UPDATED HYDROLOGICAL & HYDROGEOLOGICAL QUALITATIVE RISK ASSESSMENT FOR MODIFICATIONS TO THE PROPOSED DEVELOPMENT

AT

JUNCTION OF SANTRY AVENUE AND SWORDS ROAD, SANTRY, CO. DUBLIN

Technical Report Prepared For

Dwyer Nolan Developments Ltd

Technical Report Prepared By

Alan Wilson BSc
Environmental Consultant

Our Reference

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awnconsulting

The Tecpro Building,
Clonshaugh Business & Technology Park,
Dublin 17, Ireland.

T: + 353 1 847 4220
F: + 353 1 847 4257
E: info@awnconsulting.com
W: www.awnconsulting.com

Cork Office
Unit 5, ATS Building,
Carrigaline Industrial Estate,
Carrigaline, Co. Cork.
T: + 353 21 438 7400
F: + 353 21 483 4606

AWN Consulting Limited
Registered in Ireland No. 319812
Directors: F Callaghan, C Dilworth,
T Donnelly, T Hayes, D Kelly, E Porter

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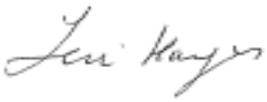
Signature		
Name	Alan Wilson	Teri Hayes
Title	Environmental Consultant	Director
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1.0 INTRODUCTION

1.1 Background

AWN were requested to carry out a Hydrological and Hydrogeological Qualitative Risk Assessment for a proposed development on behalf of Dwyer Nolan Developments Ltd. Dwyer Nolan Developments Ltd. wishes to apply for permission for a Large-Scale Residential Development (LRD) on this site, c. 1.5 hectares, located at the junction of Santry Avenue and Swords Road, Santry, Dublin 9.

The development site is bounded to the north by Santry Avenue, to the east by Swords Road, to the west by Santry Avenue Industrial Estate, and to the south by the permitted Santry Place development (granted under Dublin City Council Ref. 2713/17 (as extended under Ref. 2713/17/X1), 2737/19 & 4549/22).

1.2 Objective of Report

The scope of this desktop review is to assess the potential for any likely significant impacts on receiving waters and protected ecological areas during construction or post development, in the absence of taking account of any measures intended to avoid or reduce harmful effects of the proposed project (i.e. design or mitigation measures).

In particular, this review considers the likely impact of construction and operation impacts (construction run-off, and domestic sewage) from the proposed development on water quality and overall water body status within the Liffey and Dublin Bay Catchment (Sub-Catchment: Mayne_SC_010).

The primary objectives of this assessment are to ensure that the proposed development:

- Protects and enhances where possible the groundwater quality, quantity and classification;
- Provides evidence that the construction of the proposed development shall not place groundwater at undue risk;
- Provides evidence that the structural stability of adjoining or neighbouring buildings and land areas are not put at risk;
- Provides a management plan for any demolition works and for the construction of the basement;
- Does not have an adverse effect on existing patterns of surface water drainage;
- Shall not significantly impact on groundwater or surface water flows to the extent that this is likely to increase the risk of flooding;
- Ensures appropriate handling and dealing with waste removal;
- Conserves and where possible enhances the biodiversity value of the site; and
- Complies with the relevant regulations.

1.3 General Qualifications and Conditions of Use

The subject report is intended to be an accurate and unbiased account of what the potential impacts of constructing a basement within the proposed residential development. It has been compiled based on information from the following sources:

- Geological Survey of Ireland- online mapping (GSI, 2024);
- GSI - Geological Heritage Sites & Sites of Special Scientific Interest;

- Environmental Protection Agency (EPA, 2024);
- Ordnance Survey of Ireland (OSI, 2024);
- Teagasc subsoil database (2024);
- National Parks and Wildlife services (NPWS, 2024);
- Office of Public Works (OPW, 2024);
- Strategic Flood Risk Assessment (SFRA) - Dublin City Development Plan, 2022–2028;
- Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites, Eastern Regional Fisheries Board (ERFB);
- Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors" (CIRIA 532, 2001);
- Water Framework Directive (2000/60/EC);
- The Construction Industry Research and Information Association (CIRIA) Environmental Good Practice on Site (C502);

The assessment relies on information regarding construction and design provided by Dwyer Nolan Developments as follows:

- Appendix A - Ground Investigation Report. Development in Santry (GII, 2019);
- Appendix B - Engineering Services Report. Mixed Use Development (LRD), Santry Avenue, Dublin (Ref: 230146-X-Z-Z-ZZZ-RP-DBFL-CE-0001), DBFL, October 2023; and
- Various site plans and drawings.

This report is based on the above information and prepared for the purpose of making a submission to the planning authority on this particular site only. The impacts categorised above are based on the judgement and experience of the Engineers & Hydrogeologist carrying out the assessment, and may be based on information or documentation supplied by others.

Moreover, the report is intended for the sole use of Dwyer Nolan Developments and their elected agents and advisors and, further, solely for the purpose for which it was originally commissioned. It may not be assigned or copied to third parties or relied upon by third parties.

Project Personnel

This report was prepared by **Alan Wilson** (BSc), and **Teri Hayes** (BSc MSc PGeol EurGeol).

Alan Wilson (BSc) is an Environmental Consultant at AWN. Alan holds a BSc Honours in Environmental Management in Agriculture/ Environmental and Geographical Sciences. Alan has worked on a range of large scale projects involving EIA reports, site specific flood risk assessments, baseline studies, hydrological and hydrogeological risk assessments, environmental due diligences, site investigations and groundwater, surface water and soil monitoring on various operational developments and greenfield and brownfield sites. Alan has over 2 years' experience as an Environmental Consultant including roles in Ecology and Forestry related work. Alan is a member of the International Association of Hydrogeologists (IAH) Irish Group and the Institute of Geologists of Ireland (IGI).

Teri Hayes (BSc MSc PGeol EurGeol, Adv Dip in Environmental & Planning Law) is a Director and Senior Hydrogeologist with AWN Consulting with over 25 years of experience in water resource management, environmental assessment and environmental licensing. Teri is a former President of The International Association of Hydrogeologists (IAH, Irish Group) and is a professional member of the Institute of Geologists of Ireland (IGI) and European Federation of Geologists (EurGeol). She has qualified as a competent person for contaminated land assessment as required by the IGI and EPA. Her project experience includes contributions to a wide range of complex Environmental Impact Statements, planning applications and environmental reports for Industry Infrastructure and residential developments. Teri's specialist area of expertise is water resource management, eco-hydrogeology, hydrological assessment and environmental impact assessment.

2.0 HYDROLOGICAL ENVIRONMENT

2.1 Site Setting

The proposed development measures approximately 1.5ha in area and is located at the junction of Santry Avenue and Swords Road, with frontage onto both roads (being bounded to the east by Swords Road and to the north by Santry Avenue) and is currently occupied by Chadwicks building providers (formerly Heiton Buckley). Access to the subject site is currently limited to an existing site entrance off / onto Santry Avenue.

The proposed development site lies within the Liffey and Dublin Bay Catchment (Hydrometric Area 09) and Mayne River sub-catchment (WFD name: Mayne_SC_010).

There are no watercourses located in the immediate vicinity of the site. According to the EPA river network (EPA maps, https://gis.epa.ie/EPAMaps/), the nearest watercourse is the Santry River which resides c. 680 m to the north of the proposed development (refer to Figure 2.1 below). The Naniken River system currently flows culverted to the south of the proposed development (refer to Figure 4.2). The Dublin Bay coastal waterbody is located c. 7.4 km southeast of the proposed development.

Figure 2.1 *Site Location and Regional Hydrological Environment (EPA, 2024)*

2.2 Areas of Conservation

A review of the EPA (2024) on-line database indicates there are no NPWS protected areas in the immediate vicinity of the proposed development site. The nearest Natura 2000 Sites are North Dublin Bay Special Area of Conservation (SAC) / proposed Natural Heritage Area (pNHA) and North Bull Island Special Protection Area (SPA), which are located in Dublin Bay c. 7.4 km to the south-east of the proposed development.

There is no direct hydrological connection between the proposed development site and these Natura 2000 Sites.

3.0 DESCRIPTION OF EXISTING AND PROPOSED DRAINAGE

Existing Surface Water Drainage

There is an existing 225mm diameter public surface water sewer located on the Swords Road (R104) to the east of the site.

A surface water network was constructed within the previously approved proposed mixed-use development (Planning Ref: 2713/17 & 2737/19) to the south of the proposed development. This system contains an attenuation system, hydrobrake and petrol interceptor on the outfall surface water sewer. This outfall sewer discharges to the existing 225mm diameter sewer noted above. A connection to the public sewer has been made at the junction of the Swords Road with Schoolhouse Lane under permission of Dublin City Council. This connection has been approved under Planning Ref: 2713/17 & 2737/19. It is proposed a new surface water sewer network for the proposed development which will be entirely separate from the foul water sewer network. Any existing private infrastructure present onsite will be grubbed up and removed.

