HYDROLOGICAL & HYDROGEOLOGICAL QUALITATIVE RISK ASSESSMENT FOR A STRATEGIC HOUSING DEVELOPMENT (SHD) AT OUR LADY'S GROVE, GOATSTOWN ROAD, GOATSTOWN, DUBLIN 14

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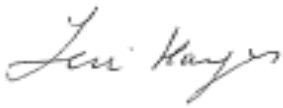
Signature		
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1.0 INTRODUCTION

1.1 Site Location & Hydrological Setting

The proposed development site is located off Goatstown Road, Dublin 14 within the grounds of Our Lady's Convent and School.

The site is currently compromised of open grassland to the south with tarmac covered sport surfaces in the northern section of the site, a creche facility is situated in the north eastern corner with additional hardstanding to the south east which appears to have been previously used as a construction compound. The topography ranges from approx. + 42 mOD to + 40 mOD with a gradent rising south to north east.

Figure 1.1 Site location in relation to regional drainage (hydrological setting)

It is proposed that stormwater from the site, following attenuation, will discharge to the existing 300mm diameter public storm sewer located at the entrance to the site on the eastern boundary of Our Lady's Grove. Foul water will discharge, also on the eastern site of the site at the entrance, to an existing 225 mm diameter foul sewer, which later joins a public foul sewer line along the Goatstown Road to the east of the proposed development site.

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 approx. 560 m west of the proposed development site boundary; the Elm Park Stream is approx. 200 m at its nearest point to the north of the proposed development site (Figure 1.2).

1.2 Objective of Report

The scope of this desk top review is to confirm any hydrological pathway to a Natura 2000 site and determine any risk of impact on water body status or habitat requirements to any Natura 2000 sites based on the construction and operation of the proposed development.

In particular, this review considers the likely impact of construction run-off and domestic sewage from the proposed development on water quality status within Dublin Bay farther to the east. This technical report will inform The Project Ecologist's '*Provision of Information for Screening for Appropriate Assessment'* report, which aims to address the unmitigated impact on any Natura 2000 site that might be at risk of likely significant effects

Figure 1.2 Site location in relation to European sites and NHAs/pNHAs in the vicinity of the proposed development. (EPA, 2020)

The assessment relies on information regarding construction and design provided by the site engineers DBFL, as outlined in their '*Civil & Structural Design Statement* (2020).

This report is prepared by *Paul Conaghan* (BSc and MSc) and *Teri Hayes* (BSc MSc PGeol EurGeol). 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.

Paul is an Environmental Consultant with over 9 years' experience working in the environmental science and environmental engineering fields. Paul holds a degree in Environmental Science from the University of Limerick and a master's in environmental engineering from Queens University Belfast. Paul has worked on a wide range of projects including hydrogeology, contaminated land, project management, site geotechnical evaluations, site assessments specialising in environmental impact assessment. Paul is a member of the International Association of Hydrogeologists.

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 environments.

2.1 Hydrological Catchment Description

The proposed development site lies within the Liffey and Dublin Bay Catchment (Id. 09) and River Dodder sub-catchment (name: Dodder_SC_010, Id. 09_16) (EPA, 2020). The River Slang (Figure 1.2) - a tributary of the River Dodder - is located approx. 560 m west of the subject lands. From here the River Slang flows for approx. 780 m in a northerly direction before converging with the River Dodder which then flows north for a further ~4.9 km before discharging into the Liffey Estuary lower transitional waterbody which in turn discharges into Dublin Bay coastal waterbody which includes a Special Area of Conservation (SAC)/proposed Natural Heritage Area (pNHA). The Elm Park Stream rises in Goatstown approx. 200 m from the proposed development lands, is culverted for part of its course (Figure 1), and discharges through UCD before emerging in Elm Park Golf Course, from where the water course finally discharges to Dublin Bay just south of the 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 current WFD risk score of 'At risk of not achieving good status'. The EPA does not collect water quality data for Elm Park Stream. The Dodder catchment discharges to the Liffey Estuary Lower which has a WFD status (2013-2018) of 'Good' and current score of 'At risk'. The Dublin Bay waterbody has a WFD risk score of 'Not at risk' and achieved 'Good' status between 2013-2018. The most recent surface water quality data for the Liffey Estuary Lower and Dublin Bay (2010-2012) 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 & Superficial Deposits

The Geological Survey of Ireland GSI (2018) classifies the bedrock beneath the site as 'Dinantian Upper Impure Limestones' - dark Limestone and shale (Calp). 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)

The GSI (2020) has described 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) classifies the bedrock aquifer in the region of the site as having *Low* (L) vulnerability status. 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 Figure 2.1 below.

