HYDROLOGICAL AND HYDROGEOLOGICAL QUALITATIVE RISK ASSESSMENT

for

PROPOSED SHD AT FORMER BAILEY GIBSON SITE, 326-328 SOUTH CIRCULAR ROAD, DUBLIN 8. CO. DUBLIN

Technical Report Prepared For

Virtus PM

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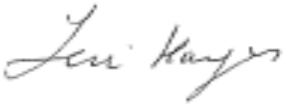
Signature		
Name	Marcelo Allende	Teri Hayes
Title	Environmental Consultant	Director
Date	2 Jun 2022	2 Jun 2022

TABLE OF CONTENTS **Page**

Tables

Figures

1.0 INTRODUCTION

1.1 Background

AWN have been requested by Vitus PM to carry out a Hydrological and Hydrogeological Qualitative Risk Assessment for a Strategic Housing Development at the 'Bailey Gibson' site, South Circular Road, Dublin 8. The application area is c.5.08 hectares, it includes the Bailey Gibson site (1.53 hectares) in the ownership of the applicant, 0.36 hectares of land in the ownership of the Roman Catholic Church and 2.95 hectares in the ownership of Dublin City Council to accommodate works to facilitate public open space, connections to municipal services and works proposed to public roads.

The proposed development will consist of:

- The demolition of all buildings and structures on the site to make way for development of the site;
- The construction of 346 no. residential units distributed across 5 no. blocks (BG 1-5) all contained within the Bailey Gibson site which also included tenant amenities, recreational facilities, communal open spaces, public open spaces, childcare facility, etc.;
- The provision of 75 no. car parking spaces at basement level; 11 no. car parking spaces at podium levels and also provision of street visitor car parking spaces;

1.2 Hydrological Setting

The site comprises the former Bailey Gibson site which includes 10 buildings including warehousing and offices, a small portion of open green area that is part of the Player Wills site owned by the Applicant which is to be included in the 'Players Park' (0.048ha) and DCC lands to the east and northeast of the Bailey Gibson site which are currently open space but will be developed for a multi-purpose play pitch, a public park and internal street network. The lands immediately east of the Bailey Gibson site that will form the Player Park is currently open green area formerly part of the playing pitches, while the lands in the northeast of the site is open brownfield lands, formerly part of the St Theresa's Gardens Flats complex.

According to the EPA river network (EPA maps, https://gis.epa.ie/EPAMaps/Water accessed on 25-05-2022), there are no open streams or rivers on or adjacent to the site. The nearest surface water receptor is the River Poodle, which is located c. 500 m to the east of the site (Refer to Figure 1.1 below). The River Poddle is culverted and flows north to join the River Liffey approximately 1.4 km north of the site.

Figure 1.1 *Site Location in relation to local Hydrological Environment*

However, as explained in Section 1.3 below, there is a 910-1210mm stormwater culvert in Donore Avenue (along the northeast boundary of the subject site) which is historically known as the Abbey Stream, a distributary from the original river Poddle. This culvert carries the main river Poddle flow, flows along the Donore Avenue and turns east between Ebenezer Terrace and Harman Street towards Blackpitts and then north toward the River Liffey.

A review of the EPA (2022) on-line database indicates that the nearest designated land to the site is the Grand Canal pNHA (Site Code: 002104) at c.100m to the south of the subject site. As the canal is a contained feature (fully lined) there is no potential for a source pathway linkage

The nearest Natura 2000 Sites with potential hydrological link are South Dublin Bay Special Area of Conservation (SAC)/ Special Protection Area (SPA)/ proposed Natural Heritage Area (pNHA) sites which are c. 4.7 km to the east of the site. There will be an indirect discharge to the Dublin Bay waterbody from the Proposed Development site through the stormwater and foul water site drainage as described in Section 1.3 below.

