HYDROLOGICAL & HYDROGEOLOGICAL QUALITATIVE RISK ASSESSMENT

for

PROPOSED STUDENT ACCOMMODATION DEVELOPMENT at GOATSTOWN ROAD, CO. DUBLIN

Technical Report Prepared For

Orchid Residential Ltd.

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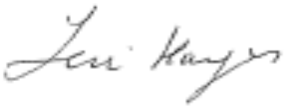
Signature		
Name	Marcelo Allende	Teri Hayes
Title	Environmental Consultant	Director
Date	28 August 2020	28 August 2020

TABLE OF CONTENTS **Page**

Tables

Figures

1.0 INTRODUCTION

1.1 Site Location & Hydrological Setting

It is proposed to construct a new student accommodation development at a site on Goatstown Road, 600m north of the Goatstown Town centre, and 800m south-west of the UCD Belfield Campus.

The development will consist of demolition of the existing building (c.960sqm) and hard surface parking area and construction of a purpose built student accommodation development comprising 239 no. student bedspaces within a part 4 no. storey, part 6 no. storey building (total gross floor area 6,620sqm), including internal and external amenity space, 188 no. cycle spaces, 6 no car parking spaces, vehicle ingress and egress from Goatstown Road, an ESB substation and switchroom, refuse store and all associated site development works including hard and soft landscaping, lighting and ancillary infrastructure all within the 0.39ha site (refer site location in Figures 1.1 below).

The site is currently used by a car dealership and comprises a showroom and hardstanding surfaces covering all of the remaining site area.

Figure 1.1 Site Location in relation to local drainage

There is no direct discharge to ground or surface water body proposed as part of this development. The nearest surface water receptor to the west is the River Slang which is c. 930m west of the proposed development site boundary; the Elm Park Stream is c. 550m at its nearest point to the north of the proposed development site (refer to Figure 1.1 above).

A review of historical maps of this zone was conducted (Geohive web maps; OPW, 2020), which does not show any additional historical rivers in the vicinity of the proposed development site.

The EPA (2020) on-line database indicates there is no NPWS protected area in the vicinity of the proposed development site. The nearest protected area is the South Dublin Bay SPA/SAC/pNHA which is c. 2.7km to the east of the site.

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 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 Slang River, Elm Park Stream and ultimately Dublin Bay. The assessment relies on information regarding construction and design provided by Barrett Mahony (*Civil Engineering Infrastructure Report & Flood Risk Assessment for Planning. Goatstown Student Accommodation. BM, 2020*). A ground investigation carried out by Causeway Geotech (*Goatstown Development – Ground Investigation. Causeway Geotech. April 2020*) was also analysed.

This report was prepared by Marcelo Allende (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 and a member of the International Association of Hydrogeologists (Irish Group). 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.

1.3 Description of Drainage

The nearest surface water receptors lie to the north and to the west of the proposed development site (refer Figure 1.1 above). These are identified as follows:

- Slang River (EPA code: 09S04) which is located c. 930m to the east of the site. This stream flows towards the north where it joins the Dodder River c. 1.5Km to the northwest of the site. The Dodder River outfalls into the Liffey River at Ringsend.

- Elm Park Stream (EPA code: 09_2203) which is located c. 550m to the north of the site. This stream site outfalls into Dublin Bay just south at Merrion Gates.

With regard to the development site, currently there is an existing car showroom to the north of the site, with the remaining area consisting of tarmac surfacing. Surface water drains via a series of gullies and surface drains to the existing public sewer

under the Goatstown road to the west of the site. There is no evidence of flow control devices restricting discharge rates from the site.

It is proposed that stormwater from the site, following interception and attenuation Sustainable Drainage Systems (SuDS), will be discharged into an existing public surface water pipe running along the Goatstown road to the west of the site. Foul water will be discharged into an existing 225mm diameter sewer running also along the western boundary of the site, falling northwards along the Goatstown Road.

This foul sewer eventually discharges to the Ringsend Waste Water Treatment Plant (WWTP) where it is treated and ultimately discharges to Dublin Bay.

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, 2020). The River Slang (Figure 1.2) - a tributary of the River Dodder - is located approx. 930m west of the subject development site. From here the River Slang flows for approx. 1.2Km in a northerly direction before converging with the River Dodder which then flows north for a further ~4.9km before discharging into the Liffey Estuary lower transitional waterbody which in turn discharges into Dublin Bay coastal waterbody which includes Special Area of Conservation (SAC)/proposed Natural Heritage Area (pNHA). The Elm Park Stream rises in Goatstown c. 550m from the subject proposed development site, is culverted for part of its course and discharges through UCD before emerging in Elm Park Golf Course, from where the water course finally discharges to Dublin Bay just south at Merrion Gates.

