HYDROGEOLOGICAL ASSESSMENT OF PROPOSED SOAKAWAY

Strategic Housing Development at St. Joseph's House and Adjoining Properties at Brewery Road and Leopardstown Road, Dublin 18.

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September 2021

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HYDROGEOLOGICAL ASSESSMENT OF PROPOSED SOAKAWAY

Client: HOMELAND SILVERPINES LIMITED

Location: Strategic Housing Development at St. Joseph's House and Adjoining Properties at Brewery Road and Leopardstown Road, Dublin 18.

Date: ^{23rd} September 2021

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Document Control

PROJECT NUMBER: IE2268		DOCUMENT REF: IE2268_Report_4968			
5.0	Final	JK	PMS	PMS	23-9-2021
4.0	Final	JK	PMS	PMS	15-9-2021
3.0	Final	JK	PMS	PMS	11-8-2021
2.0	Draft	JK	PMS	PMS	3/6/2021
1.0	Draft	JK	PMS	PMS	07/5/2021
Revision	Purpose Description	Originated	Checked	Reviewed	Date

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1. Background

It is proposed to utilise a soakaway as part of the management of stormwater for a proposed Strategic Housing Development at St. Joseph's House and Adjoining Properties at Brewery Road and Leopardstown Road, Dublin 18.

Barret Mahony have commissioned a hydrogeological assessment to support their design, for the forthcoming strategic housing development planning application to An Bord Pleanala.

2. Approach to Study

A desk review of the following source of information was undertaken;

- GSI public website
- Apex Geophysical Survey May 2016 – focussing on Northern part of Development site.
- Ground Investigation Ireland Report September 2016- focussing on Northern part of Development site (blocks A/B/C),
- Trinity Green- Soil Infiltration- July 2019
- 19-198-001A - TOPO SURVEY - ISSUED 121019.pdf
- IGSL Ground Investigation report May 2020.-focussing on Southern leg of site (Blocks D/F)
- BP2-OMP-01-ZZ-DR-A-1001 Masterplan
- BPR-BMD-00-00-DR-C-1000 Proposed Foul and Surface Drainage Ground PL5
- BPR-BMD-00-ZZ-DR-C-1205 Suds Details.pdf
- BPR-BMD-00-00-DR-C-1005-Schematic Suds Plan Layout.pdf

These should be referred to, if necessary, when reading this report.

3. Conceptual Ground Model

A conceptual understanding of the ground conditions on the site has been established as follows;

The ground elevation is approximately 83m O.D to the south dropping to approximately 81m O.D to the north, with a slight slope to the Northeast. The local topography slopes towards the Northeast and the Irish Sea.

The underlying bedrock comprises a pale grey fine to coarse grained Granite. The top 1.0m of the granite is weathered to a sand, and competent granite bedrock is encountered typically at between 1.5m bgl and 2.7m bgl. The elevation of competent rock profile is variable but appears consistent within this range.

The granite sand is not found everywhere, but where present is in the range of 0.3m to 1.2m thick.

A consistent cover of gravelly CLAY (glacial Till) overlies the Granite and Granite Sand except where replaced by Made Ground. The Made Ground may be a combination of reworked/imported material.

The Granite is classified by the Geological Survey of Ireland (GSI) as a *POOR Aquifer, generally unproductive except for localised zones*. Localised zones include deep weathered zones or faults. The maps do not indicate the presence of any such features in the area, and the geophysical survey undertaken as part of this project did not identify any such features. It is reasonable therefore to suggest that the Granite beneath this site is generally impervious and probably receives little to no recharge.

The GSI applies a recharge cap of 80mm per year which is approximately 20% of the 417mm effective rainfall (total rainfall – evapotranspiration). This suggests that the remaining 80% is shed as surface run-off and picked up by drainage features or watercourses.