Proposed Surface Water Drainage

The surface water drainage from this development is proposed to discharge, following attenuation and hydrobrake flow control device, via a new 225mm diameter surface water sewer to a manhole constructed as part of the previously approved mixed-use development (Planning Ref: 2713/17 & 2737/19) to the south of this development.

The location of the proposed connection/outfall point will be on the existing 225mm surface water sewer constructed for the mixed-use development (Planning Ref: 2713/17 & 2737/19), following the installed hydrobrake and before the petrol interceptor. The petrol interceptor, placed under the aforementioned planning reference, has been designed to accommodate the combined permitted discharge rate from both of this development and the development located to the south (Planning Ref: 2713/17 & 2737/19). The proposed petrol interceptor 'Kinspan' NSBE010 bypass petrol interceptor class 1 is designed to accommodate a flow rate of 10 l/s. The combined permissible discharge rate from both this development and neighbouring development (Planning Ref: 2713/17 & 2737/19) is 8.9l/s. This proposed connection location will negate the requirement for any construction outside of the site boundary and minimise any disruption to the public.

Surface water management for the proposed development is designed to comply with the 'Greater Dublin Strategic Drainage Study (GDSDS) Regional Drainage Policies Technical Document – Volume 2, New Developments, 2005' and the 'Greater Dublin Regional Code of Practice for Drainage Works, V6.0 2005'. CIRIA Design Manuals C753, C697 and C609 have also been used to design the surface water drainage system within the site.
It is proposed to use a sustainable urban drainage system (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 and allow for the maximum collection of rainwater for re-use where possible. In addition, SuDS features aim to replicate the natural characteristics of rainfall runoff for any site by providing control of run-off at source and this has been achieved by the current proposals.

SuDS are a requirement of Dublin City Council under their 'Regional Code of Practice for Drainage Works' and 'The Greater Dublin Strategic Drainage Study'. Additionally, these systems are recommended under the 2009 guidelines, 'The Planning System and Flood Risk Management'.

There are a number of SuDS features proposed which have been designed in accordance with CIRIA documents C753, C697 and C609 as follows:

- Permeable Paving;
- Extensive Green Roofs;
- Intensive Green Roofs;
- Blue Roofs;
- Catchpit Manhole; and
- Petrol Interceptor.

Refer to Drawing 230146-X-91-X-DTM-DR-DBFL-CE-1001 – Surface Water Layout and the Engineering Services Report (DBFL, 2023) for further details.

Existing Foul Water Drainage

There is an existing 300mm diameter public foul sewer located on the Swords Road (R104) to the east of the site.

As part of Irish Water Connection Reference, No: CDS19003221 a 225mm diameter foul sewer has been constructed within the previously approved mixed-use development (Planning Ref: 2713/17 & 2737/19) to the south of the site. This foul sewer has been constructed from the development site boundary across Swords Road and connected to the existing 300mm diameter public foul sewer noted above under a Connection Agreement with Irish Water. No diversion works of existing Irish Water infrastructure are required to facilitate this proposed development. Any existing private foul infrastructure present onsite will be grubbed up and removed.

Proposed Foul Water Drainage

The foul sewerage from this development is proposed to discharge via gravity by means of a new 225mm diameter sewer out-falling to a manhole constructed as part of the previously approved proposed mixed-use development (Planning Ref: 2713/17 & 2737/19) to the south of this development. This will negate the requirement for any construction outside of the site boundary and minimise any disruption to the public. The new sewer will be designed and constructed in accordance with Irish Water Code of Practice and Standard Detail requirements.

A Pre-Connection Enquiry was submitted to Irish Water CDS23007437. The Applicant will enter into conversation with Irish Water to progress required works following receipt of Planning Approval.
The Developer will enter into a Connection Agreement with Irish Water, post planning, to facilitate the proposed foul connection and any upgrade works that may be required.

Foul sewage in apartment blocks located over the basement will be drained on separate systems via 150mm diameter pipes slung from the underside of basement roof slabs and adjacent to the basement walls. Service pipes from individual properties will project through ground floor slabs and connect into the slung drainage system which in turn will connect by gravity to the proposed external foul drainage system.

Any surface water from the basement car park generated by incidental run-off/spillage will drain through an underground system of collector pipes, gullies and ACO drains which in turn will pass through a petrol interceptor prior to discharging into a foul pumping well located under the basement. The run-off will then be pumped via a rising main which will connect to the gravity foul drainage system for the site at ground level via an outfall manhole in accordance with the requirements of the Greater Dublin Strategic Drainage Study (GDSDS) and Irish Water.

Using Irish Water parameters, the peak flow from the site is calculated as 8.04 l/s, however using the EN752 method in MICRODRAINAGE the peak flow is 17.8 l/s.

Sewers and drains shall be laid to comply with the requirements of the Building Regulations 1997 in accordance with the recommendations contained in the Technical Guidance Documents, Section H (revised 2005). Standard drainage details will be in accordance with the Greater Dublin Regional Code of Practice for Drainage Works and Irish Water Standard Details for Wastewater Infrastructure.

Please see drawing 230146-X-92-X-DTM-DR-DBFL-CE-1101 – Foul Sewer Layout and the Engineering Services Report (DBFL, 2023) for further details.

Flood Risk Assessment

The EU Floods Directive (2007/60/EC) required Member States to undertake a national preliminary flood risk assessment by 2011 to identify areas where significant flood risk exists or might be considered likely to occur. Members States were also required to prepare catchment-based Flood Risk Management Plans by 2018 that will set out flood risk management objectives, actions and measures. The OPW in co-operation with various Local Authorities produced a number of PFRAs which aimed to map out current and possible future flood risk areas and develop risk assessment plans. As part of the CFRAM programme provisional flood maps had been produced by the OPW which have been used in this assessment.

The OPW CFRAM on-line database (www.floodmaps.ie) was reviewed with regard to incidences of historical regional and local flooding relevant to the site area. The review included the river and coastal flooding extents estimated by the OPW for different hydrological conditions (low, medium and high probability).

The review of the available data on fluvial, pluvial and groundwater flooding shows there are no historical flood hazards identified in the immediate vicinity of the site.

The CFRAM river flooding extents shown in Figure 3.1 below demonstrates that the site is located entirely within Flood Zone C i.e. the probability of flooding is low (less than 0.1% AEP or in 1 in 1000 chance a year) for river and coastal flooding. Review of the Strategic Flood Risk Assessment (SFRA) included in the Dublin City Development Plan 2022-2028 also confirms this.

Figure 3.1 *Extract from CFRAM River Flooding Extents for the Site Area (OPW, 2024)*

No historic flooding was identified at the site or surrounding area with the exception of a single event in 1965 recorded c.250m to the south of the site. This event is

associated with the Naniken River system which currently flows culverted in this area (refer to Figure 4.1 below)

4.0 ASSESSMENT OF BASELINE WATER QUALITY, RIVER FLOW AND WATER BODY STATUS

A reliable Conceptual Site Model (CSM) requires an understanding of the existing hydrological and hydrogeological setting. This is described below for the proposed development site and surrounding hydrological and hydrogeological environs.

4.1 Existing Site Conditions

The proposed development measures approximately 1.5ha in area and is located at the junction of Santry Avenue and Swords Road, with frontage onto both roads (being bounded to the east by Swords Road and to the north by Santry Avenue) and is currently occupied by Chadwicks building providers (formerly Heiton Buckley). Access to the subject site is currently limited to an existing site entrance off / onto Santry Avenue. The brownfield site is currently Heiton Buckly Building Suppliers. The site is relatively flat.

Existing Ground Conditions

A ground investigation was carried out for the adjoining development at Santry Place by GII, in January 2019 and was included as reference for the Foundation Assessment undertaken by DBFL. This investigation included the following:

- 3 no. trial pit to a maximum depth of 3.1 mbgl;
- 3 no. cable percussion boreholes to a maximum depth of 1o mbgl;
- 1 no. rotary core boreholes to a maximum of 9.7 mbgl;
- Geotechnical and environmental laboratory testing.

This report is included as part of the present application (GII, 2019). Given the homogeneity of the area in terms of geology and the absence of structural geological elements (such as faults, as can be seen in sections below) this investigation is considered to be representative of the subject site.

The location of site investigation points are presented in Figure 4.1 below.

