceptible

No.	Construction Activity	Attribute	Character of Potential Impact	Mitigation	Post Mitigation Impact
			bedrock aquifer is not anticipated. The discharge of sediment laden water to surface water has the potential to impact on surface water quality.	system before being discharged to the local drain., along the northern site boundary. Construction phase filtering of surface water for suspended solids will be undertaken carried out. Untreated water discharges or runoff shall not be permitted from the site into the land drain. All waters abstracted from excavations will be monitored, as a minimum, on a daily, bimonthly, and monthly basis to ensure compliance with the 2009 Surface Water Regulations and with any conditions set by the planning authority. Daily monitoring will comprise visual and on-site monitoring (e.g. pH, Electrical Conductivity, Temperature and Total Dissolved Solids). Bimonthly monitoring will involve samples collected for laboratory testing including Total Suspend Solids (TSS), Total Dissolved Solids (TDS), pH, Electrical Conductivity, Chloride and Ammoniacal Nitrogen. Monthly monitoring will include heavy metals, nitrate, nitrite, ORP and total hydrocarbons. Any exceedances of baseline conditions in the land drain or water quality disposed to the drain that is attributed to the construction operations will be immediately assessed by the contractor and identification of the source of the impact identified to facilitate appropriate measures to prevent any further potential impacts. The contractor will consult with the local authority to facilitate the application and granting of a temporary discharge licence.	

No.	Construction Activity	Attribute	Character of Potential Impact	Mitigation	Post Mitigation Impact
				The implementation of the above-described mitigation measures will ensure the risk posed by the identified potential impact will be low, temporary and neutral.	

Table 9.9 Predicted Construction Phase Mitigation Measures

9.9.2 Operational Activities

No.	Construction Activity	Attribute	Character of Impact	Mitigation	Post Mitigation Impact
1.	Hydrocarbon laden surface water runoff from roads, carparks and general hardstanding	Groundwater Surface Water	Road surface runoff and poorly designed drainage system being channelled to groundwater and surface water can result in contamination of the subsurface and proximate rivers/streams and wetlands.	An appropriately designed drainage system has been designed for the subject site. The system was designed in accordance with the CIRIA SUDS Manual 2015 and Recommendations for Site Development Works for Housing Areas published by the Department of the Environment and Local Government. It is proposed to use a sustainable urban drainage systems (SuDS) approach to stormwater management throughout the site, the overall strategy aims to provide an effective system to mitigate the adverse effects of urban stormwater runoff on the environment by reducing runoff rates, volumes and frequency, reducing pollutant concentrations in stormwater, contributing to amenity, aesthetics and biodiversity enhancement	Imperceptible

				and allow for the maximum collection of rainwater for re-use where possible. The SuDS features includes swales, filter strips, filter drains, oil-water interceptor and permeable paving.	
2.	Reduced infiltration of rainwater to the underlying aquifer	Groundwater Surface Water	The increased presence of hard standing across a large area could potentially reduce the amount of infiltration of rainwater to the underlying aquifer and potential impact on the hydrogeological and hydrological regime.	The surface water collection and infiltration system for the entire site has been designed in accordance with the CIRIA SUDS Manual 2015 and Recommendations for Site Development Works for Housing Areas published by the Department of the Environment and Local Government. It also incorporates partial infiltration design on all SuDS features. Therefore, the potential impact on reduced rainfall infiltration has been minimised with the overall effects anticipated to be low, long-term and imperceptible.	Imperceptible
3.	Flood Risk - Pluvial	Surface Water	Flooding from surcharging or blocking of the developments' drainage systems.	Drainage system has been designed in accordance with the regulations e.g. Greater Dublin Strategic Drainage Study (GDSDS) and considering the flood exceedance for storms of return periods exceeding 1% AEP (Annual Exceedance Probability). Proper operation and maintenance of the drainage system will be implemented to reduce the risk of human or mechanical error causing pluvial flood risk from blockages etc.	Imperceptible

Table 9.10 Predicted Operational Stage Mitigation Measures

9.10 RESIDUAL IMPACTS

The nature of the development dictates that the greatest potential impact on the hydrological and hydrogeological environments (including soil, subsoil and bedrock) associated with the proposed development will be during the construction phase. It is predicted that the hydrogeological and hydrological impacts associated with the construction phase of the development that implements the proposed mitigation measures will be temporary and imperceptible and neutral. The residual impacts predicted during the operational phase relates to potential impacts to groundwater and surface water from hydrocarbon land surface water runoff from the site and reduced infiltration of rainwater to the underlying groundwater body. However, implementation of the planned mitigation measures will ensure the post mitigation impacts will be imperceptible, long-term and neutral.

9.11 REFERENCES

- Appropriate Assessment Screening & Natura Impact Statement - Information for a Stage 1 (AA Screening) and Stage 2 (Natura Impact Statement) AA for a strategic housing development at a site located at Hacketstown in the townland of Milverton, Skerries, Co. Dublin (Altemar Marine and Environmental Consultancy, 2020).
- Environmental Report for pre-application consultation with An Bord Pleanála, John Spain Associates (JSA, 2020);
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