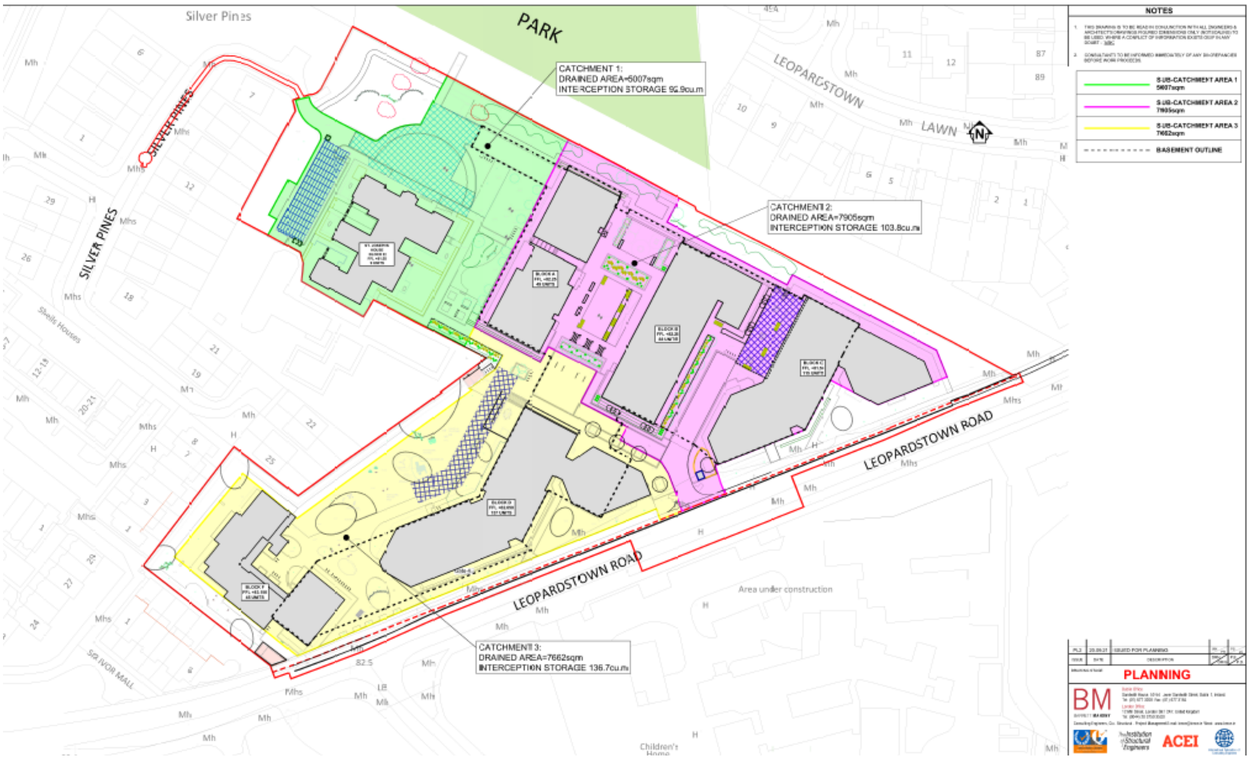
Furthermore any rainfall that does pass through the low permeability gravelly CLAY, will be vertically constrained by the low permeability of the granite. The water will therefore dissipate slowly through the impersistent granite Sand, and will follow the topographic gradient towards the Northeast, possibly recharging some local streams such as the Brewery Stream.

During wet weather, the suspected slow permeability, will lead to the formation of a perched water table on top of the granite bedrock.

4. Description of proposed surface water management in Sub Catchment 3

Surface water management for the proposed development has been divided into a series of sub-catchments. As the other sub-catchments are serviced by discharges to public storm sewers following attenuation, they are not considered further in this report. Sub-catchment 3 is serviced by SUD's devices including a soakaway, which is the main subject of this assessment.

Sub-catchment 3 is approximately 8000m^2 in area as shown below in yellow.



Approximately 60% of the sub-catchment is landscaping, receiving natural recharge. Approximately 25% of the area will be fitted with permeable paving as a SUDs device.

This means that approximately 15% of the area or 1200m^2 will comprise roof area, with green roof SUDs devices, which will attenuate flows from the roof. This attenuated flow will be conveyed to the soakaway.

- The soakaway will occupy a plan area of 364m^2 and comprises 546m^3 of cellular crate proprietary system with a nominal porosity of 95%, at 1.5m deep & ~750mm cover (base @ 2.25m BGL at 79.25m O.D)

The soakaway has a storage volume of approximately 519m^3.

The derived "f" value from the BRE Test is 5.86 x 10^{-6} m/s.