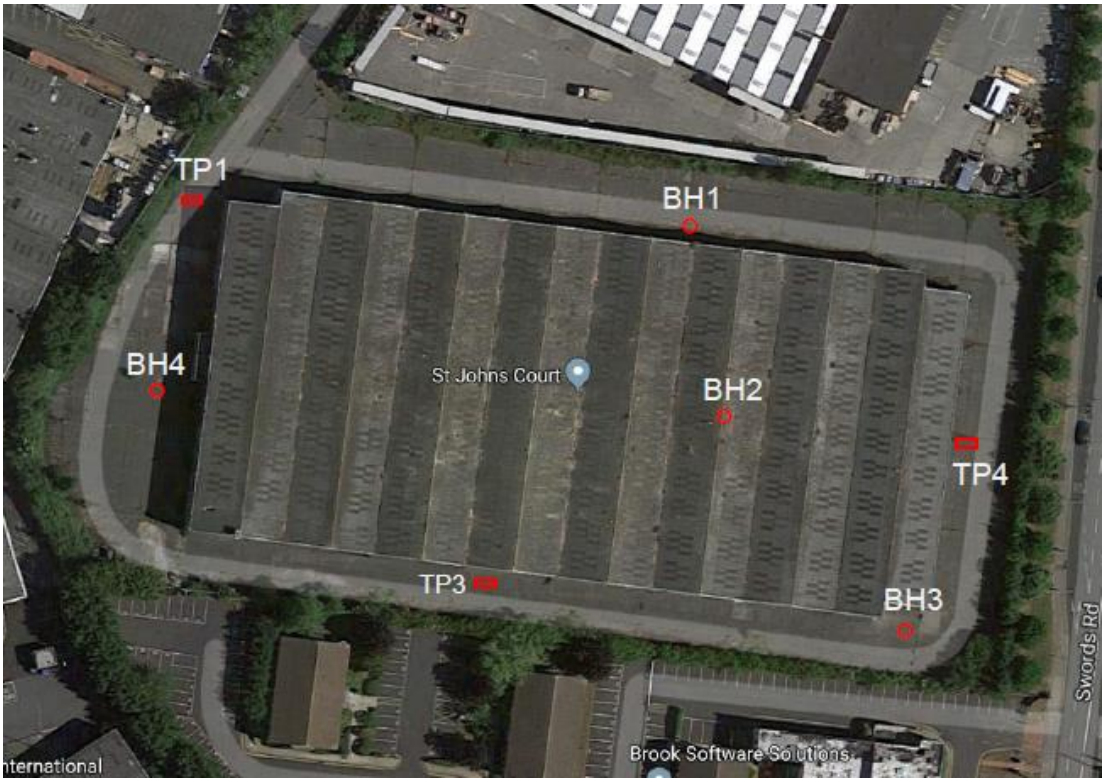

Figure 4.1 *Location of Site Investigations (in blue) (Source: GII, 2019)*

The stratification encountered at the adjacent site is as follows:

- Surfacing: Reinforce concrete up to 0.3 mbgl;
- Fill: Granular fill were encountered beneath the concrete to a depth of 0.4-1.0 mbgl;
- Made Ground: Made ground deposits (described as sandy gravelly Clay with occasional cobbles and contained rare fragments of plastic and plywood) were encountered beneath the Fill material to a variable depths between 0.7-3.4 mbgl;
- Cohesive Deposits: Deposits described as low permeability stiff sandy gravelly Clay were encountered beneath the Made Ground up to depths of 10 mbgl.
- The depth of bedrock head was not proven during the site investigation, with the maximum exploration to 10 mbgl.

This stratification is consistent with the groundwater vulnerability considered by the GSI at the site.

Groundwater strikes associated with perched water within the overburden was encountered in only 1 no. of the exploratory boreholes at 5.5 mbgl (measured in February 2019, i.e., during wet and winter/ spring conditions).

Soil samples were selected from the exploratory holes for a range of environmental testing, including Waste Acceptance Criteria (WAC), pH and sulphate. Results show no evidence of contamination, as samples meet all WAC criteria for inert soils.

4.2 Hydrological Catchment Description

The proposed development site lies within the Liffey and Dublin Bay Catchment (Hydrometric Area 09) and Mayne River Sub-Catchment (WFD name: Mayne_SC_010).

There are no watercourses at the site or in the immediate vicinity of the site. According to the EPA river network (EPA maps, https://gis.epa.ie/EPAMaps/), the nearest watercourse to the site is the Santry River which resides c. 680 m to the north of the site (refer to Figure 2.1 above). The Naniken River system currently flows culverted to the south of the proposed development (refer to Figure 4.2 below). Dublin Bay Coastal Waterbody is located c. 7.4 km east of the proposed development.

Figure 4.2 *Hydrological Map (EPA, 2024. The Rivers of Dublin, Sweeney, 2017)*

4.3 Surface Water Quality

Water Framework Directive Status

The most recent classification and published status has been reviewed as made available by the www.epa.ie - River Waterbody WFD Status 2016-2021.

The Environmental Protection Agency (EPA, 2022) on-line mapping presents the available water quality status information for water bodies in Ireland.

The Santry River belongs to the Santry_010 WFD surface waterbody which has a '*Poor*' WFD Status (2016-2021) and its WFD risk score is '*At Risk'* of not achieving good status. This '*Poor*' status is related to its '*Poor*' biological conditions (Ecological Status or Potential), likely due to urban run-off from diffuse sources. This '*Poor*' status is related to data from 1 no. EPA active water quality station in Clonshaugh Road, located 2 km to the east of the proposed development site

Dublin Bay Coastal Waterbody has a WFD status (2016 – 2021) of 'Good' and a WFD risk score of 'Not at Risk'. The ecological status (which comprises biological and chemical status) of transitional and coastal water bodies during 2016-2021 for Dublin Bay is classed as 'Good'. The most recent surface water quality data for the Dublin Bay on trophic status of estuarine and coastal waters indicate that they are 'Unpolluted' (based on *Water Quality in 2020*, EPA, 2021)'.

The Environmental Protection Agency (EPA, 2024) on-line mapping presents the available water quality status information for water bodies in Ireland.

4.4 Aquifer Description & Superficial Deposits

Mapping from the Geological Society of Ireland (GSI, 2024 http://www.gsi.ie, accessed on 27-02-2023) indicates the bedrock underlying the site is part of the Tubber Formation (code CDTUBB) and made up of crinoidal and cherty limestone and dolomite. The lithological description comprises crinoidal medium-grey (packstones and wackestones), sometimes with shaly partings, cherts and dolomite. The GSI also classifies the principal aquifer types in Ireland as:

- Lk - Locally Important Aquifer - Karstified
- Ll - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
- Lm - Locally Important Aquifer - Bedrock which is Generally Moderately Productive
- Pl - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
- Pu - Poor Aquifer - Bedrock which is Generally Unproductive
- Rk - Regionally Important Aquifer (karstified diffuse)

Presently, from the GSI (2024) National Bedrock Aquifer Map, the GSI classifies the bedrock aquifer beneath the subject site as a 'Locally Important Aquifer – Bedrock which is Moderately Productive only in Local Zones'. The proposed development is within the 'Dublin' groundwater body and is classified as 'Poorly productive bedrock'. The most recent WFD groundwater status for this water body (2016-2021) is 'Good' with the current WFD risk score under 'Review'.

Aquifer vulnerability is a term used to represent the intrinsic geological and hydrological characteristics that determine the ease with which groundwater may be contaminated generally by human activities. The GSI (2024) guidance presently classifies the bedrock aquifer vulnerability in the region of the subject site as 'Low' which indicates a general thick overburden depth potential of >10m, indicating good protection of the underlying aquifer by low permeability subsoil. This desk study data was confirmed by the site investigations undertaken at the adjacent site which shows the overburden has depths greater than 10.0mbgl before reaching the bedrock. The aquifer vulnerability class in the region of the site is presented as Figure 4.3 below.

