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Hydrological and Hydrogeological Risk Assessment Report

PRESENTED TO

SONAS
Proposed Refuge Development at Kilcross, Sandyford, Dublin 18

DATE

March 2024

Environmental Consultancy Services

DOCUMENT CONTROL SHEET

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1 INTRODUCTION

Enviroguide Consulting (hereafter referred to as EGC) was appointed by O'Carroll Fitzgerald Project and Commercial Management (hereafter referred to as OCF) on behalf of SONAS (hereafter referred to as the Applicant) to complete a hydrological and hydrogeological risk assessment for a proposed refuge development at Kilcross, Sandyford, Dublin 18 (hereafter referred to as the 'Proposed Development' and 'Site').

1.1 Project Objective

The project objective was to establish the baseline hydrological and hydrogeological conditions at the site and to identify the potential for any impacts on receptors associated with the Site and the Proposed Development:

- Establish the hydrological and hydrogeological regime and Conceptual Site Model at the proposed development site.
- Determine if there are any potential impacts on the receiving water environmental receptors including those at the site and adjoining downgradient of the site.
- Determine if the proposed development could impact on any Groundwater Dependant Terrestrial Ecosystems (GWDTE) including the Fitzsimons Woods proposed Natural Heritage Area (pNHA).
- Determine if the proposed development could impact on any designated and protected Natura 2000 sites hydraulically connected with the site.
- Determine if the proposed development could impact on the water quality status assigned by the EPA of the receiving water bodies hydraulically connected with the site for the purposes of the Water Framework Directive.

1.2 Project Scope of Work

The scope of the hydrological and hydrogeological assessment included the following tasks:

- A desk-based review of published information and information pertaining to the Site and Proposed Development provided by the Applicant.
- Develop a hydrogeological Conceptual-Site-Model and identify any potential source-pathway-receptor linkages.
- Identify and assess any potential impacts associated with the proposed development on sensitive receptors associated with the receiving water environment.

This assessment is reliant on the design information for the proposed development provided by the Applicant.

1.3 Professional Competency

The report was prepared by Warren Vokes a Senior Consultant of Enviroguide Consulting with over 8 years' experience of preparing environmental and hydrogeological assessments and reviewed by Gareth Carroll BA BAI MIEnvSc CEnv, a Principal Consultant of Enviroguide Consulting with over 11 years' experience of preparing environmental and hydrogeological and assessments. The report was approved by Patrick Higgins BSc, MSc, MIEnvSc CEnv who is Technical Director with Enviroguide Consulting, who is professionally competent and accredited to undertake environmental risk assessments.

2 METHODOLOGY

2.1 Standards and Regulations

The methodology adopted for this assessment takes cognisance of the relevant standards and regulations pertinent to undertaking a hydrological and hydrogeological assessment in particular the following:

- Council Directive 2006/118/EEC, 2006. On the protection of groundwater against pollution and deterioration. European Parliament and the Council of European Communities;
- Commission Directive 2014/80/EU of 20 June 2014 amending Annex II to Directive 2006/118/EC of the European Parliament and of the Council on the protection of groundwater against pollution and deterioration;
- EU Water Framework 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 with amendments;
- European Communities (Water Policy) Regulations 2003 (S.I. No. 722/2003);
- Environmental Protection Agency, December 2011. Guidance on the Authorisation of Discharges to Groundwater;
- Department of the Environment, Heritage and Local Government, Environmental Protection Agency and Geological Survey of Ireland, 1999. Groundwater Protection Schemes (Groundwater Protection Schemes, 1999);
- Local Government, July 1990. No. 21 of 1990. Local Government (Water Pollution) (Amendment) Act, 1990;
- S.I. No. 9/2010 - European Communities Environmental Objectives (Groundwater) Regulations 2010 and as amended; and,
- S.I. No. 272/2009 - European Communities Environmental Objectives (Surface Waters) Regulations 2009 and as amended.

2.2 Desk-based Study

A desk-based study was undertaken including a review of relevant information from the following publicly available sources and information provided by the Applicant:

- Ordnance Survey Ireland Online mapping (OSI, 2023);
- Geological Survey of Ireland Online mapping (GSI, 2023);
- Environmental Protection Agency Online mapping (EPA, 2023);
- National Parks & Wildlife Services, Protected Sites Webmapping (NPWS, 2023);
- Information provided by the Applicant including:
    - Information pertaining to the design proposals for the Proposed Development;
    - IGSL Ltd., 2023. Report on a Site Investigation at Proposed Housing Development Kilcross Sandyford (IGSL, 2023) including trial pits, infiltration tests and laboratory analysis;
    - Aidan O'Connell & Associates Ltd., 2024. Civil Works Design Report SONAS Refuge Centre, Kilcross, Sandyford, Dublin 18. (AOCA, 2024a);
    - Aidan O'Connell & Associates Ltd., 2024. Flood Risk Assessment SONAS Refuge Centre, Kilcross, Sandyford, Dublin 18 (AOCA, 2024b); and

- Aidan O'Connell & Associates Ltd., 2024. Construction Environmental Management Plan SONAS Refuge Centre, Kilcross, Sandyford, Dublin 18 (AOCA, 2024c).

2.3 Risk Based Impact Assessment

A risk-based and receptor-focussed approach was adopted to include an assessment of any impact to the receiving hydrological and hydrogeological (water) environment associated with the Proposed Development.

The basis for a risk assessment is the Conceptual Site Model (CSM) or Source-Pathway-Receptor (SPR) model which underpins the Directive 2000/60/EC (Water Framework Directive) amended by Directives 2008/105/EC, 2013/39/EU and 2014/101/EU that has been transposed to Irish legislation as European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003) as amended, as well as EPA guidelines on the protection of groundwater and surface water resources including associated aquatic ecosystems and human health receptors (e.g., groundwater supply users), the EPA Guidance on the Authorisation of Discharges to Groundwater (EPA, 2011) and the EPA Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites (EPA, 2013) on the protection of groundwater and surface water resources including associated aquatic ecosystems and human health receptors (e.g., groundwater supply users).

A risk assessment is undertaken to provide an understanding of the risk associated with the presence of any potentially contaminating materials and/or activities on a Site. This is informed by the assessment of potential for viable pollutant linkage(s) to be present. A pollutant linkage is established when there is a viable or potentially viable **S**ource, a **P**athway and a **R**eceptor (refer to Section 2.4 below).If one or more of the three elements are missing, the exposure pathway is considered incomplete and there is no risk associated with the activity or contaminant source (i.e., a viable means of exposure is not considered to be present or is unlikely to be present).

The objective of the Water Framework Directive (WFD) is no deterioration of the water quality status, and the "prevent or limit" objective is a key element of achieving that WFD status for all water bodies regardless of the water quality status of the water body. The 'prevent or limit' objective is a key element to achieving the WFD status and water quality objectives and in principle, prevent or limit measures (i.e., avoidance and mitigation) are the first line of defence in restricting inputs of pollutants from a development (i.e., 'source' removal) and any potential impact or deterioration of water quality status or WFD status of the receiving water body.

In this assessment all three elements of the Source-Pathway-Receptor model will be identified to develop a Conceptual Site Model (CSM), and any potential linkages evaluated and assessed to determine if the development could potentially impact upon any identified receptors including Natura 2000 sites as well as the WFD Status of the water bodies associated with the Site.

2.4 Conceptual Site Model

A CSM represents the characteristics of the Site and identifies the possible relationship and potential risk between contaminant sources (i.e., characteristics of the Proposed Development), pathways and receptors (receiving environment) . These three essential elements of the CSM are described as:

- A **source –** a substance that is in, on or under the land and has the potential to cause harm or pollution;
- A **pathway** – a transport route or means by which a receptor can be exposed to, or affected by, a contaminant source; and
- A **receptor** – in general terms, something that could be adversely affected by a contaminant, such as people, an ecological system, property, or a water body.

The term pollutant linkage is used to describe a particular combination of source-pathway-receptor. Each of these elements can exist independently, but they create a risk only where they are linked together so that a particular contaminant affects a particular receptor through a particular pathway (i.e., a pollutant linkage).

The preliminary CSM for the Site of the Proposed Development is initially defined and this is then revised throughout the risk-based assessment process.

3 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The Proposed Development will consist of the following:

- A 12No. apartment (six (6No.) one-bed and six (6No.) two-bed) refuge complex for victims of domestic violence. Each apartment will comprise of the following:
  - A kitchen/dining area;
  - Bathroom;
  - Shower room;
  - Storage cupboards; and
  - Balconies and external garden space.
- Provision of 12No. car parking spaces;
- Internal common space for meeting rooms, staff offices and areas of initial counselling and necessary medical attention for both clients and staff on duty;
- External communal amenity facilities (including playground and sensory garden)
- External hard (terrace) and soft landscaped open spaces; and
- All associated works to facilitate the development.

The layout of the proposed development is presented in Figure 3-1.

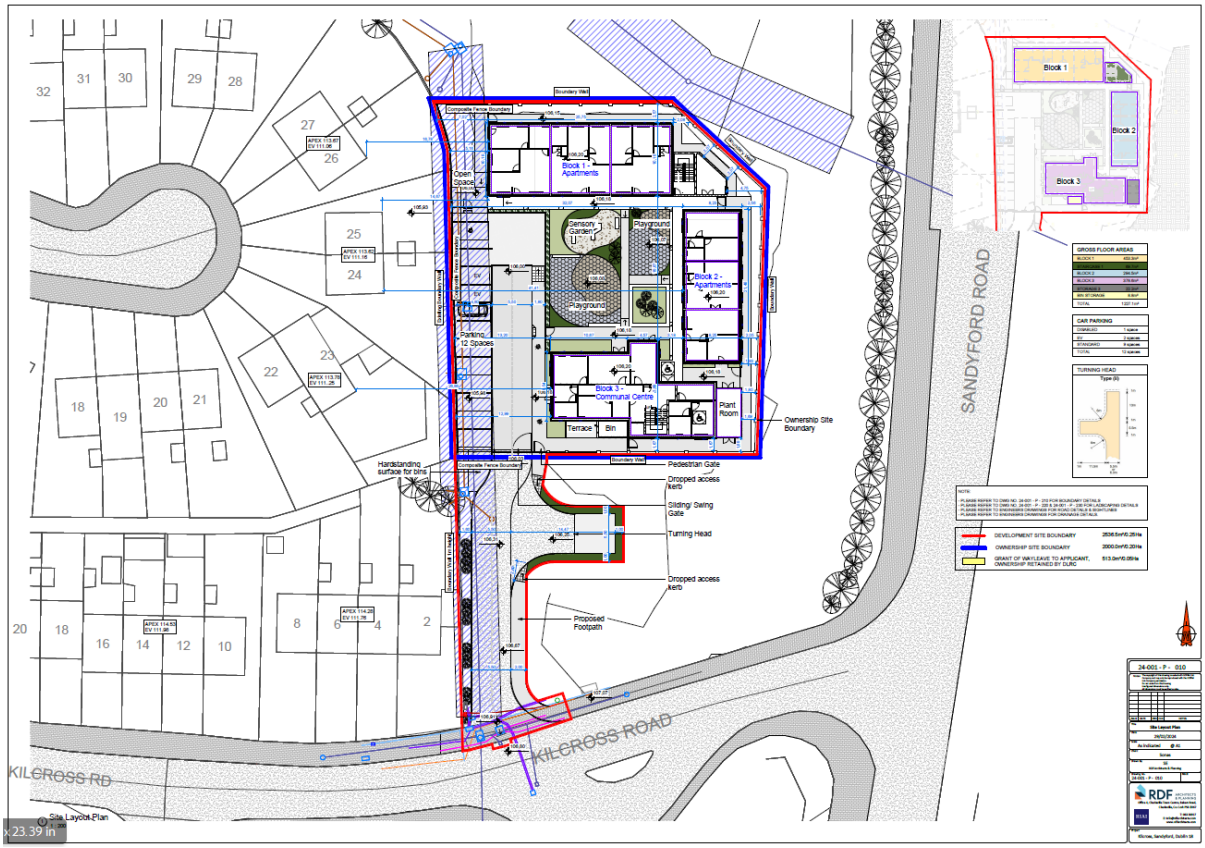

Figure 3-1. Proposed Development Site Layout (RDF Architects, 2024)