The EPA (2020) on-line mapping presents the available water quality status information for water bodies in Ireland. The River Slang and the River Dodder have a Water Framework Directive (WFD) status (2013-2018) of ‘Moderate’ and a WFD risk score of ‘At risk of not achieving good status’. This moderate status is related to its biological status (invertebrate and fish) and dissolved oxygen conditions (which fails in relation to its percentage saturation); all remaining chemical condition have been classified as ‘good’. Its most recent quality data (2019) also indicate that it is ‘Slightly polluted’. The EPA does not collect water quality data for the Elm Park Stream and does not have assigned status and risk currently. However, it is likely to be in similar condition to the Slang.

The Dodder catchment discharges to the Liffey Estuary Lower which has a WFD status (2013-2018) of ‘Good’, and Dublin Bay has a WFD status of ‘Good’. The Liffey Estuary Lower waterbody has a WFD risk score of ‘At risk of not achieving good status’ while the Dublin Bay waterbody has a WFD risk score of ‘Not at risk’. The most recent surface water quality data for the Liffey Estuary Lower and Dublin Bay (2019-2020) indicate that they are ‘Unpolluted’. 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.

2.2 Aquifer Description and Superficial Deposits

Mapping from the Geological Society of Ireland (GSI, 2020) 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 (2020) 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 (2013-2018) is '*Good*' with a current WFD risk score of '*Not at risk*'*.*

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 (2020) guidance presently classifies the bedrock aquifer vulnerability in the region of the subject site as '*Low*' which indicates a general overburden depth potential of >10m. This shows that the aquifer is naturally protected by low permeability glacial clays. The aquifer vulnerability class in the region of the site is presented as Insert 2.1 below.

Figure 2.1 Aquifer Vulnerability (site location indicated, red cross)

The GSI/ Teagasc (2020) 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 (TGr, i.e. Till derived from granites).

This has been confirmed by local site investigations carried out by Barrett Mahony (BM, 2020) and Causeway Geotech (2020). In fact, 2 no. infiltration tests undertaken by BM show that the site is underlain by boulder clay of very low permeability and therefore soakaways were not considered feasible for the design.

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 sources are considered plausible for the proposed construction site:

(i) Re-fuelling will generally be undertaken off-site or at a designated bunded refuelling area. However, some construction sites may have a bunded, double-skinned fuel oil tank/ bowser on site for re-fuelling purposes. As a worst-case scenario, a rupture of a 1,000 litre tank to ground is considered. 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. This could be considered an intermittent short-term event, i.e. if adequate mitigation measures were not incorporated in the Construction Environmental Management Plan (CEMP).

Operational Phase

The following sources are considered plausible post construction:

(i) The development site includes only 2 no. disabled parking spaces and 4 no. set-down parking bays to facilitate arrivals and departures of students, or for use by service vehicles or taxis. Therefore, a standard car parking area is not considered reducing the potential for any sort of car leak during operation. 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 comprise permeable paving, intensive biodiverse areas and paved green roofing.

(ii) The stormwater drainage system follows SuDS measures, which are composed of an interception storage system (permeable paving, intensive biodiverse, paved green roofing, rainwater harvesting system) and an attenuation storage tank (concrete or lined stormtech system). The storage system will discharge following the characteristics of a greenfield run-off into the existing public surface water pipe running along the Goatstown road. No additional treatment measures were considered due to the expected loading and provision of the mentioned interception system.

(iii) The development will be fully serviced with separate foul and stormwater sewers which will have adequate capacity for the facility 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. 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 and meet environmental legislative

requirements as set out in such licence. It is noted that an application for a new upgrade to this facility is currently in planning.

(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 impact assessment presented in Section 3.4:

The potential for offsite migration due to any construction discharges is low as there is no significant p
athway in the aquifer or through land ditches or streams.

(i) Vertical migration to the underlying limestone is minimised due to the recorded '*Low*' 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 Calp limestone which is a '*Locally Important Limestone Aquifer*' 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 or operation run-off or any small hydrocarbon leaks from the site to the River Slang (and River Dodder), Elm Park Stream or Dublin Bay. However, an indirect pathway exists through the public stormwater sewers.