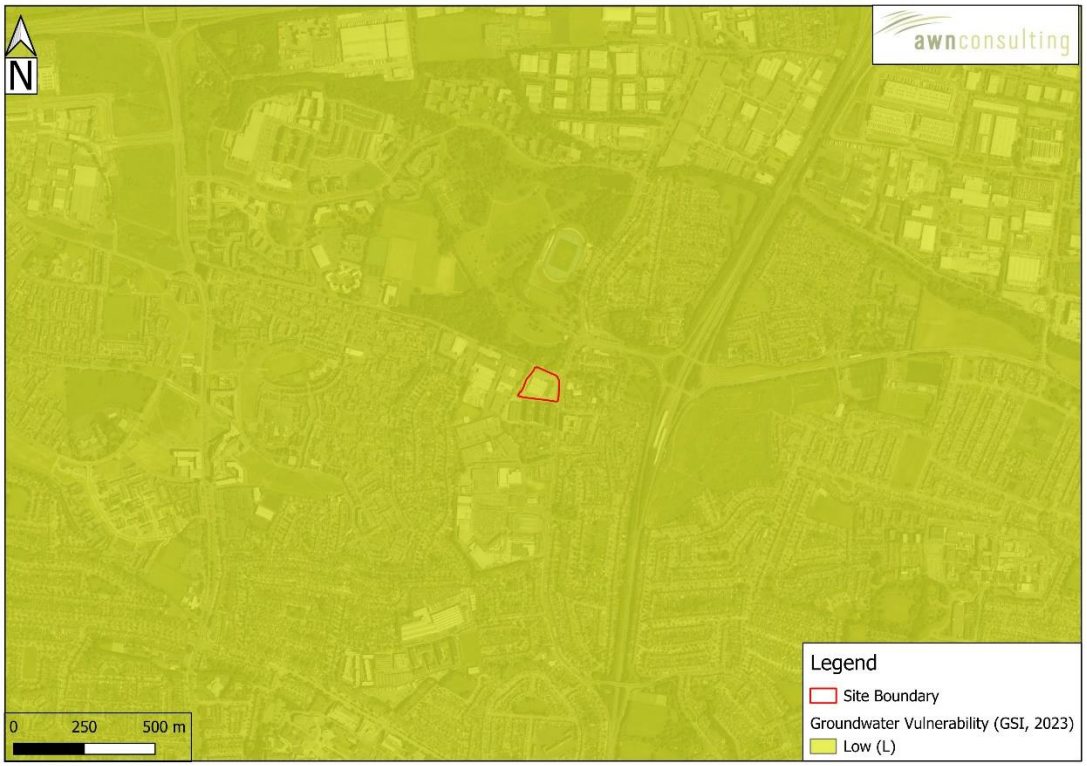

Figure 4.3 *Aquifer Vulnerability (source: GSI, 2024)*

The GSI/ Teagasc (2024) mapping database of the quaternary sediments in the area of the proposed development indicates the principal subsoil type in the area comprises urban made ground and gravel derived from limestones.

The GSI/ Teagasc (2024) mapping database of the quaternary sediments in the area of the subject site indicates the principal subsoil type in the residential area comprises Till derived from limestones (TLs), which is also consistent with the adjacent site investigations undertaken.

With regard to static groundwater level, there is no current available information. However, the GII site investigation at the adjacent site encountered groundwater strike at 5.5 mbgl in 1 no. borehole (winter measurement). It is noted this is a perched water level within made ground. No dewatering of the water table within bedrock is required for the proposed development.

5.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

The development provides for 321 no. apartments, comprised of 104 no. 1 bed, 198 no. 2 bed, & 19 no. 3 bed dwellings, in 4 no. seven to thirteen storey buildings, over basement level, with 3 no. retail units, a medical suite / GP Practice unit and community/arts & culture space (total c.1,483sq.m), all located at ground floor level, as well as a one storey residential amenity unit, facing onto Santry Avenue, located between Blocks A & D.

Vehicular access to the proposed development will be via two proposed access points: (i) on Santry Avenue to the north and (ii) off Swords Road to the east. Car parking for the proposed development is provided for in the form of basement level parking and surface level parking. In total, the proposed development caters for 194 no. car parking spaces.

The potential impacts on the receiving water environment considered within this report are:

- The management of foul, surface water run-off and accidental oil leaks during construction phase.
- Proposed changes to existing services (foul sewer and stormwater sewer).

Due to the residential nature of the proposed development it has been assumed that there will be no bulk oil storage during the operational phase.

The basement for the proposed development will be founded at a formation level of approx. 4.5 mbgl.

Given the geotechnical characteristics of the cohesive deposits at the subject site conventional strip and pad foundations are considered suitable for walls and columns for all blocks up to 14 storeys in height. Circulation cores are proposed to be founded on raft foundations as these cores provide stability to the overall scheme and as a result will attract higher load.

The ground conditions and allowable bearing capacity was verified using the ground investigation report carried out by IGSL on the nearby Coolock lane development (refer to DBFL, 2023 & GII 2019). A piling solution was not considered due to the relatively shallow depth of the stiff cohesive deposits.

Given the location of the basement within the site and the space between the basement perimeter and the site boundary, a 45 degree batter is achievable to form the basement excavation.

It is also recommended that extensive ground investigations are carried out on the proposed site (including a combination of trial pits, boreholes and dynamic probes), before more detailed project design takes place. Refer to Figure 5.1 below for the basement plan and Figure 5.2 for a projected basement section.

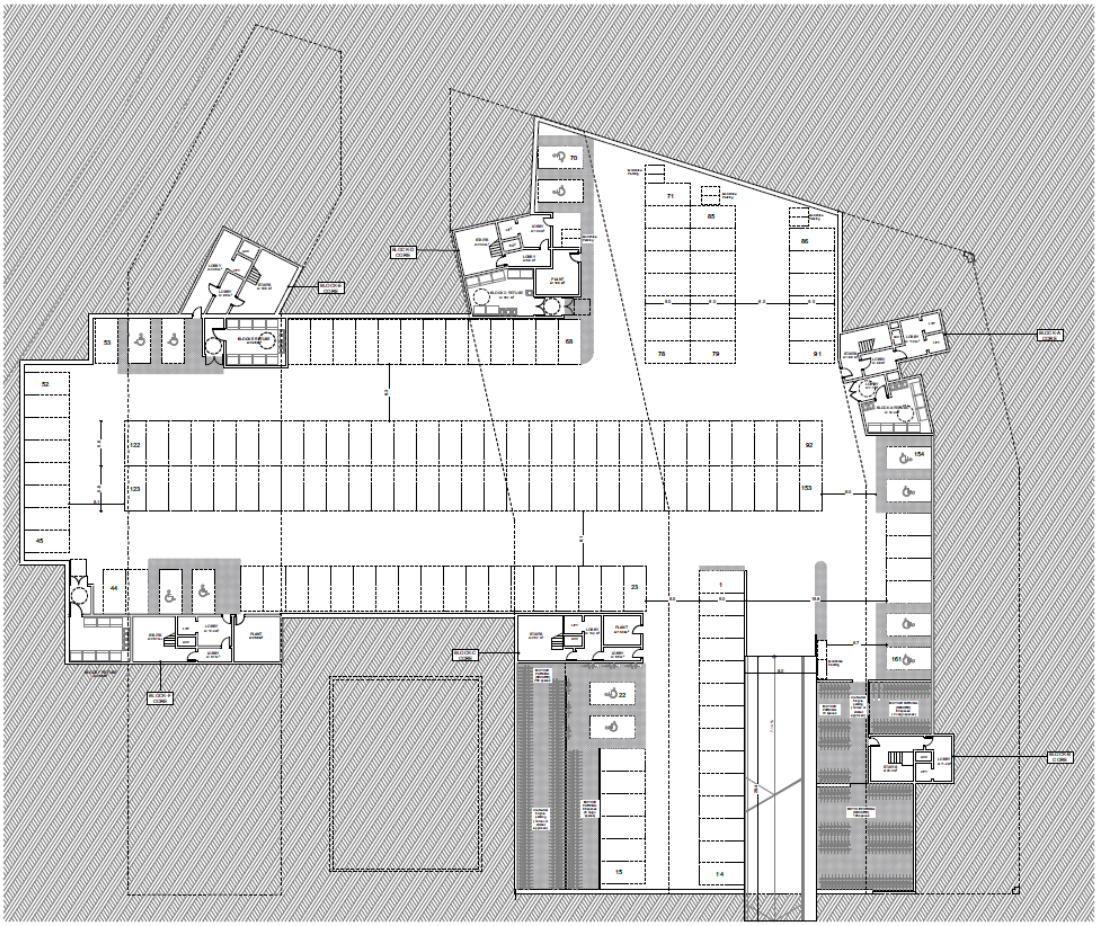

Figure 5.1 *Basement Layout Plan - D1809.P05 (Davey Smith Architects, 2024)*

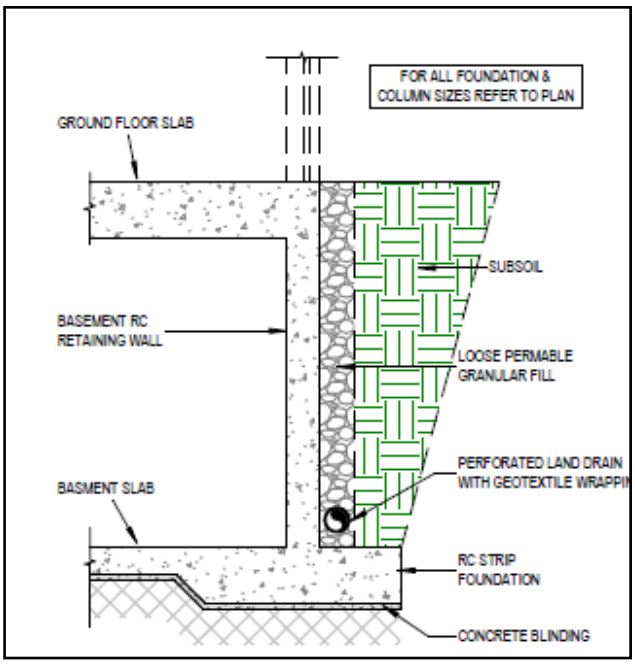

Figure 5.2 *Typical Basement Section (source: DBFL, 2021)*

For further information on the existing and proposed development design refer to Chapter 3 – Development Description and Engineering Services Report (DBFL, 2023).