3.1 Construction Phase

The Construction Phase of the Proposed Development will be undertaken over a period of 12months and will include:

- Foundation design will consist of pad and strip foundations with no requirement for piling;
- The stripping of existing topsoil at the Site;
- Excavation of soil and subsoil for the construction of building foundations, surface water and foul water drainage infrastructure. It is anticipated that there will be no requirement for the excavation of bedrock during the Construction Phase of the Proposed Development;
- Where possible, it is intended to reuse suitable excavated soil and subsoil for landscaping and engineering use. However, where required, surplus materials will require removal offsite in accordance with all statutory legislation;
- Based on the finding of the previous site investigations (IGSL, 2023), shallow groundwater is not anticipated and it is therefore considered unlikely that there will be a requirement for dewatering during the construction of building foundations and utility infrastructure on the basis of the information provided;
- Construction of new foul and mains water connections in accordance with UE Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03), UE's Code of Practice for Water Infrastructure (IW-CDS-5020-03):
    - Foul water connection from the Proposed Development to the existing 225 mm foul line which traverses the Site within the western boundary; and
    - Main water connection from the Proposed Development to the existing 6" watermain in Kilcross Road to the south of the Site.
- Construction of new surface water drainage designed in accordance with the principles and objectives of Sustainable Drainage Systems (SuDS) and the Greater Dublin Sustainable Drainage System (GDSDS) and the requirements of Dún Laoghaire-Rathdown County Council (DLRCC).
    - Surface water connection from the Proposed Development to the existing 300mm concrete surface water pipe which traverses the Site within the western boundary.

3.2 Operational Phase

3.2.1 Surface Water Drainage

As documented in the Civil Works Design Report (Aidan O'Connell & Associates Ltd. (AOCA), 2024a), the proposed surface water drainage system has been designed to accommodate surface water runoff from impermeable surfaces in the development, including roadways, roofs, and parking areas. Surface water from the Proposed Development will be managed in accordance with the principles and objectives of Sustainable Drainage Systems (SuDS) and the Greater Dublin Sustainable Drainage System (GDSDS) to treat and attenuate surface water prior to discharging at greenfield runoff rates to the existing 300mm concrete surface water pipe which traverses the Site within the western boundary.

The existing 300mm concrete surface water pipe, which also serves the adjoining Kilcross residential estate, discharges to the River Slang (River Waterbody Code: IE_EA_09D010900), located approximately 1.17km downstream of the Site and 0.87km west of the Site at its closest point, and associated downstream waterbodies.

As detailed in the Civil Works Design Report (AOCA, 2024a), the following SuDS measures will be incorporated into the Proposed Development to provide a sustainable manner in which to attenuate surface water runoff, reduce surface water runoff, reduce pollution impact and replicate the natural characteristics of rainfall runoff for the Site:

- Intensive green roof is proposed and 50% coverage is applied to meet the minimum requirements of the Dún Laoghaire-Rathdown County Development Plan 2022-2028.
- Permeable paving is proposed on all external ground level hard surfaces within the ownership site boundary, with the exception of the wayleave area (i.e., access road and adjacent footpath).
- Attenuation storage (127.9m^3) has been designed to cater for surface water runoff from the Proposed Development and will adequately accommodate the 1 in 100 year rainfall event plus 20% to account for the effects of climate change (AOCA, 2024a). It is noted that additional attenuation and storage volume is provided through the other SuDS measures for the Proposed Development.
- Use of a hydrobrake.
- Surface water runoff will also pass through a Class 2 Bypass Petrol Interceptor (sized in accordance with the restricted flow rate discharging from the Site) before entering the existing 300mm concrete surface water pipe which traverses the Site within the western boundary.

The proposed surface water drainage layout and SuDS design are presented in Drawing No. 23-OCF-023-P-201 and 23-OCF-023-P-202 submitted as part of the planning application for the Proposed Development.

3.2.2 Foul Drainage

As documented in the Civil Works Design Report (AOCA, 2024a), foul water from the Proposed Development will be discharged via a 150 mm pipe to a new manhole on the existing 225mm foul line which traverses the Site within the western boundary. The wastewater drainage system's pipework is designed for six times the dry weather flow, following UE's Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03) and standard details.

The proposed foul water drainage layout is presented in Drawing No. 23-OCF-023-P-201 submitted as part of the planning application for the Proposed Development.

Construction of new foul drainage connection will in accordance with UE's Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03).

The UE Confirmation of Feasibility (CoF) letter dated the 6th of February 2024 (UE COF Reference: CDS24000410) states that the proposed foul water connection is feasible without infrastructure upgrade from UE.

Foul water from the Proposed development will be treated in the Ringsend Wastewater Treatment Plant (WWTP) (Discharge Licence No. D0034-01) before ultimately discharging to the Liffey Estuary Lower transitional waterbody (EU Code: IE_EA_090_0300).

3.2.3 Water Supply

As documented in the Civil Works Design Report (AOCA, 2024a), water supply to the Proposed Development will be from the existing 6" watermain in Kilcross Road to the south of the Site.

The UE Confirmation of Feasibility (CoF) letter dated the 6th of February 2024 (UE COF Reference: CDS24000410) states that the proposed water supply connection is feasible without infrastructure upgrade from UE.

Construction of new water supply connection will be in accordance with UE's Code of Practice for Water Infrastructure (IW-CDS-5020-03).

4 SITE SETTING

4.1 Site Location and Description

The Site of the Proposed Development, which comprises an area of 0.27 hectares (Ha), is located at Kilcross, Sandyford, Dublin 18. The Kilcross Estate adjoins the western boundary of the Site. The Site is accessed via the R117 regional road (Kilcross Road) which links the site to Dundrum to the north and Sandyford village to the south.

The land use at the Site comprises undeveloped open grasslands. The surrounding lands are mainly comprised of residential and retail developments.

The Site is bounded to the west by Kilcross Estate, to the north and east by open grasslands and to the south by the R117 regional road (Kilcross Road). The M50 motorway is located approximately 0.05km north of the Site and the Fitzsimons Wood pNHA (001753), which is accessed via the adjoining Kilcross Estate.

The Site of the Proposed Development is located within the administrative jurisdiction of Dún Laoghaire Rathdown County Council (DLRCC). The Dún Laoghaire Rathdown County Development Plan 2022-2028 is the current statutory plan for the region, against which planning applications will be considered. Under the Dún Laoghaire Rathdown County Development Plan 2022-2028, the Site is subject to the zoning objective 'A', which has an objective 'to provide residential development and improve residential amenity while protecting the existing residential amenities'. It is considered that the Proposed Development is compliant with the zoning objective which governs the future development of the lands. The Proposed Development is in line with the national, regional and local sustainable planning principles. The Proposed Development will protect the amenity of the surrounding lands through the achievement of a high-quality architectural design.

The Site Location is presented in Figure 4-1 and the current layout of the Site is presented in Figure 4-2.