The design outflow is calculated as follows

Outflow from the soakaway

$O = a_{s50} \times f \times D$

where:

- a_{s50} = the internal surface area of the soakaway to 50% effective depth: this excludes the base area which is assumed to clog with fine particles and become ineffective in the long-term;
- f = the soil infiltration rate determined in a trial pit at the site of the soakaway;
- D = the storm duration.

a_{s50} is calculated at $2 \times (52 + 7) \times (1.5 \div 2) = 88m^2$

Taking a storm duration of 120 minutes = 120 x 60 seconds = 7200 seconds.

The outflow will be $88 \times 5.86 \times 10^{-6} \times 7200 = 3.7\ m^3$ over 2 hours or $1.85\ m^3/hr$.

The effective storage volume with 95% free volume = $546m^3 \times 0.95 = 519m^3$

A high level emergency overflow from the soakaway is provided should this storage volume be exceeded, which in turn outfalls to the storm sewers.

Although the outflow from the soakaway will be slow, there is significant storage volume available to compensate for this, and in the event that this is exceeded, the overflow will be automatically engaged.

The time of emptying half of the storage volume

Check on time of emptying half storage volume, t_{s50}

$$t_{s50} = \frac{S \times 0.5}{a_{s50} \times f} = \frac{519 \times 0.5}{88 \times (5.86 \times 10^{-6})}$$

$$= t_{s50} = 140 \text{ hours}$$

This is a high value. However, the soakaway design demonstrates adequate storage for upto a 100 year+20% Climate change 7200 minute event, demonstrating a factor of safety of 5, which is adequate.

The inherent lack of permeability in the bedrock, means that the watertable will rise after storm events as a perched watertable develops. The basement will therefore need to be protected against ingress of water.

This suggests that there is a likelihood that the emergency overflow will need to be engaged only in a very extreme event.

5. Risks to proposed and existing infrastructure

The concentration of recharge into a soakaway area of $400m^2$ will create a recharge mound during particularly wet periods, which will slowly dissipate over time because of the low permeability value.

The water will dissipate laterally mainly through the granite sand in accordance with the shallow groundwater flow following a normal direction of drainage to the Northeast.

Reference to the geophysical survey suggests it is likely that the proposed basement will be excavated in competent rock based on the finished floor level of 78.66m O.D. The competent rock is effectively impermeable as previously discussed.

This means that the normal pathway of drainage to the Northeast will be impeded. Not only will outflow from the soakaway be impeded, the movement of groundwater from beneath the suds devices in this sub-catchment will also be impeded.

The configuration of the basement, does not allow for the provision of high permeability vertical corridors, although some water will enter the annulus between the basement wall and the rock cut. If this annulus is contiguous around the basement, some off-site flow will occur, and possibly re-connect with the natural ground pathway beyond the site. However a further mitigation measure is required.

It is proposed to include a horizontal array of relief drains as shown on drawing No. BPR-BMD-00-00-DR-C-1000 PL5 which will convey water from the annular space beside the basement directly beneath the basement into the annular space at the downgradient side of the basement.

The fan configuration of pipes will allow even dissipation of stormwater on the far side of the basement, and will allow re-connection with normal flow paths.

The system will be self-regulating controlled by the thickness and permeability of the natural subsoils.

Once re-connected to the natural flowpaths, there will be no down-gradient changes to normal seasonal variations in groundwater.

This means that down gradient conditions will be unchanged in both quantity and quality from the current situation and thus no impacts on property or the environment will arise, including to trees in nearby public parks. Although it could be argued that the site is hydraulically linked to the South Dublin Bay SAC 000210 and the South Dublin Bay and Tolka Estuary SPA 004024, there will be no impact attributable to the proposed developed, which therefore precludes the need for Appropriate Assessment or the need to implement mitigation measures to protect the SAC's

6. Conclusions

In our opinion the proposed use of a soakaway to manage stormwater for this proposed development is constrained by the low permeability characteristics of the bedrock, but the incorporation of an emergency overflow together with the use of suds devices to attenuate flow, and to accommodate rainfall from other areas of the sub-catchment will overcome the constraints.

The configuration of the proposed basement, would impede the dissipation pathway because it will cut off the natural flowpaths.

The provision of an array of drains under the basement to equalise groundwater levels, and to provide continuity of flowpaths, is considered to represent an appropriate design measure, which will create a neutral residual drainage impact from the proposed development.

As a result, no downstream impacts will result to infrastructure or environmental assets, including public amenities and European protected sites.