5.1 CONSTRUCTION WORK PROGRAMME

The approximate basement Construction Sequence is outlines below:

Demolition Works

The existing buildings on the site will be demolished as part of the planning application. Demolition will be completed by the appointed contractor in accordance with the relevant standards and guidelines. Contaminated materials used in the existing buildings will be identified and disposed of by a specialised contractor. Demolition will be carried out as described below to permit basement construction without undermining or causing loss of support to adjacent structures.

Basement Construction

A full site investigation will be carried out prior to construction commencing. A specialist ground works contractor will be appointed to carry out the excavation and any rock breaking works that may be required. The appointed specialist contractor will carry out a full risk assessment prior to the commencement of work.

A ground works operation will be carried out in order to ensure that material removed from the ground is taken away at regular intervals in order to reduce the amount of material that will be stored on site. Excavated material will be reused on site where possible subject to the WAC analysis.

Localised sump pumps will be installed to remove the water through settlement tanks and after appropriate treatment into the local drainage network infrastructure for discharge. On completion of the excavation works to the formation level of the basement slab, this will be blinded to the final design levels. Any below ground services will be installed and tested below the basement slab. Prior to construction of the foundations and suspended slab at the lower basement level, a proprietary basement tanking system and water bar will be installed at all construction joints. A typical basement slab construction is as follows:

- Trim & grade to slab formation with suitable well compacted capping material.
- Cast mass concrete blinding to form a surface for applying waterproof membrane and tanking.
- Apply continuous waterproof tanking material and seal all laps (and along perimeter of secant wall/slab junction).
- Install slab reinforcement to slab area (including any columns and wall starters) Formwork to perimeter and any box-outs necessary (around raking props).
- Clean & inspect slab pour prior to concrete operations.
- *Note: The placement of large volumes of concrete such as the deep foundations will be carried out by a mobile or static concrete pump. The above process will repeat until the foundation raft is constructed.*

When a sufficient area of basement slab is constructed the vertical elements will be constructed to allow the upper level; basement slabs to be constructed.

6.0 CONCEPTUAL SITE MODEL

Conceptual site models (CSM) have been developed based on a good understanding of the hydrological and hydrogeological environment, previous site investigations carried out by GII in 2019 and plausible sources of impact and knowledge of receptor requirements. The CSM's allow possible Source Pathway Receptor (S-P-R) linkages

to be identified. The current situation, construction phase and operational phase are shown in Figures 6.1 to 6.3 below.