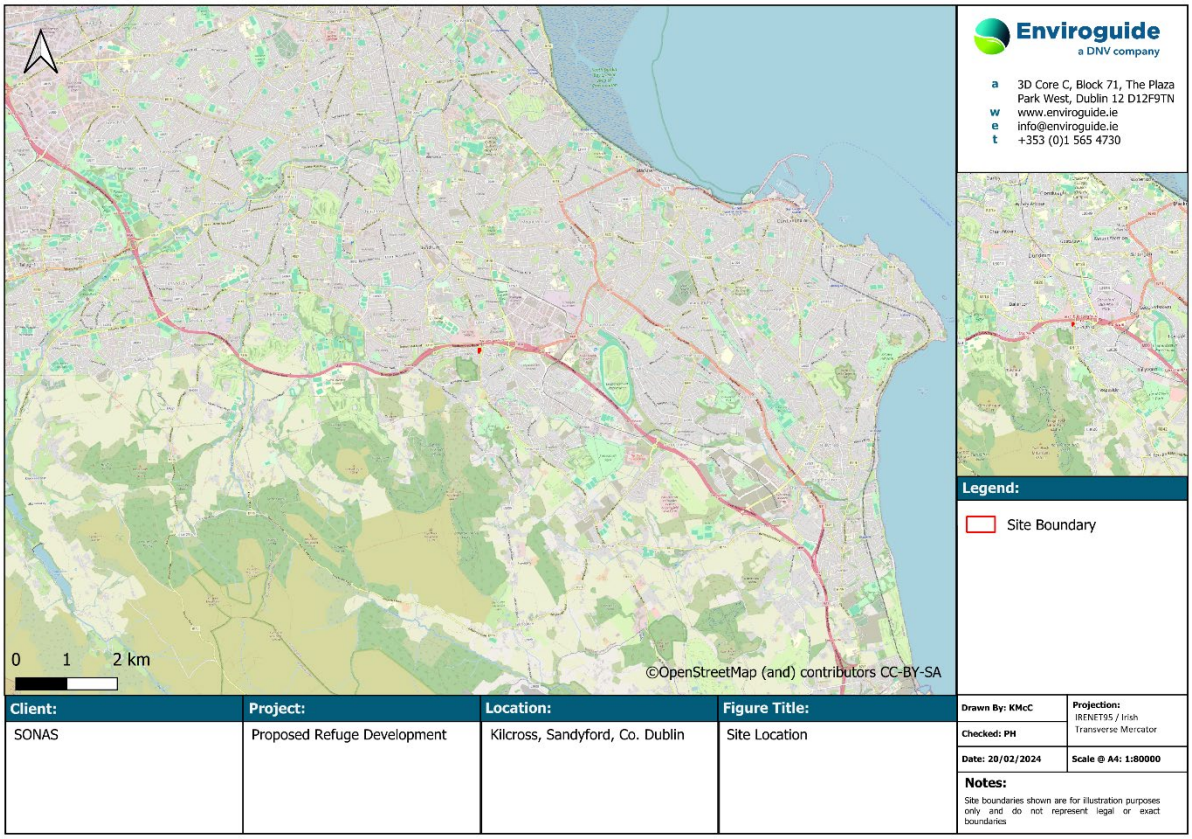

Figure 4-1. Site Location

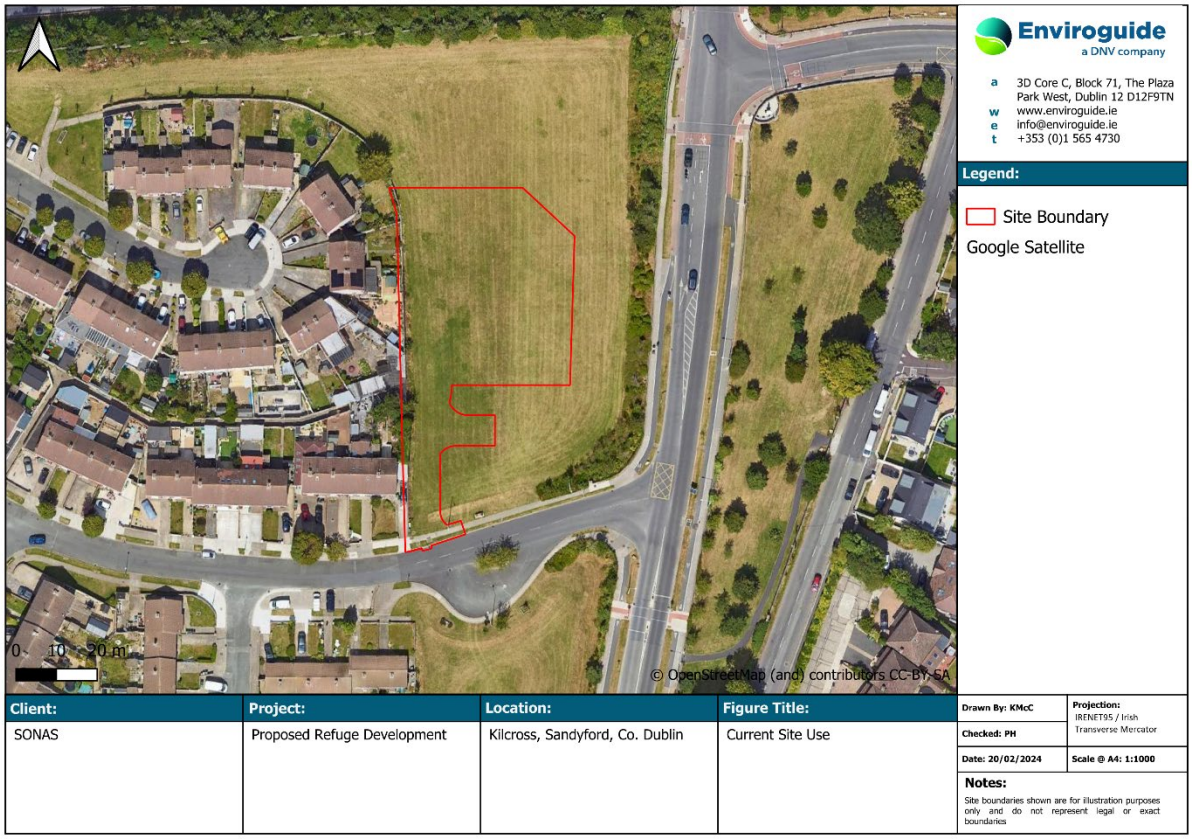

Figure 4-2. Current Site Layout

4.2 Topography

The topography of the Site itself is generally level with elevations ranging from approximately 106.33 meters above Ordnance Datum (mOD) in the south to 105.72mOD in the north.

4.3 Soil and Geology

The soils beneath the Site are mapped by Teagasc (Teagasc, 2024) as deep well drained mineral (mainly acidic), Acid Brown Earths, Brown Podzolics derived from mainly non-calcareous parent materials (IFS Soil Code: AminDW).

The subsoil or quaternary sediments beneath the majority of the site are mapped by the GSI (GSI, 2024) as bedrock outcrop or subcrop. While the subsoil or quaternary sediments beneath the southern portion of the Site (i.e., the proposed access road and turning circle) are mapped by the GSI (GSI, 2024) as till derived from granites (TGr).

The bedrock beneath the Site is mapped by the GSI (GSI, 2024) as Type 3 muscovite porphyritic described as granite with muscovite phenocrysts.

While there are no bedrock outcrops mapped within the Site boundary there are a number of bedrock outcrops mapped by the GSI (GSI, 2024) within a 2km radius of the Site. The closest bedrock outcrop recorded by the GSI (GSI, 2024) is located approximately 0.35km south of the Site at an elevation of approximately 25m above the recorded elevations at the Site. Additional outcropping is recorded approximately 0.7km east of the Site at a similar elevation to that of the Site.

There are no karst features mapped by the GSI (GSI, 2024) at the Site or within a 2km radius of the Site.

4.3.1 Previous Site Investigation Results

4.3.1.1 Soils and Geology

The soils and geology encountered during the previous site investigations (IGSL, 2023) are summarised as follows:

- Topsoil was encountered at all four (4No.) trial pit locations (TP1 through TP4) from ground level to depths ranging between 0.1 meters below ground level (mbGL) (TP3 and TP4) and 0.2mbGL (TP1).
- Grey to brown sandy gravelly CLAY with occasional granite cobbles (described as possible made ground) was encountered below the topsoil at trial pits TP1 through TP4 to depths ranging between 0.7mbGL (TP1) and 1.5mbGL (TP4) respectively.
- Brown sandy gravelly CLAY with roots and fibres (described as possible old topsoil / grass) was encountered below the made ground at TP3 and TP4 to depths of 1.7mbGL and 1.9mbGL respectively. This unit was not encountered at trial pit locations TP1 and TP2.
- Grey clayey sand (described as possible highly weathered granite) was encountered at trial pit locations TP3 and TP4 to depths of 2.4mbGL and 2.3mbGL respectively. Due to shallow refusal, this unit was not encountered at trial pit locations TP1 and TP2.

4.3.2 Soil Quality

Two samples (TP3(1.0) and TP4(1.0)) were selected for analysis for the purposes of waste classification. All samples were classified by IGSL as non-hazardous.

The results are summarised as follows:

- Asbestos was reported by the laboratory as 'no asbestos detected' (NAD).
- The concentrations of mineral oil, total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene, o-xylene and p/m-xylene (BTEX), methyl tert-butyl ether (MTBE) and polychlorinated biphenyls (PCBs) were reported as below the laboratory limit of detection.
- It is noted that low levels of speciated polycyclic aromatic hydrocarbons (PAHs) (naphthalene and pyrene) were recorded for both samples collected.

4.4 Hydrogeology

4.4.1 Groundwater Body

The EPA (EPA, 2024) maps the groundwater body (GWB) beneath the Site as the Kilcullen GWB (EU Code: IE_EA_G_003). The Kilcullen GWB covers some 642 km^2 and occupies an area across Northeast Wicklow, Northwest Kildare and South Dublin (GSI, 2024). It is noted that the eastern boundary of the Site is immediately adjacent to the boundary between the Kilcullen GWB and the Wicklow GWB (EU Code:IE_EA_G076).

The Kilcullen GWB Report (GSI, 2024) identifies that the dominant recharge process in this area will be diffuse recharge from water percolating through the overlying tills and into the aquifer. High rates of potential recharge are expected in the hilly areas where there are very thin subsoils and high rainfall. The main discharge mechanisms within the Kilcullen GWB Report (GSI, 2024) are described as via springs at the break of slopes located at the foot of hills throughout the area and to the overlying streams and rivers as baseflow. Given that a large portion of the potential recharge will be rejected as a result of the low storativity of the poor aquifers in the area a high proportion of the recharge will discharge to surface watercourses (GSI, 2024).

As documented in the Kilcullen GWB Report (GSI, 2024), the majority of groundwater flow in this aquifer will take place in the upper 3m flowing towards discharge points such rivers and streams. Deeper groundwater flow is possible and deep-water strikes are often encountered (between 10mbGL and 40mbGL) but they are more isolated features located along open fractures, which allow groundwater flow (GSI, 2024). Regional groundwater flow paths are not considered to develop, as the rocks do not have sufficient transmissivity to transport water over long distances. Typical groundwater flow paths will be in the order of a couple of hundred metres, with discharge occurring to the closest surface water feature. Locally, groundwater flow direction in the vicinity of the Site is likely to be to the north / northwest toward the Slang River but may vary locally based on topography.

4.4.2 Aquifer Classification

The gravel aquifer mapped by the GSI (GSI, 2023) beneath the Site is classified as Poor Aquifer which is generally unproductive except for local zones (Pl). As documented by the GSI

(GSI, 2017 A Description of Irish Aquifer Categories), poor aquifers are capable of supplying small abstractions (e.g. domestic supplies, small group schemes), or 'moderate' to 'low' yields (<100 m^3/d). Groundwater flow occurs predominantly through a limited and poorly-connected network of fractures, fissures and joints.

The bedrock aquifer beneath the Site is presented in Figure 4-3 below.

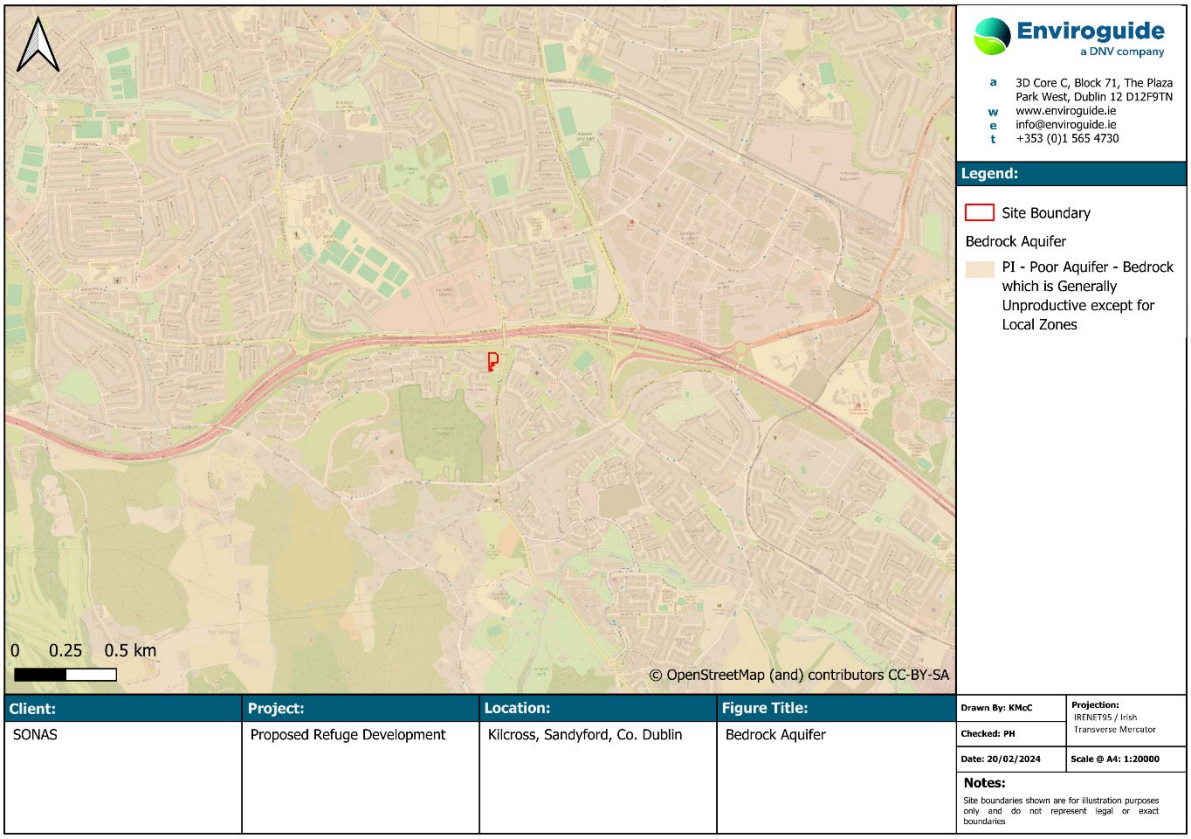

Figure 4-3. Bedrock Aquifer

4.4.3 Groundwater Vulnerability

The vulnerability categories, and methods for determination, are presented in the Groundwater Protection Schemes publication (DEHLG/EPA/GSI, 1999) and summarised in Table 4-1. The publications state that *'as all groundwater is hydrologically connected to the land surface, it is the effectiveness of this connection that determines the relative vulnerability to contamination. Groundwater that readily and quickly receives water (and contaminants) from the land surface is considered to be more vulnerable than groundwater that receives water (and contaminants) more slowly and in lower quantities. The travel time, attenuation capacity and quantity of contaminants are a function of the following natural geological and hydrogeological attributes of any area'.*

Table 4-1. Vulnerability Mapping Criteria

Subsoil Thickness	Hydrogeological Requirements				
	Diffuse Recharge			Point recharge	Unsaturated Zone
	Subsoil Permeability & Type			(Swallow holes, losing streams)	(sand & gravel aquifers only)
	High permeability (sand & gravel)	Moderate permeability (sandy subsoil)	Low permeability (clayey subsoil, clay, peat)		
0-3m	Extreme	Extreme	Extreme	Extreme (30m radius)	Extreme
3-5m	High	High	High	N/A	High
5-10m	High	High	Moderate	N/A	High
>10m	High	Moderate	Low	N/A	High

Notes: (i) N/A = not applicable (ii) Permeability classifications relate to the material characteristics as described by the subsoil description and classification method.