1.3 Objective of Report

The scope of this desktop review is to assess the potential for any likely significant impacts on receiving waters and protected areas during construction or development, in the absence of taking account of any measures intended to avoid or reduce harmful effects of the proposed project (i.e. 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 Dublin Bay (where the relevant European Sites are located), including bathing water locations. The assessment relies on information regarding construction and design provided by Ravensbrook as follows:

- Civil Engineering Infrastructure Report. Proposed Strategic Housing Development, Former Bailey Gibson Site, 326-328 South Circular Road, Dublin 08. Barrett Mahony Consulting Engineers (BMCE), April 2022;
- Environmental Risk Assessment and Waste Characterisation Report, Bailey Gibson. O'Callaghan Moran & Associates (OCM), 2019
- Environmental Risk Assessment and Waste Characterisation Reports. Player Wills Phase 3 Area, O'Callaghan Moran & Associates (OCM), 2020
- Bailey Gibson Site. Factual Ground Investigation Report. Ground Investigation Ireland, August 2019;
- Player Wills. Factual Ground Investigation Report. Ground Investigation Ireland, November 2020;

This report was prepared by Marcelo Allende (BSc BEng), and Teri Hayes (BSc MSc PGeol EurGeol). Marcelo is a Water Resources Engineer with over 15 years of experience in environmental consultancy and water resources studies. Marcelo is an Environmental Consultant with AWN Consulting, a member of the International Association of Hydrogeologists (Irish Group) and a member of Engineers Ireland (MIEI).

Teri is a hydrogeologist with over 25 years of experience in water resource management and impact assessment. She has a Masters in Hydrogeology and is a former President of the Irish Group of the Association of Hydrogeologists (IAH) and has provided advisory services on water related environmental and planning issues to both public and private sector bodies. She is qualified as a competent person as recognised by the EPA in relation to contaminated land assessment (IGI Register of competent persons www.igi.ie). Her specialist area of expertise is water resource management eco-hydrogeology, hydrological assessment and environmental impact assessment.

1.4 Description of Drainage

The nearest surface water receptor is the River Poddle (WFD code: IE_EA_09P030800; EPA segment code 09_1874). The River Poddle is a highly urbanised catchment. The majority of the flows into the River Poddle is originated from the public stormwater drainage system. The River extends from the Cookstown area north of Tallaght to the north east where it joins with the River Liffey between Grattan Bridge and the Millennium Bridge (c. 1.4 km to the north of the subject site) and has a catchment area of c. 16.4 km^2. The River Poddle is an ungauged catchment so no historic flow data or rating curves are available. The Poddle is a heavily modified channel with no natural tributaries. This is noted in the changes in the River's course over time including the canalisation and culverting of the River as well as the introduction of in line lakes at Tymon North and in Tymon Park

With regard to the local drainage network, there are no public surface water drains located in either the South Circular Road or Rehoboth Place (adjacent to the Bailey Gibson site to the south and west). A 1,060mm brick combined sewer is located within the South Circular Road and a 150mm diameter combined sewer is located within Rehoboth Place. Surface Water runoff from the former Bailey Gibson salvage

yard area of the site currently discharges, untreated and unattenuated, to both combined sewers.

In addition, there is a 910-1,210mm stormwater culvert in Donore Avenue. The culvert extends under Donore Avenue from near the junction with Merton Avenue, flowing northwards along Donore Avenue until it turns east and leaves Donore Avenue, flowing eastwards between Ebenezer Terrace and Harman St (towards Blackpitts). This culvert is historically known as the Abbey Stream, a distributary from the original River Poddle. It once traversed the St. Teresa's Gardens, entering at the south corner of St. Teresa's church, but was diverted to continue beneath Donore Avenue to the east of the church many years ago. Due to drainage works which have occurred upstream, this culvert now carries the main river Poddle flow.

A 1030mm concrete stormwater culvert has been identified which extends across the boundary between the Player Wills site and the adjacent church property exists, but is permanently flooded to the level of the overflow into the culvert in Donore Avenue mentioned above. It has been proved that the culvert caters for surface water runoff only from the northern area of the Player Wills car park surface and discharges this runoff via the overflow connection to the stormwater culvert in Donore Avenue.

