HYDROLOGICAL & HYDROGEOLOGICAL QUALITATIVE RISK ASSESSMENT

for

A PROPOSED SHD DEVELOPMENT ON LANDS AT HAROLD'S BRIDGE COURT, HAROLD'S CROSS, DUBLIN 6W, CO. DUBLIN

Technical Report Prepared For

Adroit Company Ltd.

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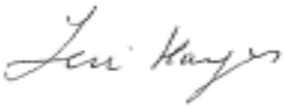
Signature		
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1.0 INTRODUCTION

1.1 Background

AWN have been requested by Adroit Company Ltd. to carry out a Hydrological and Hydrogeological Qualitative Risk Assessment for a strategic housing development on lands at 'Harold's Bridge Court', Harold's Cross Road & Greenmount Lane, Harold's Cross, Dublin 6W.

The proposed development provides for 194 no. dwellings comprised of studio, 1, 2 & 3 bed apartment units in 4 no. 4-9 storey blocks (Blocks A-D). The development also includes 1 no. commercial / retail unit (c.175m^2) at ground floor level of Block A, 1 no. creche (142.2m^2) at ground floor level of Block C and 22 no. work studios (1,980m2) at ground & 1st floor level of Block D, all on a site area of 1.01 ha.

Permission is sought for the demolition of all existing buildings on site (c. 5,356m^2), i.e. (a) 4 no. 3 storey duplex residential buildings (i.e. 48 no. dwellings, c. 3,542m²) and 2 no. 1 storey residential buildings (c. 40m² & 41m²) all within Harold's' Bridge Court, (b) 3 no. 2 storey houses at Clare Villas (c. 331m²) and (c) an existing warehouse (c. 1,248m²) and ancillary structures (c.154m2) fronting onto Greenmount Lane.

Vehicular access to the proposed development will be via Harold's Cross Road, utilizing the existing entrance. Vehicular traffic only associated with Block D will be allowed enter the site from Greenmount Lane with no vehicular through traffic progressing further through the development. Pedestrian and cyclist access is proposed via Greenmount Lane and Harold's Cross Road.

The proposed development provides for public open space (1,355m^2), hard and soft landscaping & boundary treatments. Communal residential amenity areas and open spaces are provided for in the form of communal roof gardens and communal rooms associated with the individual blocks. Additional communal open space is provided at ground level totalling 499m². Private open spaces are provided as terraces at ground floor level of each block and balconies at all upper levels.

Car parking is to be provided in the form of surface and basement level car parking. Blocks B & C are located above the proposed basement, which accommodates 58 no. car parking spaces, 4 no. motorcycle spaces and 426 no. bicycle parking spaces (inclusive of 8 no. cargo bike spaces & 48 no. electric bicycle spaces). There are an additional 7 no. surface level car parking spaces proposed (including 4 no. club car spaces), and 50 no. surface bicycle parking spaces. Bicycle parking is also accommodated within each of the 4 no. blocks at ground floor level (104 no. spaces in total)

The proposed development includes for all associated site development works above and below ground, bin & bicycle stores, plant (M&E), 2 no. sub-stations, public lighting, servicing, signage, surface water attenuation facilities etc.

The potential impacts on the receiving water environment considered are:

- Connection to foul sewer and stormwater sewer during operation.
- Management of foul, surface water run-off and accidental oil leaks during construction. No bulk oil storage during operation.

1.2 Hydrological Setting

The subject site, of approximately 1.01 Ha, is located at 'Harold's Bridge Court', Harold's Cross Road & Greenmount Lane, Harold's Cross, Dublin 6W. It is situated approximately 2 km south of Dublin City Centre and is located opposite the Grand Canal. The site is currently a combination of residential and commercial buildings.

The site is bounded to the north by the rear of existing residential and commercial development along Parnell Road, and by commercial development i.e. "Greenmount Office Park" and residential development i.e. "Boyne Court" to the south. The site is bounded to the east by Harold's Cross Road, to the west by Greenmount Lane and by Limekiln Lane to the south-west. The topography of the site generally slopes from South to North.

The River Poddle flows culverted in the area of the subject site and flows north towards the River Liffey where outfalls c. 2 km from the subject site (refer to Figure 1.1 below).