The GSI (GSI, 2024) has assigned a groundwater vulnerability rating of 'High' for the groundwater beneath the majority of the Site and Extreme (E) for the groundwater beneath the southern portion of the Site (i.e., the proposed entrance to the Site). Based on the findings of the previous site investigations (IGSL, 2023) where bedrock was encountered between 2.3mbGL and 2.4mbGL, the groundwater vulnerability can be considered to be Extreme (E) locally beneath the Site.

The groundwater vulnerability rating map is provided in Figure 4-4.

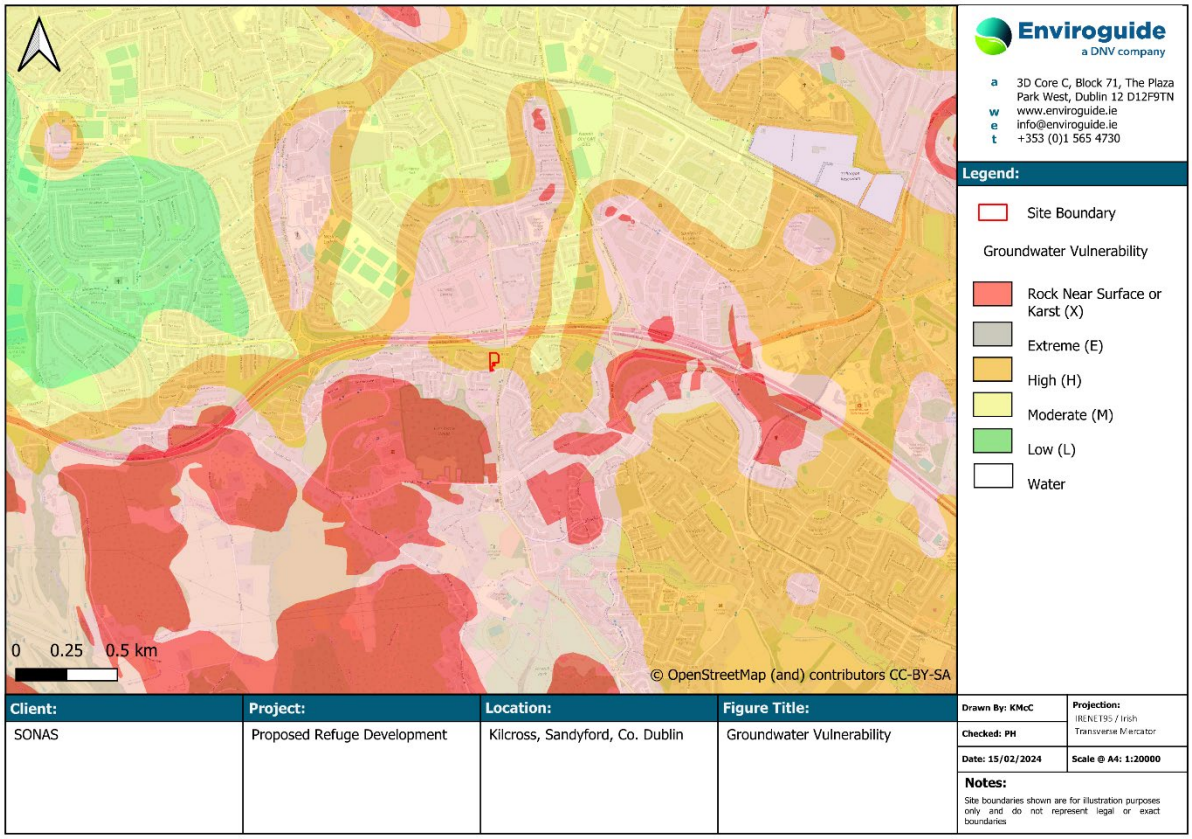

Figure 4-4. Groundwater Vulnerability

4.4.4 Site Hydrogeology

As documented in the previous site investigations (IGSL,2023), groundwater was not encountered during trial pitting.

One soakaway test was performed in accordance with BRE Digest 365 during previous site investigations (IGSL,2023). A low Infiltration Rate of 0.00016 m/min (2.6 x 10^{-6} m/sec) was established indicative of low permeability material. The result is typical of the glacial till or boulder clay of the area.

4.5 Hydrology

The Site is mapped by the EPA (EPA, 2024) as within the Liffey and Dublin Bay WFD Catchment (Catchment I.D.: 09), the Dodder_SC_10 WFD Sub-catchment (Sub-catchment I.D.: 09_16) and the Dodder_050 WFD River Sub-Basin (River Waterbody Code: IE_EA_09D010900). It is noted that the eastern boundary of the Site is immediately adjacent to the boundary between the Liffey and Dublin Bay WFD Catchment and the Ovoca-Vartry WFD Catchment (Catchment I.D.: 10).

The closest surface water feature is recorded on the EPA database (EPA, 2024) as the Carrickmines Stream (River Waterbody Code: IE_EA_10C040350), which is located approximately 0.24km east/southeast of the Site at its closest point. It is noted that the there is no identified hydraulic connection identified between the Site and the Carrickmines Stream which is located within the Ovoca-Vartry WFD Catchment.

The River Slang (River Waterbody Code: IE_EA_09D010900) is located approximately 0.87km west of the Site at its closest point. The River Slang flows north for approximately 1.47km before converging with the River Slang (River Waterbody Code: IE_EA_09D010900). The Slang River flows to the north before discharging to the Dodder River (River Waterbody Code: IE_EA_09D010900) approximately 3.62km downstream. The Dodder River flows north for approximately 4.46km before discharging to the Liffey Estuary Lower transitional waterbody (EU Code: IE_EA_090_0300) and ultimately Dublin Bay (EU Code: IE_EA_090_0000) located to the east and approximately 5.87km downstream.

The local surface waterbodies within a 2km radius of the Site are presented in Figure 4-5.

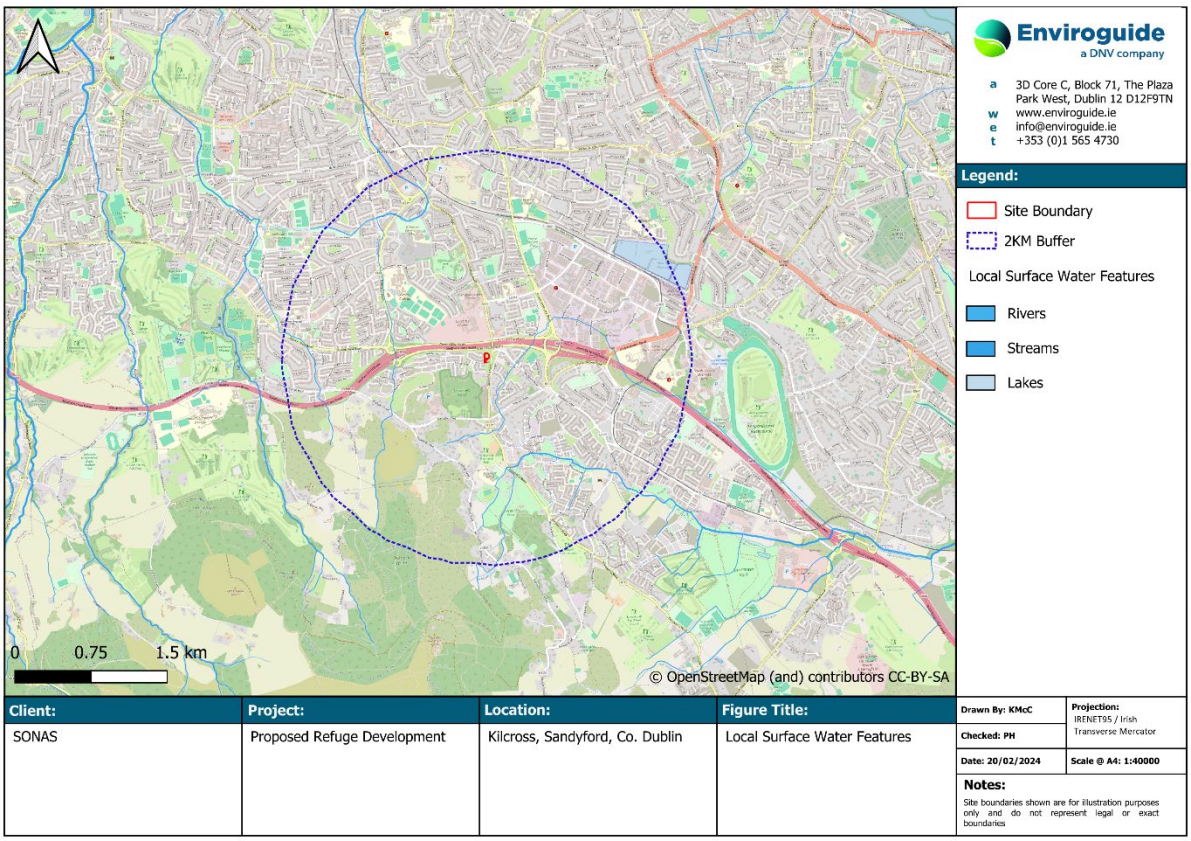

Figure 4-5. Local Surface Water Features

4.5.1 Existing Surface / Storm Drainage

Currently there is no identified direct hydraulic connection between the Site and any water courses. However, there is an existing 300mm concrete surface water pipe which traverses the Site within the western boundary. Treated and attenuated surface water from the Proposed Development will be connected to this existing 300mm concrete surface water pipe.

The existing 300mm concrete surface water pipe, which serves the adjoining Kilcross residential estate, discharges to the River Slang (River Waterbody Code: IE_EA_09D010900) approximately 1.17km downstream of the Site (refer to Figure 4-6).