In the northeast of the site there is a 300-375mm diameter stormwater pipe which extends from the boundary with the rear of the Coombe hospital, through the old St. Teresa's Gardens flats. It flows in a north-east direction and connects to the stormwater culvert in Donore Avenue mentioned above.

Refer to Infrastructure Report (BMCE, 2022) for further details on the local drainage network.

It is proposed that the new stormwater drainage system for the Bailey Gibson development will flow generally northeast, through Players Park to the east of the Bailey Gibson site and the multi-sport playing pitch and its surrounds, before finally discharging to the existing stormwater culvert in Donore Avenue, close to Ebenezer Terrace. This stormwater drainage system has also been designed to cater for stormwater runoff from the LDA Donore Project land in the northwest and west section of SDRA 12.

The multi-sport playing pitch surface which forms part of this application, shall be a fast-draining synthetic or similar type surface. Runoff from the pitch shall be attenuated by means of a hydrobrake located in the final manhole prior to discharge to the main surface water network upstream of the pitch side attenuation tank.

The proposed Players Park to the east of the Bailey Gibson site, which also forms part of this application, will have a significant area of soft landscaping throughout. Hard paved surfaces forming footpaths through the park will all drain to filter strips located along the verge/kerbline of each footpath or to tree-pits. From here, the stormwater will filter into the permeable hardcore build-up beneath the full area of the paved surface above. Essentially, this shall ensure that all stormwater in the park shall be capable of discharging to ground over the full surface area of the park. Due to the poor permeability of the boulder clays which are present at this site, and to ensure the ongoing functionality of the park during and after high intensity storm events, the filter strips will incorporate a land drain which will have an overflow connection to the main surface water network.

The stormwater management strategy includes the construction of a stormwater attenuation tank to the north side of the proposed multi-sport playing pitch. This

attenuation tank has been sized to cater for the full Bailey Gibson site, the LDA Donore project site to the west and northwest of the SDRA and any runoff from Players Park to the east of the Bailey Gibson.

There is an area within the proposed Bailey Gibson development application boundary which is also included within the permitted Player Wills development site. Except for the overlapping area within the permitted Player Wills development site, there is no direct stormwater runoff from the proposed development site to the combined sewer culvert in Donore Avenue. However, a significant proportion of the permitted Player Wills site does currently discharge stormwater to the combined sewer in Donore Avenue. By including this overlapping area of the permitted Player Wills SHD site in the Bailey Gibson planning application, this ensures that the required area of stormwater removal can be carried out within the proposed development planning permission, and thus maintain complete independence from reliance on any other planning permissions. The stormwater runoff from this overlapping area shall be attenuated through its own attenuation tank and flow control device with outflow from the tank limited to a greenfield rate prior to discharge to the main surface water network for the proposed development.

In summary, stormwater runoff within the catchment of the proposed development, including the Bailey Gibson, Players Park and multi-sport playing pitch sites, all of which are included in this application, as well as the LDA Donore Project site to the west, will be attenuated in a below ground attenuation tank, to be located to the northern side of the multi-sport playing pitch. Stormwater will finally discharge at an attenuated greenfield rate, to the stormwater culvert in Donore Avenue

SuDS devices and the attenuation system will be provided to cater for up to a 1-in-100 year rainfall event and 20% climate change. The appropriate SuDS features included in this proposal include rainwater harvesting, filter strip, bioretention system, infiltration trench, swales and attenuation tanks.

With regard to the foul water, in addition to the aforementioned 1,060mm brick within the South Circular Road and the 150mm diameter combined sewer located within Rehoboth Place, there is an existing 225mm diameter concrete combined sewer which extends from the Coombe hospital site, through the proposed multi-sport playing pitch site and connects to the combined sewer culvert in Donore Avenue.

It is proposed that the new foul drainage system for the development will be constructed across the SDRA 12 Lands, connecting to the combined sewer culvert in Donore Avenue, to the east of the multi-sport playing pitch. Given that the development site has a direct connection to the designated discharge point, the foul drainage system for the proposed development will be completed in full, without reliance on drainage infrastructure to be provided as part of any other proposed or permitted development.