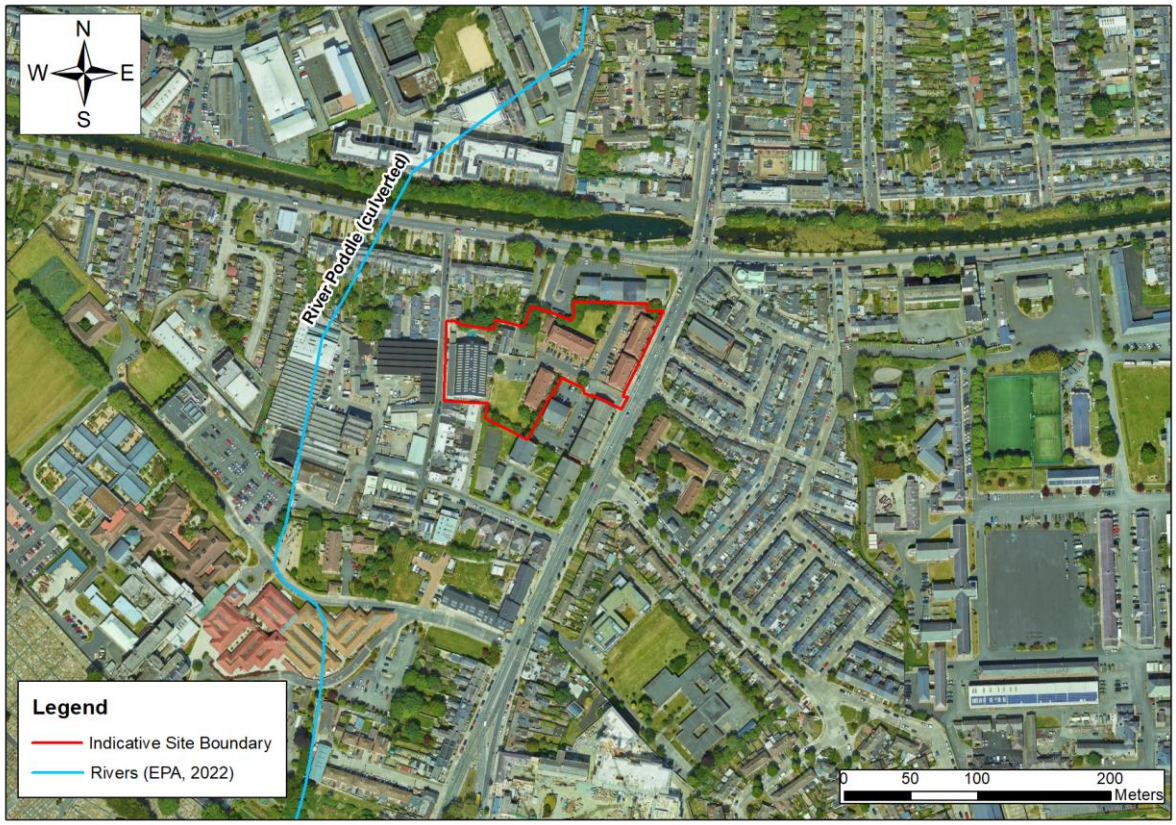

Figure 1.1 Site Location and Hydrological Environment

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. 2 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.

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.50m to the north 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. 4.2 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 1.4 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 post 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 Adroit Company as follows:

- Infrastructure Design Report. Harold's Bridge Court SHD. DBFL Consulting Engineers, June 2022;
- Site Specific Flood Risk Assessment. Harold's Bridge Court SHD. DBFL Consulting Engineers, June 2022;
- Ground Investigations Report. Greenmount Lane, Harold's Cross. Ground Investigations Ireland (GII), June 2022.

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 Current and Proposed Drainage

Current and Proposed Surface Water Drainage

The existing surface water drainage within the vicinity of the proposed development comprises the following:

- An existing 600mm diameter combined sewer which traverses the site and enters from the Harold's Cross Road. This discharges to the existing 3660mm

diameter trunk sewer located in Parnell Road which runs adjacent to the Grand Canal.

- An existing 780mm x 350mm stone combined sewer enters the site from Limekiln Lane to the south and discharges to the 3660mm trunk sewer located in Parnell Road.
- An existing 450mm diameter vitrified clay combined sewer enters the site from Greenmount Lane to the west and discharges to the 600mm diameter combined sewer in the centre of the site.