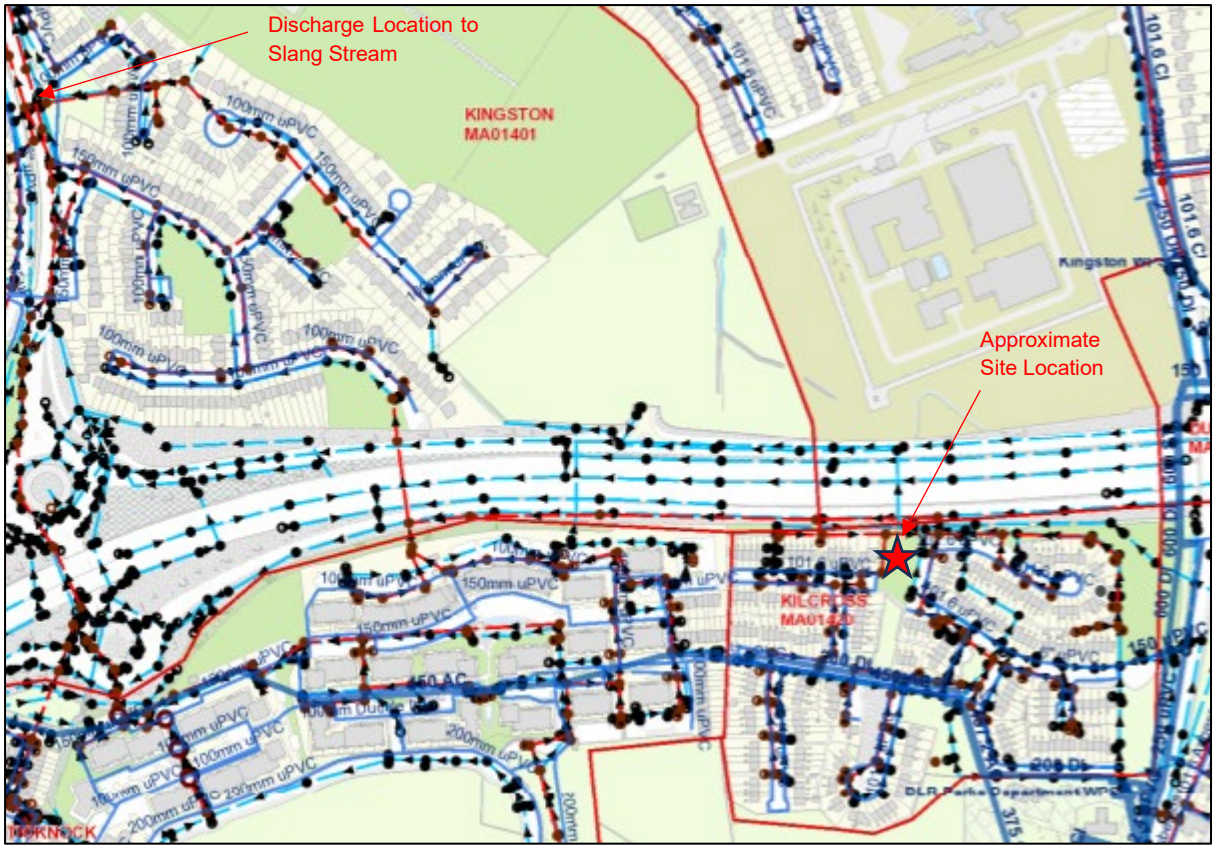

Figure 4-6. Drainage Infrastructure (DLRCC, 2024)

4.6 Flooding

The site-specific flood risk assessment (SSFRA) report produced by AOCA (AOCA, 2024b) assessed the potential flood risk associated with fluvial, groundwater, coastal and pluvial flooding for the Site and Proposed Development.

The FRA (AOCA, 2024b), which takes into account the impacts of climate change by allowing a 10% increase in rainfall to drainage, 20% increase in flood flow to rivers and a 0.5m sea level rise, identifies that the Site is located within Flood Zone C where the probability of flooding is low (less than 0.1% or 1 in 1000 for fluvial flooding).

The SSFRA (AOCA, 2024b) concludes that by means of detailed planning and the implementation of suitable mitigation measures, the risks and consequences of flooding have been alleviated throughout the Proposed Development. Furthermore, the surface water runoff from the Proposed Development will be confined to greenfield runoff and will have no adverse effect on developments located upstream or downstream of the Site.

4.7 Water Use and Source Protection

A search of the GSI groundwater well database (GSI, 2024) was conducted to identify registered wells and groundwater sources in the surrounding area. There are no groundwater sources recorded at the Site or within a 2km radius of the Site.

The Site of the Proposed Development is located within an area serviced by mains water supply. There is an existing 6” watermain in Kilcross Road to the south of the Site. It is noted

that water supply to the Proposed Development will be via this existing 6" watermain in Kilcross Road.

There are no groundwater source protection areas located within a 2km radius of the Site.

There are no surface water drinking water sources, under Article 7 of the Water Framework Directive, identified by the EPA (EPA, 2023) within a 2km radius or hydraulically connected to the Site.

4.8 Water Quality

4.8.1 Published Regional Surface Water Quality

The EPA surface water quality monitoring database (EPA, 2024) was consulted. A summary of the most recent published EPA water quality monitoring data (EPA, 2024) for waterbodies which have a potential hydraulic connection to the Site is presented in Table 4-2 below.

Table 4-2. Surface Water Quality

River I.D. (Location)	EPA WFD Parameter Quality & Trend Analysis				
	Parameter	Period	Indicative Quality	Trend	Baseline Conc. (2017)
Dodder_050 (Footbridge, Beaver Row)	Ammonia-Total (as N)	Annual	Moderate	Upward	0.11mg/l
	Dissolved Inorganic Nitrogen (as N)	Annual	Good	Downwards	1.272mg/l
	ortho-Phosphate (as P)- unspecified	Annual	Good	Upward	0..033mg/l
Tolka Estuary	Chlorophyll	Summer	High	Downward	0.5mg/m^3
		Winter	High	Downward	4.25mg/m^3
	Dissolved Inorganic Nitrogen (as N)	Summer	Good	Upward	0.45mg/l
		Winter	Good	Downward	0.599mg/l
	ortho-Phosphate (as P)- unspecified	Summer	Poor	Upward	86.0ug/l
		Winter	Good	Upward	40.0ug/l
Liffey Estuary Lower	Chlorophyll	Summer	High	Downward	2.5mg/m^3
		Winter	High	Downward	0.5mg/m^3
	Dissolved Inorganic Nitrogen (as N)	Summer	Good	Upward	0.255mg/l
		Winter	Good	Upward	0.535mg/l
	ortho-Phosphate (as P)- unspecified	Summer	Good	Upward	40.5ug/l
		Winter	Good	Upward	44.0ug/l
Dublin Bay	Chlorophyll	Summer	High	Downward	1.8mg/m^3
		Winter	High	Downward	0.5mg/m^3

River I.D. (Location)	EPA WFD Parameter Quality & Trend Analysis				
	Parameter	Period	Indicative Quality	Trend	Baseline Conc. (2017)
	Dissolved Inorganic Nitrogen (as N)	Summer	High	Upward	0.035mg/l
		Winter	High	Downward	0.203mg/l
	ortho-Phosphate (as P)- unspecified	Summer	High	Upward	9.950ug/l
		Winter	Good	Upward	27.0ug/l

4.8.2 Published Regional Groundwater Quality

The EPA (EPA, 2024) groundwater monitoring data was reviewed and there are no groundwater quality monitoring stations within a 2km radius of the Site or that are hydraulically connected to the Site.

4.8.3 Receiving Water Quality – Ringsend Wastewater Treatment Plant (WWTP)

Foul water from the Site will discharge via the Ringsend WWTP to the Liffey Estuary Lower transitional waterbody. The WWTP is operated under relevant statuary approvals. The most recent available Annual Environmental Report (AER) for the Ringsend WWTP is 2022 (UE, 2022). The AER identified that the final effluent was non-compliant with the Emission Limit Values (ELV) specified in the discharge license (D0034-01). The parameters falling to meet there ELV's included biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), total nitrogen and total phosphorus. It was reported that the non-compliances for all parameters were as a result of overloading with the exception of total phosphorus which was due to no phosphorus removal treatment onsite.

While exceedances in the ELV's is noted, the following is also noted under the significance of results section of the AER:

- *'The primary discharge from the wastewater treatment plant does have an observable negative impact on the water quality in the near field of the discharge and in the Liffey and Tolka Estuaries.*
- *The primary discharge from the WWTP does not have an observable negative impact on the Water Framework Directive status in the Liffey Estuary.'*

4.9 Water Framework Directive

The WFD status for river, lake, groundwater, transitional and/or coastal water bodies that have a potential hydraulic connection to the subject site as recorded by the EPA (EPA, 2024) in accordance with European Communities (Water Policy) Regulations 2003 (SI no. 722/2003) are provided in Table 4-3 and shown in Figure 4-7 overleaf.

Table 4-3. Water Framework Directive Status

Waterbody Name	Waterbody EU Code	Location from Site	Distance Downstream of the Site (km)	WFD Status (2016-2021)	WFD Risk	Hydraulic Connection to the Site
River Waterbodies						
Carrickmines Stream_010	IE_EA_10C040350	East	0.2	Good	Not At Risk	Not Hydraulically connected to Site
Dodder_050	IE_EA_09D010900	West	1.17	Moderate	At risk	Yes, downstream of the Site
Transitional Waterbodies						
Liffey Estuary Lower	IE_EA_090_0300	North	10.47	Moderate	At Risk	Yes, downstream of the Site and via discharge from Ringsend WWTP
Tolka Estuary	IE_EA_090_0200	Southwest	13.91	Poor	At Risk	Yes, converges with Liffey Estuary Lower
Coastal Waterbodies						
Dublin Bay	IE_EA_090_0000	Southwest	16.34	Good	Not At Risk	Yes, downstream of the Site and the Ringsend WWTP discharge
Groundwater Bodies						
Dublin GWB	IE_EA_G_008	Underlying	0.0	Good	Review	Yes, underlying the Site