The existing 225mm combined sewer, which is currently located within the multi-sport playing pitch site, will be diverted to the north side of the multi-sport playing pitch and increased in size to cater for the proposed Bailey Gibson development flows as well as the adjacent LDA Donore Project flows.

In relation to the basement drainage, it will have a series of gullies and drainage channels cast into the floor slab which will cater for the limited amount of run-off that enters the through ramps, service openings and from vehicles. These channels will connect to a buried gravity pipe network that will fall to a petrol interceptor. The outflow from the petrol interceptor will flow to a sump with duty and standby pumps

from where it will be pumped through a rising main, to the nearest foul manhole on the main gravity system, via a standoff manhole.

The combined sewer in Donore Avenue eventually discharges to the Ringsend Waste Water Treatment Plant (WWTP) where it is treated and ultimately discharges into South Dublin Bay. The WWTP and pumping station operate under an EPA licence D0034-01.

According to the Site Specific Flood Risk Assessment included in the Infrastructure Report (BMCE, 2022) the entire proposed residential portion of the development is located within Flood Zone C (i.e., where the probability of flooding from rivers is less than 0.1% or 1 in 1000 years – probability of fluvial flooding is low risk), and, therefore, deemed 'Appropriate'. It has also been shown that the multi-sport playing pitch is in Flood Zone A, but also deemed 'Appropriate' based on its classification as Water Compatible Development. Therefore, the proposed development is not at risk of inundation from any of the modelled flood events, including the climate change and residual risk scenarios.

2.0 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.

2.1 Hydrological Catchment Description

The proposed development site lies within the Liffey and Dublin Bay Catchment (Hydrometric Area 09) and River Dodder sub-catchment (WFD name: Dodder_SC_010, Id 09_16) (EPA, 2022).

The Environmental Protection Agency (EPA, 2022) on-line mapping presents the available water quality status information for water bodies in Ireland. The River Poddle belongs to the Poddle_010 WFD surface waterbody which has a 'Poor' Status (EPA, 2022) and its WFD risk score is 'At risk of not achieving good status'. It should be noted that, although the Poddle River is an ungauged and culverted catchment with no historical monitoring data from the EPA, its status was estimated by an expert technical opinion, which, according to the EPA, has "low confidence" (refer to www.catchments.ie).

The Coastal Waterbody Dublin Bay has a WFD status (2013 – 2018) 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 2013-2018 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)'. Under the 2015 'Trophic Status Assessment Scheme' classification of the EPA, 'Unpolluted' means there have been no breaches of the EPA's threshold values for nutrient enrichment, accelerated plant growth, or disturbance of the level of dissolved oxygen normally present.

As the Proposed Development will have no additional stormwater run-off, when compared with the current situation, during a stormwater event, the development will, therefore, have no measurable impact on the water quality in any overflow situation at Ringsend WWTP apart from a minor contribution from foul sewage. As explained in Section 3.4 below, the maximum contribution of foul sewage (peak flow of 8.363 l/s) from the Proposed Development is 0.075% of the peak hydraulic

capacity at Ringsend WWTP. The proposed stormwater and foul water networks within the site will be entirely independent systems and rainfall will have no impact on foul flows to the Ringsend WWTP.

It should be noted that the bathing status has no direct relevance to the water quality status of the Natura 2000 sites due to rapid mixing and dilution resulting in no measurable change in water quality within the overall water body.

2.2 Aquifer Description and Superficial Deposits

Mapping from the Geological Survey of Ireland (GSI, 2022 http://www.gsi.ie, accessed on 25-05-2022) indicates the bedrock underlying the site is part of the Lucan Formation (code CDLUCN) and made up of dark limestone and shale (Calp). The lithological description comprises dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey. There are rare dark coarser grained calcarenitic limestones, sometimes graded, and interbedded dark-grey calcar. The beds are predominantly fine-grained distal turbidites in the north Dublin Basin. The formation is intermittently exposed on the coast between Rush and Drumanagh Head. The formation ranges from 300m to 800m in thickness. 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
- Rkd - Regionally Important Aquifer (karstified diffuse)