The proposed surface water drainage system will collect storm-water run-off from the proposed residential development via a traditional pipework and manhole system laid within the proposed street network. Run-off from hard standing areas will be collected via collectors. Sustainable Urban Drainage Systems (SuDS) will be incorporated to reduce run-off volumes and improve run-off water quality. Surface water from the development will discharge via an attenuated outlet to the existing 600mm diameter public Dublin City Council combined sewer which traverses the subject site. This in turn discharges to an existing 3,660mm trunk sewer located in Parnell Road and runs parallel to the Grand Canal. This 3,660mm trunk main eventually discharges to the Ringsend Waste Water Treatment Plan (WWTP).

The SuDs features comprise green roofs, permeable paving, tree pits, petrol interceptors and an underground stormtech attenuation system. These features will be provided to cater for up to a 1-in-100 year rainfall event and 20% climate change. Refer to the Infrastructure Design Report (DBFL, 2022) for further details.

According to the site specific Flood Risk Assessment carried out by DBFL (2022), the vast majority of the Site is within Flood Zone B (i.e., where the probability of flooding from rivers is between 0.1% AEP or 1-in-1,000 year event and 1% AEP or 1-in-100 year event). Floor levels within the development will be set at 22.10 m AOD which is 100mm above the 0.1% AEP and is significantly higher than the 1% AEP Event.

Therefore, any flood events will not cause flooding of the Proposed Development, and the development will not affect the flood storage volume or increase flood risk elsewhere.

Current and Proposed Surface Water Drainage

As mentioned above, there is an existing 600mm combined sewer which traverses the site and enters from the Harold's Cross Road. This in turn discharges to an existing 3,660mm trunk sewer located in Parnell Road and runs parallel to the Grand Canal. This 3,660mm trunk main eventually discharges to the Ringsend WWTP.

The general foul sewer strategy for the development will be to discharge by gravity to the existing 600mm diameter combined sewer which enters the site from the Harold's Cross Road and discharges to the existing trunk sewer in Parnell Road. Within the site foul sewer networks comprising 225mm and 150mm diameter sewers would serve the proposed development. Individual houses will connect to the 150/225mm diameter foul sewer via individual 100mm drains or per the Irish Water Code of Practice.

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 6.002 l/s) from the Proposed Development is 0.054% of the peak hydraulic capacity at 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 & Superficial Deposits

Mapping from the Geological Society of Ireland (GSI, 2022 http://www.gsi.ie, accessed on 29-06-2022) 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 in the region of the subject site as having mainly '*Moderate*' vulnerability which indicates a general overburden depth potential 5-10m, indicating that the aquifer is naturally protected by low permeability tills. The site investigation carried out by GII is consistent with this classification as bedrock was encountered at depths between 6.55m and 8.2m. The GSI 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). This is consistent with the subsoils described in the Site Investigation Report (GII, 2022).

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 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 the expected depths of bedrock.

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. Any corresponding risk here will be mitigated by the proposed oil/ petrol interceptor at the site. Within the basement carpark area, any rainwater entering the sealed system as a result of snow melt or raindrops from cars will pass through a petrol interceptor providing treatment before discharging to the foul sewer.

(iii) The stormwater drainage system follows SuDS measures that comprises green roofs, permeable paving, tree pits, petrol interceptors and an underground attenuation system. This system has been designed in order to discharge following the characteristics of a greenfield run-off into the public sewer. 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 development will be fully serviced with a combined sewer 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 combined sewer will be sewage and grey water only due to the 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 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.

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

3.2 Assessment of Pathways

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

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.

(i) Vertical migration to the underlying Limestone is minimised due to the recorded '*Moderate*' vulnerability present at the site resulting in good aquifer protection from any localised diesel/ fuel oil spills during either construction or operational phases. The site is underlain by 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 public combined sewer that traverses the subject site 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 mentioned public combined sewer which ultimately discharges to the Ringsend WWTP prior to final discharge to Dublin Bay post treatment.

3.3 Assessment of Receptors

The receptors considered in this assessment include the following:

(i) Underlying limestone bedrock 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. 4.2 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 4.2 km from the site).

The peak wastewater discharge is calculated at 6.002 l/s (DBFL, 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 6.002 l/s (which would equate to 0.054% 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 (0.054% 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. 4.2 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. 4.2 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 5-10m 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: 4.2km)	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. 4.2 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 peak effluent discharge (6.002 l/sec which would equate to 0.054% of the licensed discharge 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).
Discharge to ground of hydrocarbons from carpark leak	Indirect pathway through public combined sewer to Dublin Bay waterbody (distance source-receptor 4.2km)	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. 4.2 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 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 0.054% 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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