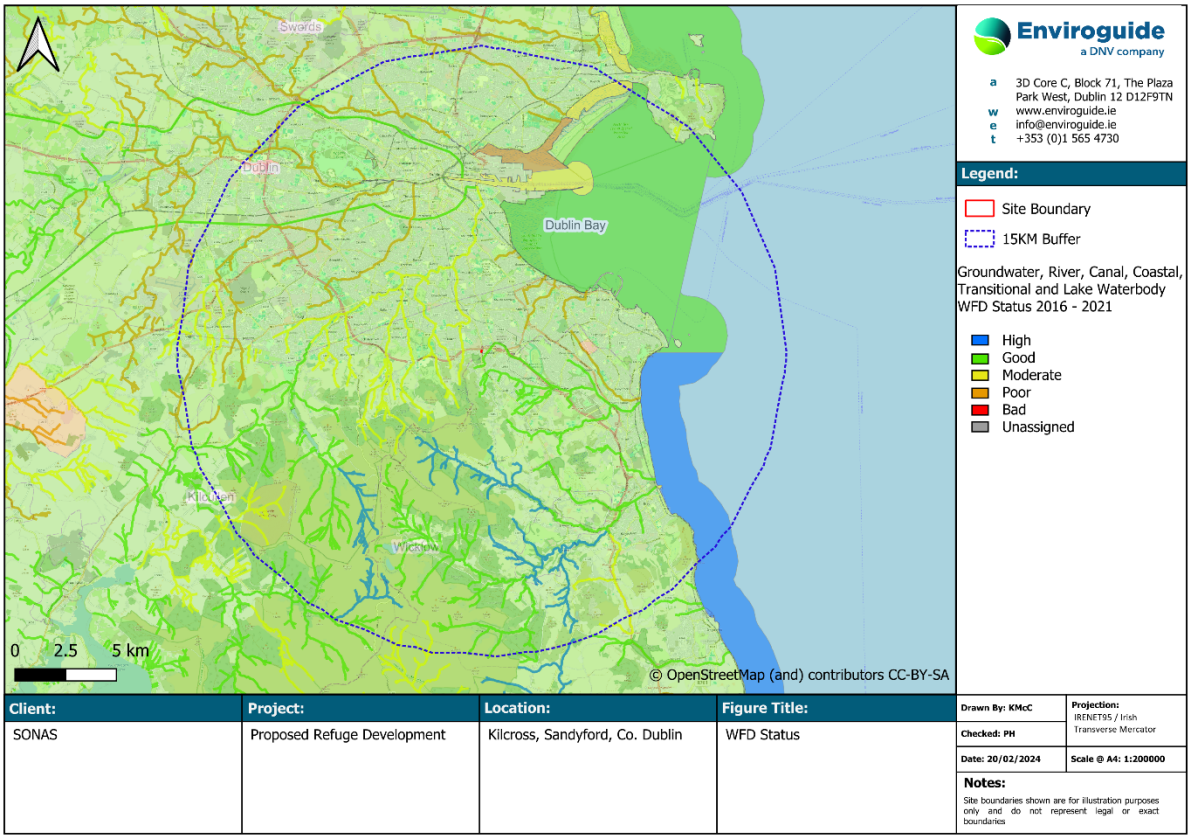

Figure 4-7. Water Framework Directive Status

4.10 Designated and Protected Sites

The Habitats Directive (92/43/EEC) seeks to conserve natural habitats and wild fauna and flora by the designation of Special Areas of Conservation (SACs) and the Birds Directive (2009/147/EC) seeks to protect birds of special importance by the designation of Special Protection Areas (SPAs). SACs and SPAs are collectively known as Natura 2000 or European sites (referred to hereafter as Natura 2000 site).

There are three (4No.) Natura 2000 sites that are identified with a potential hydraulic connection to the Site and Proposed Development. There are also five (5No.) proposed Natural Heritage Areas (pNHA) identified with a potential hydraulic connection to the Site and Proposed Development. The Natura 2000 sites and other protected and designated sites or areas with a potential hydraulic connection to the site are summarised in Table 4-4 and Figure 4-8. It is noted that the Kilcullen GWB beneath the site is considered to have short groundwater flow paths (be in the order of a couple of hundred metres), with groundwater discharging to the closest surface water feature (i.e., the Slang River). Therefore, there is no perceived pathway from groundwater beneath the Site to the identified downgradient Natura 2000 sites and other protected and designated sites.

Table 4-4. Designated and Protected Sites

Designated Site	Site Code	Distance from Site (km)	Direction	Potential Risk
Special Area of Conservation (SAC)				

Designated Site	Site Code	Distance from Site (km)	Direction	Potential Risk
North Dublin Bay SAC	000206	9.81	Northeast	Yes, hydrological connection via River Slang and downstream waterbodies. There is also a connection via discharge from Ringsend WWTP.
South Dublin Bay SAC	000210	4.82	Northeast	
Special Protection Area (SPA)				
North-West Irish Sea SPA	004236	9.81	Northeast	Yes, hydrological connection via River Slang and downstream waterbodies. There is also a connection via discharge from Ringsend WWTP.
North Bull Island SPA	004006	9.81	Northeast	
South Dublin Bay and River Tolka Estuary SPA	004024	4.82	Northeast	
Proposed Natural Heritage Area (pNHA)				
Fitzsimon's Wood pNHA	001753	0.16km	Southwest	No, located hydraulically upgradient of the Site.
Royal Canal pNHA	002103	8.56	North	No, located upstream of surface waterbodies hydraulically connected to the Site (i.e., the Dodder River and the Liffey Estuary Lower).
Grand Canal pNHA	002104	6..96	North	
South Dublin Bay pNHA	000210	5.5	Northeast	Yes, hydrological connection via River Slang and

Designated Site	Site Code	Distance from Site (km)	Direction	Potential Risk
North Dublin Bay pNHA	000206	9.41	Northeast	downstream waterbodies. There is also a connection via discharge from Ringsend WWTP.

Note:
'*' = Distance is measured as closest point to the Site

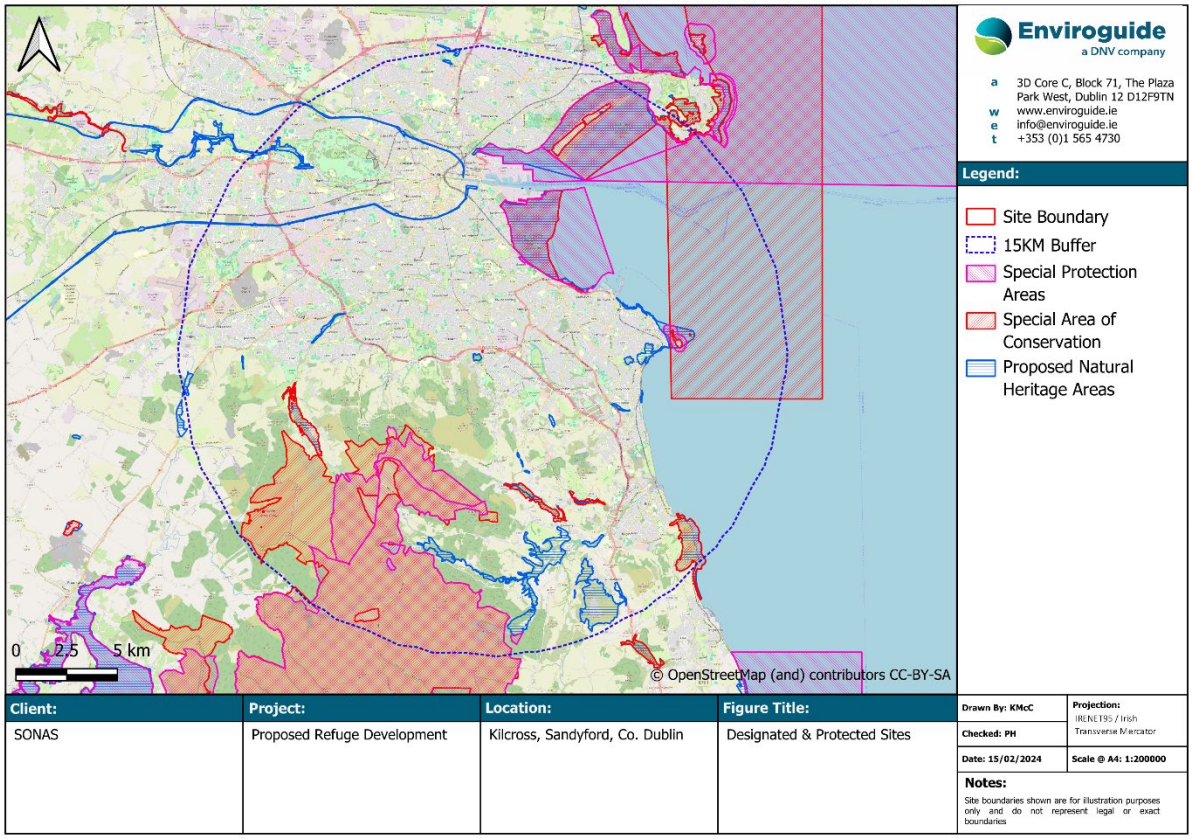

Figure 4-8. Protected and Designated Areas

5 ASSESSMENT OF POTENTIAL IMPACTS

5.1 Conceptual Site Model

As outlined in Section 2.4, the conceptual site model (CSM) represents the characteristics of the Site and identified the possible relationship and potential risk between the contaminant sources, pathways and receptors.

The preliminary CSM and identified sources, pathways and receptors associated with the Site and Proposed Development are outlined in Section 5.1.1, Section 5.1.2 and Section 5.1.3.

5.1.1 Potential Sources

The potential sources associated with the Construction Phase and Operational Phase of the Proposed Development are discussed below:

5.1.1.1 Construction phase

During the Construction Phase of the Proposed Development there will be no direct discharges to surface water or groundwater with the exception of rainfall which will infiltrate to ground via exposed surfaces during excavation works for the construction of building foundations and utility infrastructure.

Based on the finding of the previous site investigations (IGSL, 2023), shallow groundwater is not anticipated and therefore there will be no requirement for dewatering of groundwater during the construction of building foundations and utility infrastructure. However, there may be a requirement for management of surface water (rainwater), where encountered during groundworks. There will be no unauthorised discharge of water (groundwater or surface water runoff) to ground, drains or water courses during the Construction Phase of the Proposed Development.

Foul water discharge from the temporary welfare units at the Site during the Construction Phase of the Proposed Development will be either tankered offsite in accordance with waste management legislation or discharged under temporary consent to the UE mains foul network for treatment at Ringsend WWTP subject to agreement with UE.

Potential sources of contamination that could impact on water quality during the Construction Phase based on the design of the Site include:

- Storage and use of fuel, oils and chemicals used during construction which in the event of an accidental release through the failure of secondary containment or a materials handling accident could infiltrate to the underlying groundwater;
- Use of concrete and cementitious materials during construction in particular for installation of below ground infrastructure and foundations where shallow groundwater may be encountered;
- Suspended sediment and other contaminants entrained in runoff arising from groundworks, stockpiling of materials and other constructions works at the Site;
- Sediment or other material on construction vehicles could potentially be tracked offsite to external public roads;

- Accidental release of wash-water or foul water from facilities at the subject site (e.g., wheel wash and temporary welfare facilities); and
- Release of foul water from existing foul water drainage during connection to live sewers.

5.1.1.2 Operational phase

During the Operational Phase, there will be limited recharge to ground via unpaved, permeable areas due to the low infiltration potential at the Site (IGSL, 2023). Furthermore, the proposed attenuation design does not allow for infiltration due to its proximity to building foundations.

Surface water runoff from the Proposed Development, which will be managed in accordance with the principles and objectives of SuDS and GDSDS, will be treated and attenuated prior to discharge from the Site.

The newly constructed surface water drainage network for the Proposed Development will be connected to the existing 300mm concrete surface water pipe which traverses the Site within the western boundary. The existing 300mm concrete surface water pipe, which also serves the adjoining Kilcross residential estate, discharges to the River Slang (River Waterbody Code: IE_EA_09D010900), located approximately 1.17km downstream of the Site.

The newly constructed foul water drainage network for the Proposed Development will be connected to the existing 225mm foul line which traverses the Site within the western boundary. Foul water from the Proposed Development will be treated in the Ringsend WWTP (Discharge Licence No. D0034-01), which was identified to have sufficient capacity to accept surface water and foul water from the Proposed Development. The UE CoF letter dated the 6th February 2024 (UE COF Reference: CDS24000410) states that the proposed foul water connection is feasible without infrastructure upgrade by UE.

There will be no requirement for bulk storage of petroleum hydrocarbon-based fuels during the operational phase as the main operating system for heating will be natural gas.

The most plausible, albeit worst case, source scenario is outlined:

- Fuels or other potentially hazardous materials released in the event of an accidental spill or leak from a vehicle (assumed 500 litres) is considered a worst-case source at the Site. This potential source is considered to be a short-term event in a worst-case scenario and while unlikely to occur, this scenario is considered in this assessment.
- Suspended sediment entrained in runoff is considered a low-risk source of contamination at the Site for the Operational Phase of the Proposed Development.