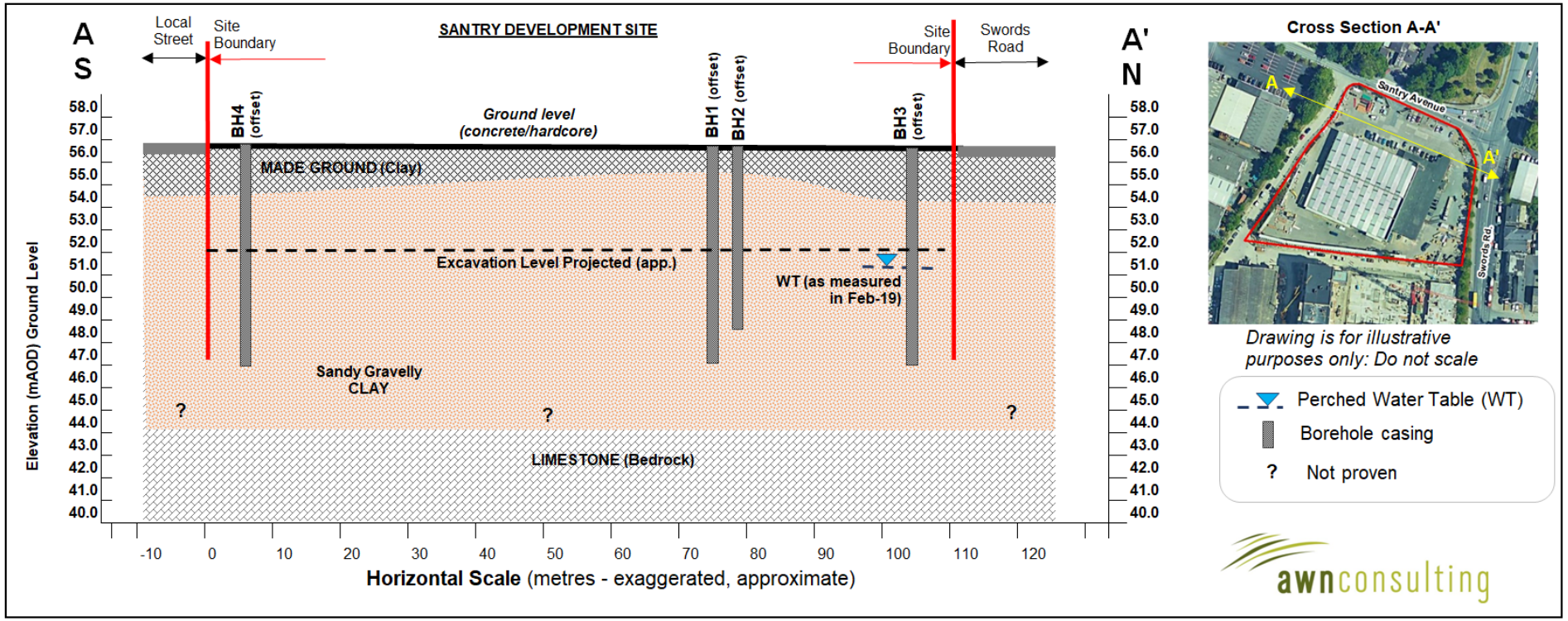

Figure 6.1 *Conceptual Cross Section A-A' for Current Situation*

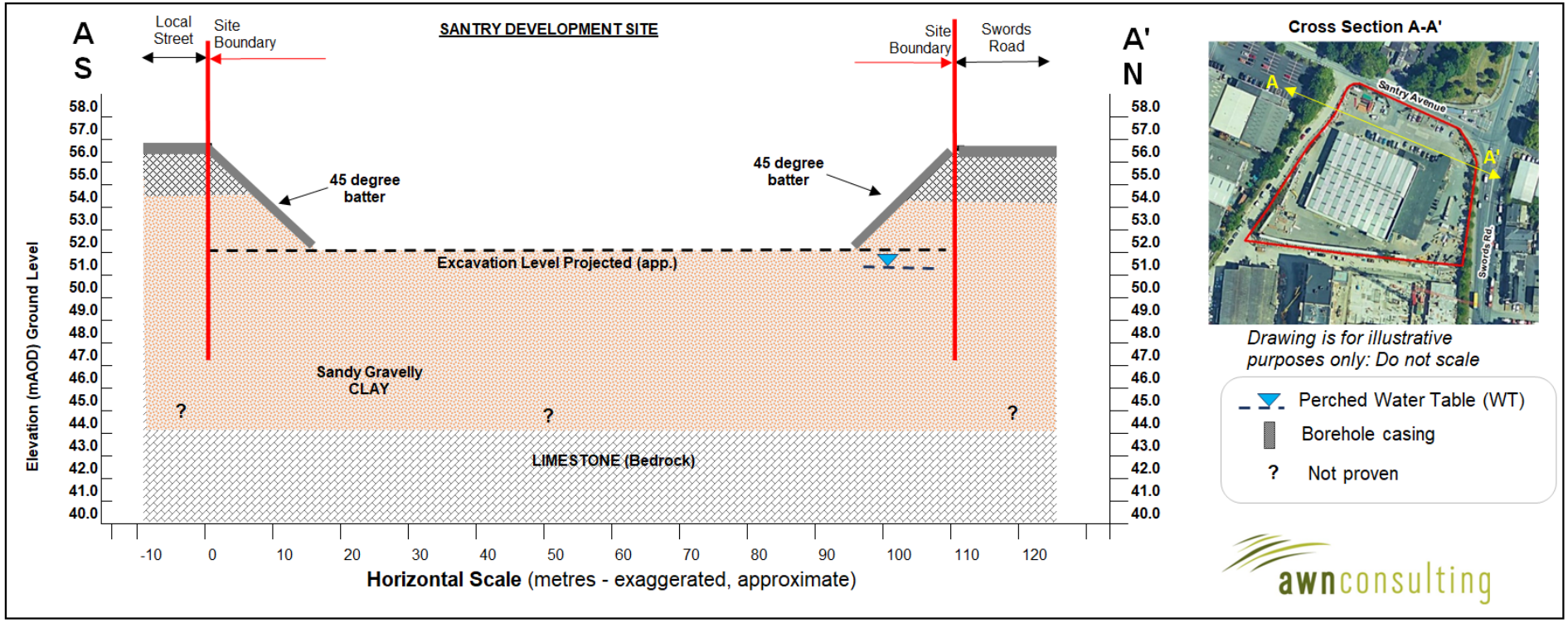

Figure 6.2 *Conceptual Cross Section A-A' during Construction Phase*

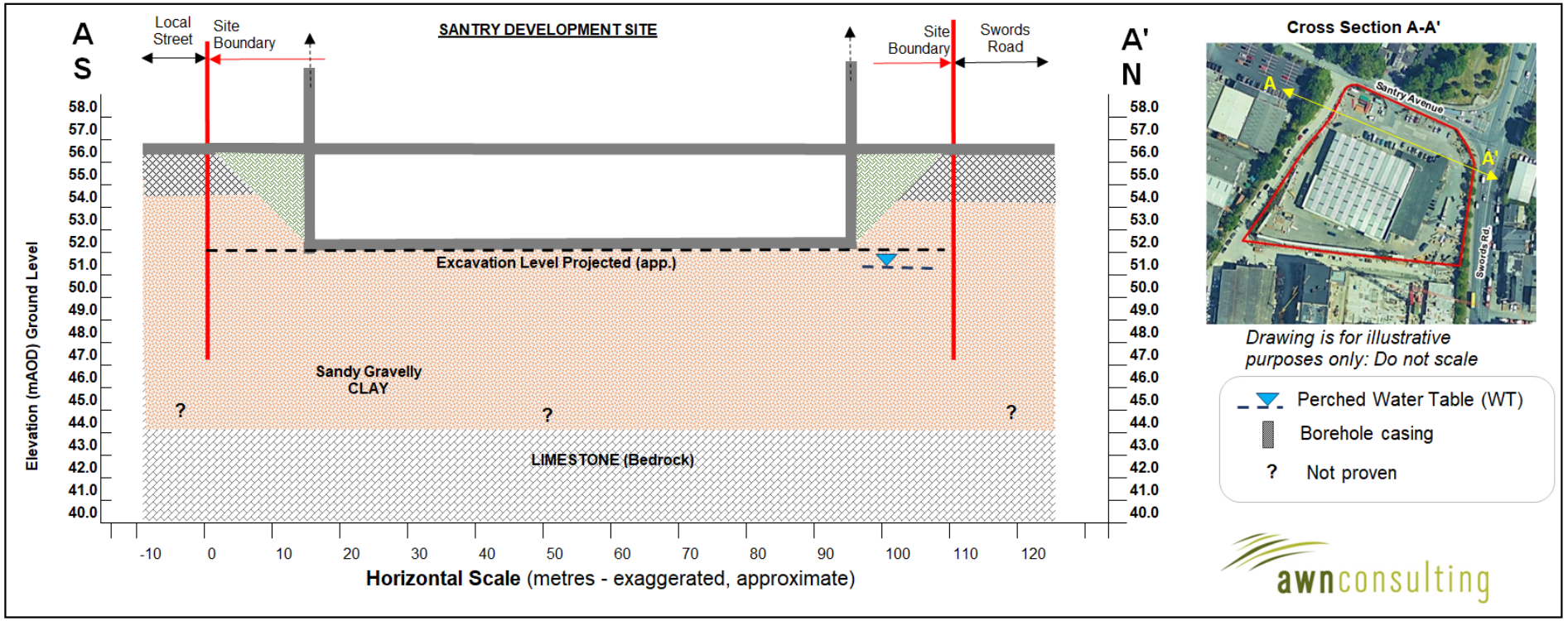

Figure 6.3 *Conceptual Cross Section A-A' during Operation Phase*

6.1 Assessment of Plausible Sources

Potential sources during both the demolition, construction and operational phases are considered. For the purposes of undertaking the potential of any hydrological/ hydrogeological S-P-R linkages, all potential sources of contamination are considered *without taking account of* any measures intended to avoid or reduce harmful effects of the proposed project (mitigation measures) i.e. a worst-case scenario. Construction sources (short-term) and operational sources (long-term) are considered below.

Construction Phase

The following potential sources are considered plausible risk scenarios for the proposed construction site:

(i) Hydrocarbons or any hazardous chemicals will be stored in specific bunded areas. Refuelling of plant and machinery will also be carried out in bunded areas to minimise risk of any potential being discharged from the site. As a worst-case scenario, a rupture of a 1,000-litre tank to ground is considered in this analysis which disregards the effect of bunding. This would be a single short-term event.

(ii) Leakage may occur from construction site equipment. As a worst-case scenario an unmitigated leak of 300 litres is considered. This would be a single short-term event.

(iii) Use of wet cement is a requirement during construction. Run-off water from recent cemented areas will result in highly alkaline water with high pH. As this would only occur during particular phases of work this is again considered as a single short-term event rather than an ongoing event.

(iv) Construction requires soil excavation (c. 4.5m deep for basement) and removal. Unmitigated run-off could contain a high concentration of suspended solids and contaminants such as hydrocarbons during earthworks, given the presence of contamination beneath the site according to site investigations. These could be considered intermittent short-term events, i.e., on the basis that adequate mitigation measures which are already incorporated in the Construction Environmental Management Plan (CEMP) fail.

(v) During the excavations for foundations and basements, no significant dewatering is expected given the low permeability overburden underlying the site. Bedrock would not be affected by excavations work given no bedrock being encountered <10 mbgl during the 2019 GII investigations.

Operational Phase

The following sources are considered plausible post construction:

(i) The proposed development does not require any bulk chemical storage and therefore the potential for water quality impact is negligible.

(ii) Leakage of petrol/ diesel fuel may occur from individual cars in parking areas; run-off may contain a worst-case scenario of 70 litres for example.

(iii) The stormwater drainage system will follow SuDS measures and has been designed in order to discharge following the characteristics of a greenfield run-off into the ground. As such the potential for silt laden runoff is low. It should be noted that the worst-case scenario (70 litres) under consideration here disregards the effect of SuDS and petrol interceptors.

(iv) The proposed development will be fully serviced with separate foul and stormwater sewers which will have adequate capacity for the facility and discharge limits as required by Irish Water licencing requirements. Discharge from the site to the public foul sewer will be sewage and grey water only due to the residential nature of the proposed development.

(v) The foul discharge from the site will join the public sewer and will be treated at the Irish Water Ringsend Wastewater Treatment Plant (WWTP) prior to subsequent discharge to Dublin Bay. This WWTP is required to operate under an EPA licence (D0034-01) and meet environmental legislative requirements as set out in such licence. It is noted that a planning permission for a new upgrade to this facility was received in 2019 and is currently in the process of construction/ implementation.

(vi) This plant operates under an EPA licence (D0034-01) and is currently in the process of being upgraded to a PE of 2.4million to meet the increased demand of the Dublin area. The most recent Annual Environmental Report (AER 2022) shows it is currently operating for a PE peak loading of 2.2 million while originally designed for 1.64million. However, the current maximum hydraulic load (854,201 m^3/day) is less than the peak hydraulic capacity as constructed (959,040 m^3/day) i.e., prior to any upgrade works.

Irish Water is working to provide infrastructure to achieve compliance with the Urban Wastewater Treatment Directive for a population equivalent of 2.1million in the second half of 2023. When all the proposed works are complete in 2025, the Ringsend Wastewater Treatment Plant will be able to treat wastewater for up to 2.4 million population equivalent.

These upgrade works (described in section 6.4 below) have commenced and comprise a number of phases and are ongoing and expected to be fully completed by 2025.

6.2 Assessment of Pathways

The following pathways have been considered within this assessment with impact assessment presented in Section 6.4:

The potential for offsite migration due to any construction discharges is low as there is no significant pathway in the aquifer or through land ditches or streams. However, during operation the development will discharge attenuated stormwater flow to the ground.