Presently, from the GSI (2022) 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 (Ground Waterbody Code: IE_EA_G_008) and is classified under the WFD Status 2013-2018 (EPA, 2021) as having '*Good status'*. The WFD Risk Score system for this GWB is 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 (2022) guidance presently classifies the bedrock aquifer vulnerability in the region of the subject site as '*Moderate*' to '*Extreme*' although the residential area is located in an area with '*Moderate*' vulnerability which indicates a general overburden depth potential of 5-10 m. This shows that the aquifer is naturally will protected by low permeability glacial clays. The aquifer vulnerability class in the region of the site is presented as Figure 2.1 below.

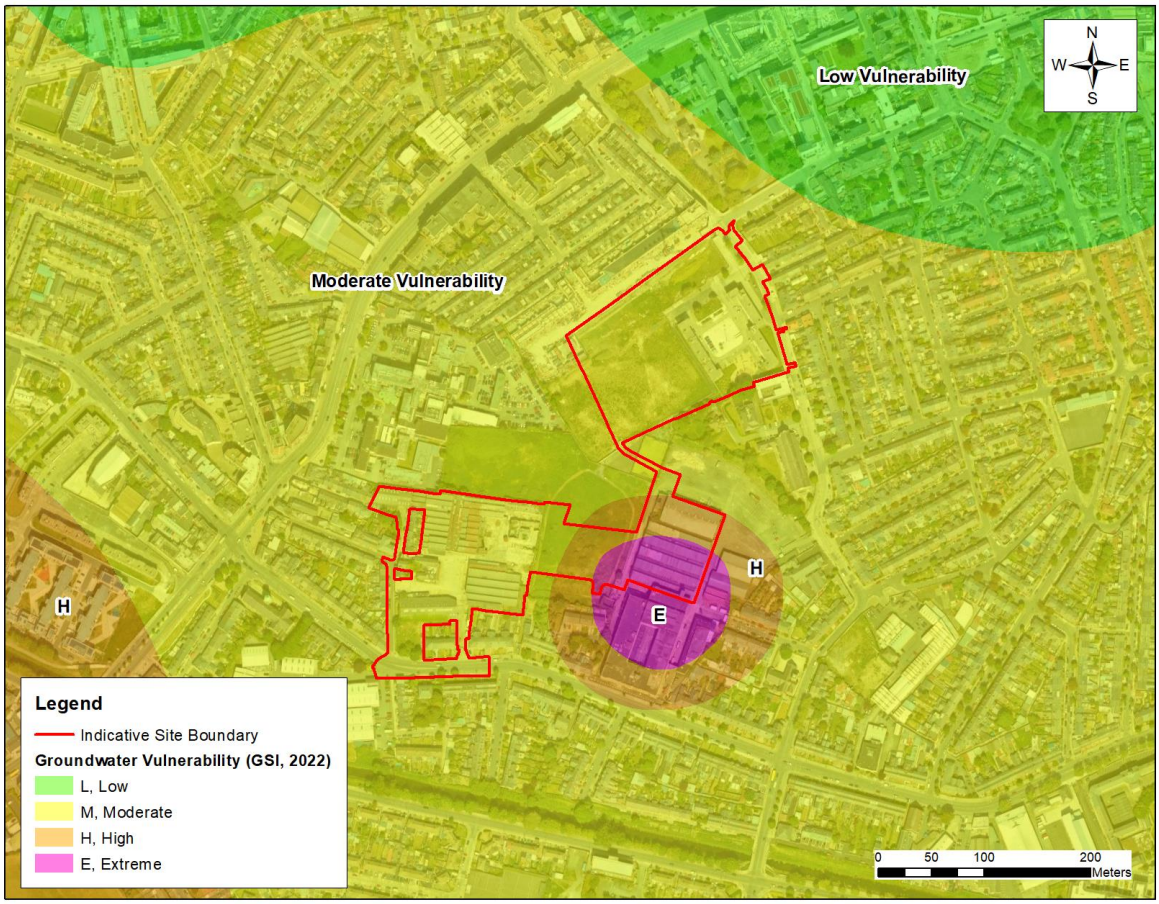


Figure 2.1 *Aquifer Vulnerability (Source: GSI, 2022)*

The GSI/ Teagasc (2022) mapping database of the quaternary sediments in the area of the subject site indicates the principal subsoil type in the residential area comprises Limestone till Carboniferous (TLs, i.e. Till derived from limestones).