5.1.2 Pathways

The following potential pathways are identified and evaluated below:

- **Vertical migration to the underlying bedrock and lateral migration within the aquifer to downgradient receiving surface water bodies**

  The site is underlain by a poor bedrock aquifer (Pl) within the Kilcullen GWB with limited capacity to accept recharge. Groundwater flow in the vicinity of the Site is likely to be to the north / northwest and discharging to the Slang River. It is noted that the Kilcullen GWB beneath the site is considered to have short groundwater flow paths (be

in the order of a couple of hundred metres), with groundwater discharging to the closest surface water feature (i.e., the Slang River). During groundworks and excavations, the groundwater vulnerability will be increased and there will be a more direct pathway for surface contaminants to enter underlying bedrock aquifer and migrate towards downgradient receiving surface water bodies (i.e., the Slang River and associated downstream waterbodies).

- **Surface Water Runoff and Migration Offsite via Watercourses to Downstream Surface Waterbodies**

  There is no direct pathway via surface runoff (open water courses, drainage etc.) to any surface waterbody for the Construction Phase and Operational Phase of the Proposed Development. This pathway is therefore not considered further in this assessment.

- **Groundwater Discharge to Mains Sewer and Downstream Receiving Surface Waterbodies**

  Based on the finding of the previous site investigations (IGSL, 2023), shallow groundwater is not anticipated and therefore there will be no requirement for dewatering of groundwater during the construction of building foundations and utility infrastructure. This pathway is therefore not considered further in this assessment.

- **Surface Water Discharge to Mains Sewer and Downstream Receiving Surface Waterbodies**

  There may be a requirement for management of surface water (rainwater) during the Construction Phase and Operational Phase of the Proposed Development. Therefore, there will be a pathway for surface water runoff (rainwater) discharged via onsite drainage network during the Construction Phase and Operational Phase of the Proposed Development:

  - Where required, surface water runoff (rainwater) during the Construction Phase will be discharged offsite in accordance with the necessary discharge licences issued by Irish Water under Section 16 of the Local Government (Water Pollution) Acts and Regulations for any water discharges to sewer (and ultimately the Liffey Estuary Lower via the Ringsend WWTP) or from DLRCC under Section 4 of the Local Government (Water Pollution) Act 1977, as amended in 1990 for discharges to surface water (and ultimately the Slang Stream and downstream receiving waterbodies).
  - Treated and attenuated surface runoff during the Operational Phase will also be discharged to the existing 300mm concrete surface water pipe before ultimately discharging to the River Slang and downstream receiving waterbodies.

- **Foul Water Discharge to Main Sewer and Receiving Surface Waterbodies**

  Foul water during the Construction Phase of the Proposed Development will be either removed by tanker in accordance with waste management legislation and managed accordingly or discharged under consent to the existing 225mm foul line which traverses the Site within the western boundary. Foul water during the Operational

Phase of the Proposed Development will also be discharged to the existing 225mm foul line and ultimately discharged to the Liffey Estuary Lower via the Ringsend WWTP. Therefore, this indirect pathway to the Liffey Estuary Lower is considered in this assessment.

5.1.3 Receptors

The receptors considered in this assessment include the following:

- Groundwater
  - Underlying poor bedrock aquifer (Pl) which is part of the Kilcullen GWB
- Surface Water:
  - Slang Stream;
  - Slang River;
  - Dodder River;
  - Liffey Estuary Lower;
  - Tolka Estuary; and
  - Dublin Bay.
- Natura 2000 Sites:
  - North Dublin Bay SAC;
  - South Dublin Bay SAC;
  - North Bull Island SPA;
  - South Dublin Bay and River Tolka Estuary SPA; and
  - North-West Irish Sea SPA
- Groundwater Dependant Terrestrial Ecosystems (GWDTE)
  - Fitzsimons Woods pNHA.

  The Fitzsimons Woods pNHA is located hydraulically upgradient of the Site and Proposed Development. Therefore, there is no perceived pathway from groundwater beneath the Site to the identified GWDTE. This receptor is therefore not considered further in this assessment.

5.2 Risk Evaluation of Source-Pathway-Receptor Linkages

A risk-based assessment of the Source-Pathway-Receptor Model and the potential risk linkages associated with the Construction Phase and Operational Phase of the Proposed Development was undertaken. The results were evaluated to determine if the Proposed Development could potentially impact any potential receptors associated with the Site.

Table 5-1. Conceptual Site Model (Source- Pathway Receptor) and Risk Evaluation

Source	Pathway	Receptor	Risk Evaluation and Avoidance
Construction Phase			
Discharge of Contaminants to Ground / Groundwater	Vertical and Lateral Groundwater Migration in Bedrock Aquifer	Underlying Bedrock Aquifer Receiving surface waterbodies (i.e., the Slang River, the Dodder River, the Liffey Estuary Lower, the Tolka	Low to Moderate Risk (worst-case unmitigated scenario) During groundworks and excavations, the groundwater vulnerability will be increased and there will be a more direct pathway for surface contaminants to enter the underlying bedrock aquifer and migrate towards downgradient receiving surface water

Source	Pathway	Receptor	Risk Evaluation and Avoidance
		Estuary and Dublin Bay) Natura 2000 Sites	bodies. However, based on the relatively low recharge potential, it is considered that there is some protection of groundwater from migration of dissolved phase contaminants to the aquifer which will likely be confined to the immediate vicinity of the Site. In a worst-case scenario during either the Construction Phase (e.g., accidental release of fuels, chemicals or oils through the failure of secondary containment or a materials handling accident) in the absence of any mitigation measures there is potential for discharge of contaminants to groundwater and downgradient receiving surface water receptors (i.e., the Slang River). Taking account of the distance downstream and the attenuation and dilution which will occur, it is considered that there is an indirect negligible risk to the downstream receiving waterbodies (i.e., Dodder River, the Liffey Estuary Lower, the Tolka Estuary and Dublin Bay and Natura 2000 sites. The Kilcullen GWB beneath the site is considered to have short groundwater flow paths (being in the order of a couple of hundred meters), with groundwater discharging to the closest surface water feature (i.e., the Slang River). Therefore, there is no perceived direct pathway from groundwater beneath the Site to the identified downgradient Natura 2000 sites. Appropriate design avoidance and mitigation measures will prevent any potential impact to the receiving water quality.
Discharge of Surface Water Runoff (i.e., Rainwater)	Discharge to Mains Sewer	Receiving surface waterbodies (i.e., the Slang Stream, the Slang River, the Dodder River, the Liffey Estuary Lower, the Tolka Estuary and Dublin Bay) Natura 2000 Sites	Low Risk Surface water runoff (rainwater) during the Construction Phase will be discharged to the existing drainage network (foul or surface water) following appropriate treatment (e.g., settlement or hydrocarbon interceptor) in accordance with the necessary discharge licences issued by UE under Section 16 of the Local Government (Water Pollution) Acts and Regulations or by DLRCC under

Source	Pathway	Receptor	Risk Evaluation and Avoidance
			Section 4 of the Local Government (Water Pollution) Act 1977, as amended in 1990 and ultimately discharged to the receiving surface waterbodies (i.e., the Slang river or the Liffey Estuary Lower via Ringsend WWTP).
Foul Water Discharge	Discharge to Mains Sewer	Receiving surface waterbodies (i.e., the Liffey Estuary Lower, the Tolka Estuary and Dublin Bay) Natura 2000 Sites	Low Risk Foul water during the Construction Phase of the Proposed Development will be either removed by tanker in accordance with waste management legislation and managed accordingly or discharged under consent to the mains UE drainage network and ultimately discharged to the receiving surface waterbodies (i.e., the River Liffey or the Liffey Estuary Lower via Ringsend WWTP). Foul water from the Site will only be discharged to the UE network under the appropriate consents from UE and therefore, the Proposed Development will not cause a potential impact at any receiving waterbody or Natura 2000 sites associated with discharges from the Site.
Operational Phase			
Discharge of Surface Water Runoff	Discharge to Surface Water Drainage Network	Receiving surface waterbodies (i.e., the Slang Stream, the Slang River, the Dodder River, the Liffey Estuary Lower, the Tolka Estuary and Dublin Bay) Natura 2000 Sites	Low to Moderate Risk (worst-case unmitigated scenario) During the Operational Phase of the Proposed Development, there is limited potential for discharge of any contaminated runoff to the receiving water courses associated with surface water runoff from the Site. However, in a worst-case scenario during the Operational Phase (e.g., failure of SuDS) in the absence of any mitigation measures there is potential for discharge of contaminants to receiving surface water receptors (i.e., the Slang river and downstream receptors). Taking account of the distance downstream and the dilution which will occur, it is considered that there is a negligible risk to downstream waterbodies (i.e., the Dodder River, the Liffey Estuary Lower, the Tolka Estuary and Dublin Bay) and Natura 2000 sites.

Source	Pathway	Receptor	Risk Evaluation and Avoidance
			Surface runoff from roofs and paved areas will be managed and treated in accordance with SUDS and pass through petrol interceptor and attenuation tanks prior to discharging to the Slang river.
Discharge of Contaminants to Ground / Groundwater	Vertical and Lateral Groundwater Migration in Bedrock Aquifer	Underlying Bedrock Aquifer Receiving surface waterbodies (i.e., the Slang River, the Dodder and downstream waterbodies) Natura 2000 Sites	No Identified Risk Based on the design of the Proposed Development there is limited potential sources of contamination during the Operational Phase and there will be limited potential for discharge of contaminants associated with surface water runoff to ground via unpaved, permeable areas due to the low infiltration potential at the Site. Furthermore, the proposed attenuation design does not allow for infiltration due to its proximity to building foundations. Surface water will be managed in accordance with the principles and objectives of SuDS and the GDSDS to treat and attenuate water prior to discharging offsite. Ongoing regular operational monitoring and maintenance of drainage and the SuDS measures will be incorporated into the overall management strategy for the Proposed Development. This will ensure that there are no impacts on water quality during the Operational Phase of the Proposed Development.
Foul Water Discharge	Discharge to Mains Sewer	Receiving surface waterbodies (i.e., the Liffey Estuary Lower, the Tolka Estuary and Dublin Bay) Natura 2000 Sites	Low Risk Foul water during the Operational Phase of the Proposed Development will be discharged to the UE drainage network and ultimately discharged to the Liffey Estuary Lower via the Ringsend WWTP. Foul water from the Site will only be discharged to the UE network under the appropriate consents from UE, and therefore, the proposed development will not cause a potential impact at any receiving waterbody or Natura 2000 sites associated with discharges from the Site .

5.2.1 Design Avoidance and Mitigation

The assessment of the potential impacts on the receiving environment takes account of the embedded design avoidance measures and standard good practice construction methods to

reduce the potential for impacts to the water environment. These are outlined below together with additional specific measures based on the findings of this assessment.

5.2.1.1 Construction Phase

During the Construction Phase, all works will be undertaken in accordance with the Construction Environmental Management Plan (CEMP) (AOCA, 2023c). Following appointment, the contractor will be required to further develop the CEMP to provide detailed construction phasing and methods to manage and prevent any potential emissions to ground with regard to the relevant industry standards (e.g., Guidance for Consultants and Contractors, CIRIA-C532', CIRIA, 2001). The CEMP will be implemented for the duration of the Construction Phase, covering construction and waste management activities that will take place during the Construction Phase of the Proposed Development. Mitigation works will be adopted as part of the construction works for the Proposed Development. These measures will address the main activities of potential impact which include:

- Control and Management of surface water runoff.
- Control and management of shallow groundwater during excavation and dewatering (if required);
- Management and control of soil and materials.
- Appropriate fuel and chemical handling, transport and storage; and
- Management of accidental release of contaminants at the Site.