(iii) There is no 'direct' pathway for foul sewage to any receiving water body (as identified above). There is however an 'indirect pathway' through the public sewer which 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) River Slang and Elm Park Stream; and
(iii) Liffey Estuary Lower and Dublin Bay.

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 overburden thickness and 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.

Should any silt-laden stormwater from construction or hydrocarbon-contaminated water from a construction vehicle leak manage to enter the public stormwater sewer, the suspended solids will naturally settle within the drainage pipes and hydrocarbons will dilute to background levels (water quality objectives as outlined in S.I. No. 272 of 2009 and S.I. No. 77 of 2019 amendment); by the time the stormwater reaches any open water based on the distance to waterways. Similarly, during operation, should any leak of hydrocarbon occur from a vehicle, the volume

of contaminant release is low and combined with the significant attenuation within in the public stormwater sewers, hydrocarbons will dilute to background levels with no likely impact above water quality objectives as outlined in S.I. No. 272 of 2009 and S.I. No. 77 of 2019. It can also be concluded that the in-combination effects of surface water arising from the proposed development taken together with that of other developments will not be significant.

The peak wastewater discharge is calculated at an average wastewater discharge of 1.696 litres/sec. The sewage discharge will be licensed by Irish Water, collected in the public sewer and treated at Irish Water's WWTP at Ringsend prior to discharge to Dublin Bay. This WWTP is required to operate under an EPA licence (D0034-01) and to meet environmental legislative requirements. The plant has received planning (2019) and will be upgraded with increased treatment capacity over the next five years. The peak foul discharge calculated for the proposed development is well within the capacity of the WWTP. Even without treatment at the Ringsend WWTP, the peak effluent discharge, calculated for the proposed development as 0.871 litres/sec (which would equate to 0.008% of the licensed discharge at Ringsend WWTP [peak hydraulic capacity]), 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). 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 (WWTP 2012 EIS, WWTP 2018 EIAR). Recent water quality assessment of Dublin Bay also shows that Dublin Bay on the whole, currently has an 'Unpolluted' water quality status (EPA, 2020).

The assessment has also considered the effect of cumulative events, such as release of sediment laden water combined with a hydrocarbon leak on site. As there is adequate assimilation and dilution between the site and the receiving water bodies, it is concluded that no perceptible impact on water quality would occur. It can also be concluded that the cumulative or in-combination effects of effluent arising from the proposed development with that of other developments discharging to Ringsend WWTP will not be significant having regard to the size of the calculated discharge from the proposal.

Source	Pathways	Receptors considered	Risk of Impact
Construction Impacts			
Unmitigated leak from an oil tank to ground/ unmitigated leak from construction vehicle.	Bedrock protected by c. 10 low permeability overburden. Migration within weathered/ less competent limestone is lo (Calp limestone has discrete local fracturing rather than large connected fractures).	Limestone bedrock aquifer (locally Important aquifer)	Low Risk of localised impact to shallow weathered limestone due to protective overburden. No likely impact on the status of the aquifer due to volume of leak indicated, 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	Overland flow/ indirect pathway through stormwater drainage to Slang and Elm Park water courses	River Slang and Elm Park Stream	No perceptible risk – Distance from source too great (> 0.5 km) and potential contaminant loading will be attenuated diluted and dispersed near source area.
Unmitigated run-off containing a high concentration of suspended solids	Indirect pathway to Dublin Bay through public sewer	Dublin Bay	
Operational Impacts			
Foul effluent discharge to sewer	Indirect pathway to Dublin Bay through public sewer	Dublin Bay	No perceptible risk – Even without treatment at Ringsend WWTP, the average effluent discharge (1.696 litres/sec which would equate to 0.008% 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 car leak	Indirect pathway through stormwater drainage to Slang and Elm Park water courses	River Slang and Elm Park Stream	No perceptible risk – Distance from source too great (> 0.5 km), potential contaminant loading will be attenuated diluted and dispersed near source area and the project does not consider an standard permanent parking area.

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.

There is no direct source pathway linkage between the proposed development site and open water (i.e. Dodder Catchment or Dublin Bay). It is concluded that there is also no resultant indirect source pathway linkage from the proposed development through public sewers which could result in any change to the current water regime (water quality or quantity) and open water as defined.

Finally, as outlined in the report prepared by Barrett Mahony (2020), and in line with good practice, mitigation measures have been included during operation 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.

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