According to the site investigations carried out in Bailey Gibson Site (GII, 2019) and Player Wills (GII, 2020), bedrock depth would be between 3.5-4.4 m below ground level (mbgl) and between 5.4-7.8 mbgl which is representative of a '*High*' and '*Moderate*' vulnerability, respectively.

This is also confirmed by the site investigations carried out by OCM in 2019 and 2020. According to these reports, the underlying subsoils comprises cohesive deposits which are consistent with the Teagasc soil descriptions for glacial tills. The subsoils in this area range in thickness from 5-6.5 mbgl and is thicker in the east of the former Flats complex site.

3.0 CONCEPTUAL SITE MODEL

A conceptual site model (CSM) is developed based on a good understanding of the hydrological and hydrogeological environment, plausible sources of impact and knowledge of receptor requirements. This in turn allows possible Source Pathway Receptor (S-P-R) linkages to be identified. If no S-P-R linkages are identified, then there is no risk to identified receptors.

3.1 Assessment of Plausible Sources

Potential sources during both the 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 and removal. Unmitigated run-off could contain a high concentration of suspended solids during earthworks. 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, no significant dewatering is expected given the low permeability overburden underlying the site.

Operational Phase

The following sources (or risk scenarios) are considered plausible post construction:

(i) The development site includes car parking areas at the ground level. Leakage of petrol/ diesel fuel may occur from these areas, run-off may contain a worst-case scenario of 70 litres for example. Any corresponding risk here would be mitigated by the interception storage system which comprises permeable paving and filter drains.

(ii) The stormwater drainage system follows SuDS measures, which are composed of rainwater harvesting, filter strip, bioretention system, infiltration trench, swales, attenuation system, vortex flow restricting devices (Hydrobrake or similar) and petrol interceptors before discharging into the public surface water sewer following the characteristics of a greenfield run-off. It should be noted that the worst-case scenario (70 litres) under consideration here disregards the effect of SuDS and petrol interceptors.

(iii) The development will be fully serviced with separate foul and stormwater sewers which will have adequate capacity for the facility as it was confirmed by Irish Water (refer to Infrastructure Report) and it is required by its licensing

requirements. Discharge from the site to the public foul sewer will be sewage and grey water only due to the predominantly residential nature of the proposed development. 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.

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 2020) shows it is currently operating for a PE peak loading of 2.27million while originally designed for 1.64million. However, the current maximum hydraulic load (832,269 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 3.4 below) have commenced and comprise a number of phases and are ongoing and expected to be fully completed by 2025.

(iv) There is no bulk fuel or chemical storage included in the development design.

3.2 Assessment of Pathways

The following pathways have been considered within this assessment with the impact assessment presented in Section 3.4:

The potential for offsite migration due to any construction discharges is moderate as there would be pathway through land ditches/ streams within or surrounding the site.

(i) Vertical migration to the underlying limestone is minimised due to the recorded '*Moderate*' to '*High*' vulnerability present at the site resulting in moderate aquifer protection from any localised diesel/ fuel oil spills during either construction or operational phases. The site is underlain by calcareous shale and limestone conglomerate which is a '*Locally Important Aquifer*'. This aquifer is characterised by discrete local fracturing with little connectivity rather than large connected fractures which are more indicative of Regional Aquifers. As such, flow paths are generally local.

(ii) There is no direct hydrological linkage for construction and operation run-off or any small hydrocarbon leaks from the site to South Dublin Bay. There is an indirect connection as stormwater discharges into an existing combined sewer in Donore Avenue which ultimately discharges to the Irish Water WWTP at Ringsend prior to discharge to Dublin Bay.