Surface water runoff management will be required to prevent runoff entering excavations during construction. Surface water will require diversion around the open excavations using standard temporary drainage methods to ensure that surface water is effectively conveyed around works areas.

Where water must be pumped from the excavations during the Construction Phase of the Proposed Development, water will be discharged by the contractor, following appropriate treatment (e.g., settlement or hydrocarbon interceptor) to sewer in accordance with the necessary discharge licences issued by UE under Section 16 of the Local Government (Water Pollution) Acts and Regulations for any water discharges to sewer or from FCC under Section 4 of the Local Government (Water Pollution) Act 1977, as amended in 1990 for discharges to surface water. Under no circumstances will any untreated wastewater generated onsite (from equipment washing, road sweeping etc.) be released to ground or to drains. Where required, all public sewers will be protected to ensure that any untreated wastewater generated onsite enters the public sewers.

Pumping of concrete will be monitored to ensure that there is no accidental discharge. All work will be carried out in the dry and effectively isolated from any onsite drains. A suitable risk assessment for wet concreting will be completed prior to works being carried out. There will be no mixer washings or excess concrete discharged onsite. All excess concrete is to be removed from Site and all washout of concrete chutes to be captured in a tank which shall be removed offsite for disposal at an authorised waste facility;

All below ground drainage infrastructure will be constructed in accordance with current UE requirements to ensure that there are no potential impacts to groundwater quality.

Welfare facilities have the potential, if not managed appropriately, to release organic and other contaminants to ground or surface water courses. Foul drainage from temporary welfare

facilities during the Construction Phase of the Proposed Development will either be discharged to temporary holding tank(s), the contents of which will periodically be tankered off site to a licensed facility or discharged to public sewer in accordance with the necessary temporary discharge licences issued by UE.

The Ringsend WWTP is operated in accordance with relevant statutory approvals issued by UE. While it is noted there is an exceedance in effluent above the discharge license ELVs, as specified in the 2022 AER, it is noted there the WWTP has an observable impact on the water quality in the in the near field of the discharge, in the Liffey Estuary Lower and the Tolka Estuary, it does not have an observable impact on the Water Framework Directive status. The increase discharge to the Ringsend WWTP as a result of the Proposed Development is considered to be insignificant in terms of the overall scale of the facility. The increased load does not have the capacity to alter the effluent released from the WWTP to such an extent as to result in likely significant effects on its receiving waters. In addition, upgrade works are currently on-going at Ringsend WWTP to increase the capacity of the facility from 1.6 million PE to 2.4 million PE. This plant upgrade will result in an overall reduction in the final effluent discharge of several parameters from the facility including BOD, suspended solids, ammonia, DIN and MRP (Irish Water, 2018).

5.2.1.2 Operational Phase

Based on the design of the Proposed Development there is limited potential sources of contamination during the Operational Phase and there will be limited potential for discharge of contaminants associated with surface water runoff to ground via unpaved, permeable areas due to the low infiltration potential at the Site. Furthermore, the proposed attenuation design does not allow for infiltration due to its proximity to building foundations. Surface water will be managed in accordance with the principles and objectives of SuDS and the GDSDS to treat and attenuate water prior to discharging offsite. Ongoing regular operational monitoring and maintenance of drainage and the SuDS measures will be incorporated into the overall management strategy for the Proposed Development. This will ensure that there are no impacts on water quality and quantity (flow regime) during the Operational Phase of the Proposed Development.

Foul water during the Operational Phase of the Proposed Development will ultimately discharge via the Ringsend WWTP to the Liffey Estuary Lower under the appropriate consents from UE. As mentioned above, the Ringsend WWTP, which is operated in accordance with relevant statutory approvals issued by UE, is currently undergoing upgrade works to improve the final effluent discharge of several parameters from the facility including BOD, suspended solids, ammonia, DIN and MRP. Foul water from the Site will only be discharged to the UE network under the appropriate consents from UE, and therefore, the proposed development will not cause a potential impact at any Natura 2000 sites associated with discharges from the Site.

5.2.2 Potential Impact on Natura 2000 Sites

Based on the findings of this assessment, it is considered that in applying the precautionary principle and assessing a worst case scenario there is no identified potential negative impact associated with the Proposed Development on the closest hydraulically connected Natura 2000 sites in particular the North Dublin Bay SAC, South Dublin Bay SAC, North Bull Island

SPA, South Dublin Bay and River Tolka Estuary SPA and North-West Irish Sea SPA individually or in-combination.

5.2.3 Water Framework Directive Status

The findings of the risk-based assessment identified that in the absence of any mitigation and avoidance measures there could be a potential impact on the water quality within receiving water bodies associated with the Proposed Development, specifically within a local zone of the Kilcullen GWB and locally within the Dodder_050. There is no identified potential impact to the downstream receiving Liffey Estuary Lower, the Tolka Estuary and Dublin Bay attributed to the separation distances and anticipated assimilation capacity of the receiving water bodies taking account of the existing baseline conditions and WFD Status.

The mitigation measures as outline above, including the implementation of the CEMP during the Construction Phase and the incorporation of SUDS in accordance with the GDSDS in the design of the Operation Phase of the Proposed Development, will prevent any impact on the receiving groundwater and surface water environment. Hence, the Proposed Development will not have any impact on compliance with the EU Water Framework Directive, European Communities (Environmental Objectives) Surface Water Regulations, 2009 (SI 272 of 2009, as amended 2012 (SI No 327 of 2012), and the European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010), as amended 2012 (SI 149 of 2012) and 2016 (S.I. No. 366 of 2016).

The Proposed Development will not cause a deterioration in the status of waterbodies hydraulically connected with the Proposed Development, taking account of design avoidance and mitigation measures that will be implemented. The Proposed Development will not jeopardise objective to achieve ‘good’ surface water status or good ecological potential.

There will be no impact to the existing WFD status of water bodies associated with the Proposed Development including the Dodder_050, the Liffey Estuary Lower, the Tolka Estuary, Dublin Bay and the Dublin GWB as a result of the Proposed Development taking account of embedded design avoidance and mitigation measures.

6 CONCLUSIONS

Enviroguide has carried out a risk-based hydrological and hydrogeological impact assessment for a proposed refuge development at Kilcross, Sandyford, Dublin 18 to determine if there is any potential for significant impacts on the receiving water environment, Groundwater Dependant Terrestrial Ecosystems (GWDTE) including the Fitzsimons Woods proposed Natural Heritage Area (pNHA) and designated Natura 2000 sites in the absence of avoidance and mitigation measures.

The CSM was developed identifying plausible S-P-R linkages for the Proposed development and receiving water environment. The CSM formed the basis of the evaluation of any potential impacts to receptors including waterbodies, GWDTEs and Natura 2000 sites associated with the Proposed Development. The assessment assumed a worst-case scenario (individually and in-combination) and in the absence of any mitigation measures intended to avoid or reduce potential harmful effects.

Based on the findings of this assessment the following can be concluded:

- The Fitzsimons Woods pNHA is located hydraulically upgradient of the Site and Proposed Development. Therefore, there is considered to be no perceived pathway and hence no identified risk from groundwater beneath the Site to the identified GWDTE.
- There is a potential risk of impact to local groundwater quality and potentially the receiving Dodder_050 waterbody via groundwater flow and/or surface water runoff, assuming a worst-case scenario at the Site and taking account of the local hydrological and hydrogeological flow regime. However, taking account of the distance downstream and the dilution and attenuation which will occur, it is considered that there is a negligible risk to any further downstream waterbodies including the Liffey Estuary Lower, the Tolka Estuary and Dublin Bay.
- The underlying aquifer has been identified as ‘Poor’ with limited recharge potential which restricts potential pollutants pathways within the Kilcullen GWB and to migration to other waterbodies. In a worst-case scenario, impacts will likely be confined to the immediate vicinity of the Site.
- There is no identified risk to water quality associated with the indirect (mains drainage) discharge of foul water from the Proposed Development to the existing mains UE foul drainage network that will ultimately be discharged to the Liffey Estuary Lower via the Ringsend WWTP under appropriate consent from UE.
- The appropriate standard design measures for the Construction Phase and Operational Phase of the Proposed Development including implementation of the CEMP and SuDS measures within the drainage design will prevent, limit and mitigate any the potential for the worst-case scenario to occur. These embedded measures will ensure there is no risk to water quality of the receiving watercourses.
- In the unmitigated worst-case scenario, there is no identified negative impact on the closest hydraulically connected Natura 2000 sites in particular North Dublin Bay SAC, South Dublin Bay SAC, North Bull Island SPA, South Dublin Bay and River Tolka Estuary SPA and North-West Irish Sea SPA associated with Proposed Development either individually or in-combination.

- There is no identified impact to the existing WFD status of water bodies associated with the Proposed Development including the Kilcullen GWB, the Dodder_050, the Liffey Estuary Lower, the Tolka Estuary and Dublin Bay as a result of the Proposed Development taking account of design avoidance and mitigation measures that will be implemented as described.

7 REFERENCES

Aidan O'Connell & Associates Ltd., 2024. Civil Works Design Report SONAS Refuge Centre, Kilcross, Sandyford, Dublin 18.

Aidan O'Connell & Associates Ltd., 2024. Flood Risk Assessment SONAS Refuge Centre, Kilcross, Sandyford, Dublin 18.

Aidan O'Connell & Associates Ltd., 2024. Construction Environmental Management Plan SONAS Refuge Centre, Kilcross, Sandyford, Dublin 18.

CIRIA (Construction Industry Research and Information Association), 2001. Control of water pollution from construction sites – guide to good practice, (CIRIA 532)

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

Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC.

Environmental Protection Agency, 2024. EPA Envision Maps. https://gis.epa.ie/EPAMaps/Water. Consulted on 21/02/2024.

Geological Society of Ireland, 2024. GSI webmapping, 2023. https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228. Consulted on 21/02/2024.

Geological Survey of Ireland, 2017. A Description of Irish Aquifer Categories.

Geological Survey of Ireland, 2024. Groundwater Body Reports, Kilcullen GWB. Consulted on 21/02/2024.

Google Earth Pro, 2024. Consulted on 21/02/2024.

IGSL Ltd., 2023. Report on a Site Investigation at Proposed Housing Development Kilcross Sandyford.

National Parks and Wildlife Services (NPWS) webmapping 2023. https://dahg.maps.arcgis.com/apps/webappviewer/index.html?id=8f7060450de3485fa1c1085536d477ba. Consulted on 21/02/2024.

Ordnance Survey Ireland, 2024. Ordnance Survey Ireland webmapping http://map.geohive.ie/mapviewer.html. Consulted on 21/02/2024.

Teagasc, 2024 webmapping. http://gis.teagasc.ie/soils/map.php. Consulted on 21/02/2024.

Uisce Eireann, 2023. Ringsend WWTP (D0034-01) Annual Environmental Report 2022.

Water Framework Directive, 2024. Water Framework Directive web mapping - http://watermaps.wfdireland.ie/NsShare_Web/. Consulted on 21/02/2024.

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