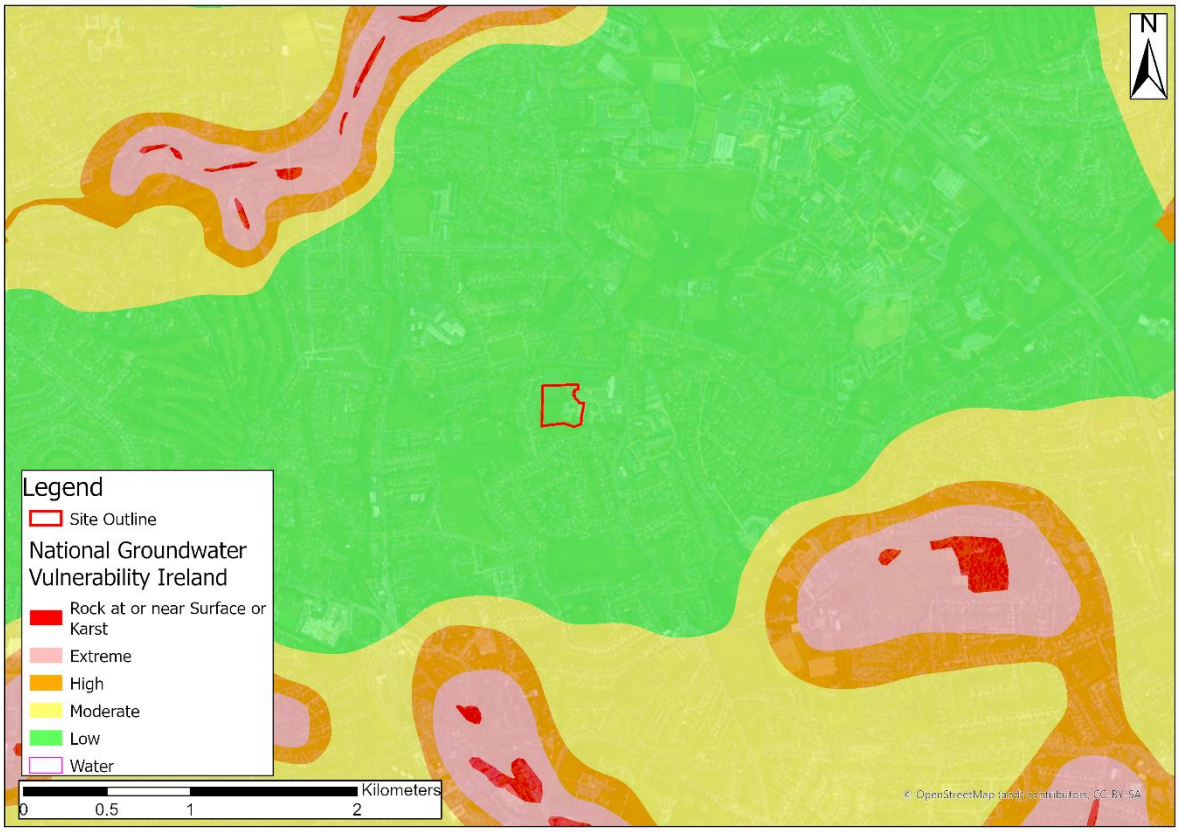

Figure 2.1 Aquifer Vulnerability (GSI, 2020)

The GSI/ Teagasc (2020) online shallow soils map indicates the site and surrounding area is underlain by Made Ground which reflects the urbanised land use in the immediate area.

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 (temporary to short-term) and operational sources (long-term) are considered below.

Construction Phase

The following sources (hazards) are considered plausible for the proposed construction site:

(i) Leakage could occur from construction site equipment. As a worst-case scenario an unmitigated leak from a temporary refuelling tank which would typically have a maximum capacity of 300 litres is considered. This would be a single short-term event i.e. if not adequately mitigated. It is noted all chemicals will be bunded to a volume of 110% of the capacity of the largest tank/ container within the bunded area(s) (plus an allowance of 30 mm for rainwater ingress). Refuelling of construction vehicles will take place in a designated area (or where possible off site) which will be away from surface water gullies or drains

(ii) Use of wet cement is a requirement during construction. Run-off water from recently 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 potential event rather than an ongoing event.

(iii) Construction requires soil excavation and removal and import. 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 proposed mitigation measures to control sediment laden run-off were to fail.

It is noted that the proposed development site is currently surrounded by established development which already has stormwater infrastructure in place and as such, this built infrastructure provides additional attenuation for run-off prior to discharging to the public stormwater sewer.

Operational Phase

The following sources are considered plausible post construction:

(i) The development will use gas heating. 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. The development will be fully serviced with foul and storm sewers which will have adequate capacity for the facility as required by Irish Water licencing. 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 has been granted.

3.2 Assessment of Pathways

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

(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

3.4.1 Assessment Without Mitigation

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 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 (as amended) & S.I. No. 77 of 2019); by the time the stormwater reaches any open water. 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 (as amended) & 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 average wastewater discharge is calculated at a rate of 1.01 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. Even without treatment at the Ringsend WWTP, the average effluent discharge, calculated for the proposed development as 1.01 litres/sec (which would equate to 0.019% 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). 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, 2018).

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.

The existing and proposed foul and storm sewers are 'separate' in compliance with the Building Regulations and Dublin City Councils '*Regional Code of Practice for Drainage works and Irish Waters Code of Practice for Wastewater Infrastructure'*. As such, there is no potential for sewage-laden water from the proposed development to enter the local stormwater network ultimately discharging to Dublin Bay.

Table 3.1 Pollutant Linkage Assessment *(without mitigation)*

Source	Pathways	Receptors considered	Risk of Impact
Construction Impacts Unmitigated leak from an oil tank to ground/ unmitigated leak from construction vehicle.	Vertical migration to weathered/ less competent limestone. (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 Unmitigated run-off containing a high concentration of suspended solids	Overland flow/ indirect pathway through stormwater drainage to Slang and Elm Park water courses	River Slang & 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.
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 (1.01 litres/sec which would equate to 0.019% 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	Slang and Elm Park Rivers	No perceptible risk – Distance from source too great (> 0.5 km) and potential contaminant loading will be attenuated diluted and dispersed near source area.

Note 1: This assessment is based on the current licenced hydraulic capacity of the Ringsend WWTW.

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 at Our Lady's Grove.

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 DBFL (2020), and in line with good practice, mitigation measures have been included in the construction design, management of construction programme and during operation of the proposed development. 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.

5.0 REFERENCES

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