(i) The potential for impact on the aquifer is low based on there will be no direct discharges to ground required for construction/ operation of the development and the absence of any bulk chemical storage on site and direct water discharges into the ground/ subsoil. The overburden thickness, low permeability nature of till and a lack of fracture connectivity within the granite/ limestone will minimise the rate of off-site migration for any indirect discharges to ground at the site. As such there is no potential for a change in the groundwater body

status or significant source pathway linkage through the aquifer to any Natura 2000 site in Dublin Bay.

(ii) During both construction and operational phases, there is no source-pathway-receptor hydrogeological connection between the subject site and Dublin Bay through the Dublin aquifer as vertical migration to the underlying limestone bedrock is minimised due to the thickness of overburden ('Low' vulnerability) present at the site providing a high level of aquifer protection from any potential source. There is low risk of migration through poorly connected fracturing within the limestone (Locally Important Aquifer) rock mass.

(iii) Therefore, no likely impact on the status of the aquifer is expected due to low potential loading, natural attenuation within overburden and discrete nature of fracturing reducing off site migration.

(iv) There is no direct pathway for foul sewage to any receiving water body. There is however an 'indirect pathway' through the public foul sewer which ultimately discharges to Ringsend WWTP prior to final discharge to Dublin Bay post treatment.

6.3 Assessment of Receptors

During both the construction and operational phases, it has been determined that there is no hydrogeological connection between the subject site and Dublin Bay, as well as the Natura 2000 Sites located within (South Dublin Bay and River Tolka Estuary SPA, South Dublin Bay SAC, North Bull Island SPA, and North Dublin Bay SAC) through the Dublin aquifer. This lack of connection is attributed to the minimal vertical migration to the underlying limestone bedrock, which is due to the thickness of overburden present at the site, resulting in a 'Low' vulnerability status and providing a high level of aquifer protection from any potential sources.

As a result, it is anticipated that there will be no significant impact on the aquifer's status, given the low potential loading, natural attenuation within the overburden, and the discrete nature of fracturing that reduces off-site migration. Furthermore, the proposed development will not establish a direct hydrological connection with the Santry, Naniken River, or Dublin Bay. These surface water bodies were excluded from the assessment due to their distance from the proposed development, lack of direct hydrological connection, low potential loading of contaminants from the site, and significant dilution along their pathways.

The foul discharge from the site will be directed to the public sewer system and subsequently treated at the Irish Water Ringsend Wastewater Treatment Plant (WWTP) before being discharged into Dublin Bay. It is important to note that this WWTP operates under EPA license (D0034-01) and is fully compliant with the environmental legislative requirements outlined in the license.

6.4 Assessment of Source Pathway Receptor Linkages

Table 3.1 below summarises the plausible pollutant linkages (S-P-R) considered as part of the assessment and a review of the assessed risk is also summarised below.

Construction Phase

The potential for impact on the aquifer is low based on the absence of any bulk chemical storage on site. The overburden thickness, low permeability nature of till and a lack of fracture connectivity within the granite / limestone will minimise the rate

of off-site migration for any indirect discharges to ground at the site. As such there is no potential for a change in the groundwater body status or significant source pathway linkage through the aquifer to any Natura 2000 site.

During construction phase, there is no direct open-water pathway between the site and the Naniken River, Santry River and Natura 2000 sites within Dublin Bay. Should any silt-laden stormwater from construction or hydrocarbon-contaminated water from a construction vehicle leak/tank leak manage to enter into the surface water sewer, the suspended solids will naturally settle within the sewer; however, in the event of a worst case hydrocarbon leak of 1,000 litres this would be diluted to background levels (water quality objectives as outlined in S.I. No. 272 of 2009, S.I. No. 386 of 2015 and S.I. No. 77 of 2019) by the time the stormwater reaches the nearest Natura 2000 Sites located in Dublin Bay c. 7.4 km to the east).

Operational Phase

During operation, the potential for a release is low as there is no bulk fuel/chemical storage and no silt laden run-off. Stormwater will be collected by a drainage system which includes SuDS measures, an attenuation system and oil/ petrol interceptors prior to discharge off-site (albeit these measures have been disregarded for this analysis). In addition, the potential for hydrocarbon discharge is quite minimal based on an individual vehicle (70 litres) leak being the only source for hydrocarbon release. However, even if the operation of the proposed SuDS and interceptor systems are excluded from consideration, there is no likely impact above water quality objectives as outlined in S.I. No. 272 of 2009, S.I. No. 386 of 2015 and S.I. No. 77 of 2019) in the worst case scenarios described above at section 3.2 and there will be no significant effect on any European site. The volume of contaminant release is low and combined with the significant attenuation within the stormwater drainage network, hydrocarbons will dilute to background levels with no likely impact above water quality objectives as outlined in S.I. No. 272 of 2009, S.I. No. 386 of 2015 and S.I. No. 77 of 2019 at any Natura 2000 sites.

It can be concluded that the in-combination effects of surface water arising from the proposed development taken together with that of other permitted developments will not be significant based on the in-combination low potential chemical and sediment expected loading. Therefore, based on the loading of any hazardous material considered in the worst-case scenarios mentioned in Section 3.1 above during construction and operation phases, there is subsequently no potential for impact on downgradient Natura 2000 habitats (those in Dublin Bay, located c. 7.4 km from the site).

The peak wastewater discharge is calculated at 8.04 l/s. The sewage discharge will be licensed by Irish Water, collected in public sewers and ultimately treated at Irish Water's WWTP at Ringsend prior to discharge to Dublin Bay. As outlined in section 6.1 (vi), upgrade works commenced in 2018 and are expected to be fully completed by 2025. The upgrade works will result in treatment of sewage to a higher quality than current, thereby ensuring effluent discharge to Dublin Bay will comply with the Urban Wastewater Treatment Directive for a population equivalent of 2.4 million by Q4 2025.

The project is being progressed in stages to ensure that the plant continues to treat wastewater to the current treatment levels throughout the delivery of the upgrade. The project comprises three key elements and underpinning these is a substantial programme of ancillary works:

- Provision of additional secondary treatment capacity with nutrient reduction (400,000 population equivalent);
- Upgrade of the 24 existing secondary treatment tanks to provide additional capacity and nutrient reduction, which is essential to protect the nutrient-sensitive Dublin Bay area; and
- Provision of a new phosphorous recovery process.

In February 2018, the work commenced on the first element, the construction of a new 400,000 population equivalent extension at the Ringsend Wastewater Treatment Plant. After commissioning stages, the Capacity Upgrade facility began accepting flows for treatment in November 2021). This facility will enable current treatment levels to be maintained during the remainder of the upgrade of the existing secondary treatment tanks.

The 2019 planning permission facilitated upgrading works to meet nitrogen and phosphorus standards set out in the licence, which are temporarily exceeded currently. Works on the first of four contracts to retrofit the existing treatment tanks with aerobic granular sludge technology commenced in November 2020 and was completed in December 2021. In September 2021, the second contract was awarded, and its construction works commenced in November 2021 and is expected to take approximately 2 years to complete. In November 2021, the third contract was awarded, and its Construction works are anticipated to commence in late 2022 (this has not yet been confirmed by Irish Water). The fourth contract was scheduled to commence in mid-2023, which has also not been confirmed by Irish Water to date.

The application for the upgrade of the WWTP in 2012 and the revised upgrade in 2018 was supported by a detailed EIAR. As outlined in the EIAR, modelling of water quality in Dublin Bay has shown that the upgrades (which are now currently underway) will result in improved water quality within Dublin Bay. The 2018 EIAR predicts that the improvement in effluent quality achieved by the upgrade will compensate for the increase in flow through the plant. The ABP inspector's report summarises the positive findings of the modelling for the post WWTP upgrade scenario on Dublin Bay water quality in sections 12.3.5 and 12.3.12 of his report and the overall positive impact for human health and the environment in his conclusions in section 12.9.1.

In addition, the EIAR report acknowledges that under the do-nothing scenario "*the areas in the Tolka Estuary and North Bull Island channel will continue to be affected by the cumulative nutrient loads from the river Liffey and Tolka and the effluent from the Ringsend WWTP*", which could result in a deterioration of the biological status of Dublin Bay (Irish Water, 2018). Nevertheless, these negative impacts of nutrient over-enrichment are considered "unlikely" (Irish Water, 2018). This is because historical data suggests that pollution in Dublin Bay has had little or no effect on the composition and richness of the benthic macroinvertebrate fauna. Therefore, the do-nothing scenario predicts that nutrient and suspended solid loads from the WWTP will "continue at the same levels and the impact of these loadings should maintain the same level of effects on marine biodiversity". Therefore, it can be concluded that significant effects on the current status of the European sites within Dublin Bay from the current operation of Ringsend WWTP are unlikely. This conclusion is not dependent upon any future works to be undertaken at Ringsend.