(iii) There is no 'direct' pathway for foul sewage to any receiving water body. There is however an 'indirect pathway' through the public combined sewer in

Donore Avenue ultimately discharges to the Irish Water WWTP at Ringsend prior to discharge to Dublin Bay post treatment.

3.3 Assessment of Receptors

The receptors considered in this assessment include the following:

(i) Underlying limestone aquifer;
(ii) South Dublin Bay and River Tolka Estuary SPA (site code: 4024), and the South Dublin Bay SAC (0210).

Other Natura 2000 Sites within Dublin Bay that may be hydrologically connected to the proposed development site, but are located further away (North Dublin Bay SAC (site code: 0206) and the North Bull Island SPA (site code: 4006)) were excluded from the assessment due to their distance from the subject site, the potential loading of contaminant from the site (risk scenarios presented in Section 3.1) and significant dilution through its pathway.

3.4 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.

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 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.

There is no direct open-water pathway between the site and South Dublin Bay. However, there is an indirect pathway through the combined stormwater sewer which discharges into the Ringsend WWTP. 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 (South Dublin Bay, c. 4.7 km downgradient).

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 (South Dublin Bay, which is located 4.7 km from the site).

The peak wastewater discharge is calculated at 8.363 l/s (BMCE, 2022). The sewage discharge will be licensed by Irish Water, collected in the public combined sewer in Donore Avenue, and treated ultimately Irish Water's WWTP at Ringsend prior to discharge to Dublin Bay. As outlined in section 3.1 (iv), 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 by Q4 2023.

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. These works are at an advanced stage with testing and commissioning stages expected to be completed in the second half of 2021.

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. Award of the second contract is due in Q3 2021 and the third and fourth contracts are scheduled to commence in late 2021 and mid 2023 respectively.

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 8.363 l/s (which would equate to 0.075% of the licensed discharge at Ringsend WWTP [peak hydraulic capacity]), 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 2020: An Indicator Report, 2021) 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 (0.075% 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 (Dublin Bay, which is c. 4.7 km from the site), 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 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 Proposed Development 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.

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 and interceptor already included in the design, no perceptible risk to any Natura 2000 Sites is anticipated given the distance from source to South Dublin Bay protected areas (c. 14 km). Potential contaminant loading will be attenuated, diluted and dispersed near source area.

Table 3.1 below presents a summary of the risk assessment undertaken.

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).	Bedrock protected by 3-10m low permeability overburden. Migration within weathered/ less competent limestone is low (limestone has discrete local fracturing rather than large connected fractures).	Limestone bedrock aquifer (Locally Important aquifer)	Low risk of migration through poorly connected fracturing within the limestone (Locally Important Aquifer) rock mass. No likely impact on the status of the aquifer/off site migration due to low potential loading, natural attenuation within overburden and discrete nature of fracturing reducing off site migration.
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	Indirect pathway through stormwater drainage to Dublin Bay waterbody (distance source-receptor: 4.7km)	South Dublin Bay SAC/SPA/pNHA	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. 4.7 km between the source and Dublin Bay.
Operational Impacts (Summary)			
Foul effluent discharge to sewer	Indirect pathway to Dublin Bay through public combined sewer	South Dublin Bay SAC/SPA/pNHA	No perceptible risk – Even without treatment at Ringsend WWTP, the average effluent discharge (8.363 l/s which would equate to 0.075% of the peak hydraulic capacity at Ringsend WWTP), would not 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).
Unmitigated discharge to ground of hydrocarbons from car leak (70 litres worst case scenario)	Indirect pathway through public combined sewer to Dublin Bay waterbody (distance source-receptor 4.7km)	South Dublin Bay SAC/SPA/pNHA	No perceptible risk – taking into account the extent of loading of contaminant, distance between the source and Dublin Bay is c. 4.7 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 3.1 Pollutant Linkage Assessment *(without mitigation)*

4.0 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 are indirect source pathway linkage from the Proposed Development through the public combined in Donore Avenue 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 0.075% 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.

5.0 REFERENCES

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