Even without treatment at the Ringsend WWTP, the peak effluent discharge, calculated for the proposed development as 8.04 l/s (which would equate to 0.0724% of the licensed discharge at Ringsend WWTP [peak hydraulic capacity] of 959,040 m^3/day), would not have a measurable impact on the overall water quality within

Dublin Bay and therefore would not have an impact on the current Water Body Status (as defined within the Water Framework Directive). This assessment is supported by hydrodynamic and chemical modelling within Dublin Bay which has shown that there is significant dilution for contaminants of concern (DIN and MRP) available quite close to the outfall for the treatment plant (Ringsend WWTP 2012 EIS, Ringsend WWTP 2018 EIAR; refer to Section 12.4.22, ABP-301798-18 Inspector's report). The most recent water quality assessment of Dublin Bay WFD Waterbody undertaken by the EPA (Water Quality in 2021: An Indicator Report, 2022) also shows that Dublin Bay on the whole, currently has an 'Unpolluted' water quality status (refer to www.catchments.ie).

With regard to bathing waters in Dublin Bay, as mentioned above the proposed development will have no impact on the water quality in any overflow situation apart from a minor contribution (0.0724% of the peak hydraulic capacity at Ringsend WWTP) from foul sewage.

It should be noted that the Ringsend WWTP upgrade has experienced capacity issues during rainfall events and therefore overflows can occur following periods of heavy rainfall. These overflows occur as a result of the impact on treatment capacity during heavy rainfall events due to surges primarily caused by the historical combined drainage system in Dublin. As the Proposed Development will not contribute any additional stormwater drainage to the WWTP over the natural greenfield rate, the development will therefore have no measurable impact on the water quality in any overflow situation.

The assessment has also considered the effect of cumulative events, such as release of sediment laden water combined with a hydrocarbon leak on site (1,000 litres as a worst-case scenario during the construction phase). As there is adequate assimilation and dilution between the site and the Natura 2000 sites located in Dublin Bay, which is c. 7.1 km from the proposed development), it is concluded that no perceptible impact on water quality would occur at the Natura 2000 sites as a result of the construction or operation of this proposed development. It can also be concluded that the cumulative or in-combination effects of effluent arising from the proposed development with that of other permitted proposed developments, or with development planned pursuant to statutory plans in the greater Dublin, Meath and Kildare areas, which will be discharged into Ringsend WWTP will not be significant having regard to the size of the calculated discharge from the proposed development and having regard to the following:

- Recent water quality assessment for Dublin Bay shows that they currently continue to meet the criteria for 'Unpolluted' water quality status (EPA, data until July 2021).
- The Ringsend WWTP upgrade which is currently being constructed will result in improved water quality by Q4 2023 (for a population of 2.1 million) and by Q4 2025 (for a population of 2.4 million) to ensure compliance with Water Framework Directive requirements.
- All new developments are required to comply with SuDS which ensures management of run-off rate within the catchment of Ringsend WWTP.
- The natural characteristics of Dublin Bay result in enriched water rapidly mixing and degrading such that the plume has no appreciable effect on water quality at Natura 2000 sites.

As the *p*roposed *d*evelopment will have no additional stormwater run-off during a stormwater event over and above the current level, surface water run-off from the

development in the operational phase will therefore have no impact on the current water quality in any overflow situation at Dublin Bay.
In addition, permeable paving will increase the quality of water which is intercepted by the system through filtration, biodegradation, pollutant adsorption and settlement and retention of solids, also the reduction in peak flows to the outfall will enhance settlement and biodegradation of pollutants.

It should also be noted that the bathing status has no direct relevance to the water quality status of the Natura sites due to rapid mixing and dilution resulting in no measurable change in water quality within the overall water body.

In addition, there is no long term discharge planned which could have an impact on the status of the water body. In the scenario of an accidental release (unmitigated leaks mentioned above) there is potential for a temporary impact only which would not be of a sufficient magnitude to effect a change in the current water body status.

Finally, in a worst-case scenario of an unmitigated leak and not considering the operation of the SuDS measures already included in the design, no perceptible risk to any Natura 2000 Sites is anticipated given the distance from source to Dublin Bay protected areas (c. 7.4 km). Potential contaminant loading will be attenuated, diluted and dispersed near source area.

Table 6.1 below presents a summary of the risk assessment undertaken (in the absence of mitigation).

Source	Pathways	Receptors considered	Risk of Impact
Construction Impacts (Summary)			
Unmitigated leak from an oil tank to ground/ unmitigated leak from construction vehicle (1,000 litres worst case scenario). Discharge to ground of runoff water with High pH from cement process/ hydrocarbons from construction vehicles/run-off containing a high concentration of suspended solids	Bedrock protected by >10m low permeability overburden. Migration within weathered/ less competent limestone is low (limestone has discrete local fracturing rather than large and connected fractures). Indirect pathway to Dublin Bay through public sewer (distance source-receptor c. 7.4km)	Granite/Limestone karstic bedrock aquifer (Locally Important Aquifer) South Dublin Bay SAC/SPA/pNHA	No likely impact on the status of the aquifer/off site migration due to low potential loading, proposed mitigation measures and natural attenuation within overburden. Potential for local temporary exceedances of statutory water quality standards at outfall. However, no perceptible risk to water requirements for the Natura 2000 sites in Dublin Bay based on loading and high level of dilution in the surface water sewer and on the distance of c. 7.4 km between the source and Dublin Bay.
Operational Impacts (Summary)			
Foul effluent discharge to sewer Discharge to ground of hydrocarbons from carpark leak (70 litres worst case scenario)	Indirect pathway to Dublin Bay through public combined sewer Indirect pathway through public combined sewer to Dublin Bay waterbody (distance source-	South Dublin Bay SAC/SPA/pNHA South Dublin Bay SAC/SPA/pNHA	No perceptible risk – Even without treatment at Ringsend WWTP, the peak effluent discharge (8.04 l/s which would equate to 0.0724% of the licensed discharge at Ringsend WWTP); would not impact on the overall water quality within Dublin Bay and therefore would

	receptor c. 7.4km)		not have an impact on the current Water Body Status (as defined within the Water Framework Directive). No perceptible risk – taking into account the extent of loading of contaminant, proposed design and mitigation measures and the distance between the source and Dublin Bay is c. 7.4 km and significant dilution in the surface water sewer will ensure any released hydrocarbons are at background levels (i.e., with no likely impact above water quality objectives as outlined in S.I. No. 272 of 2009, S.I. No. 386 of 2015 and S.I. No. 77 of 2019).

Table 6.1 *Pollutant Linkage Assessment (without mitigation)*

7.0 CONCLUSIONS

A conceptual site model (CSM) has been prepared following a desk top review of the site and surrounding environs. Based on this CSM, plausible Source-Pathway-Receptor linkages have been assessed assuming an absence of any measures intended to avoid or reduce harmful effects of the proposed project (i.e. mitigation measures) in place at the proposed development site.

During construction and operation phases there is no direct source pathway linkage between the proposed development site and open waters. There is no direct source pathway linkage between the proposed development site and any Natura 2000 sites (i.e., South Dublin Bay SAC/SPA/pNHA). There is an indirect source pathway linkage from the proposed development through the public combined sewer that crosses the subject site which will eventually discharge to the Ringsend WWTP and ultimately discharges to South Dublin Bay SAC/SPA/pNHA. The future development has a peak foul discharge that would equate to 0.0724% of the licensed discharge at Ringsend WWTP (Peak Hydraulic Capacity).

Even disregarding the operation of design measures including an attenuation system and petrol interceptors on site, it is concluded that there will be imperceptible impacts from the proposed development to the water bodies due to emissions from the site stormwater drainage infrastructure to the wider drainage network. It should be noted the proposal also includes an attenuation system and petrol interceptors as part of best practice project design, and these features will provide additional filtration from the site to the drainage network.

It is concluded that there are no pollutant linkages as a result of the construction or operation of the proposed development which could result in a water quality impact which could alter the habitat requirements of the Natura 2000 sites within Dublin Bay.

Finally, and in line with good practice, appropriate and effective mitigation measures will be included in the construction design, management of construction programme and during the operational phase of the proposed development. With regard the

construction phase, adequate mitigation measures will be incorporated in the Construction Environmental Management Plan (CEMP). These specific measures will provide further protection to the receiving soil and water environments. However, the protection of downstream European sites is in no way reliant on these measures and they have not been taken into account in this assessment.

8.0 REFERENCES

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