7 LAND AND SOILD

7.1 Introduction

This chapter has been prepared by John Considine, BE, MIStructE, MIEI, CEng, FConsEIM, Chartered Engineer of Barrett Mahony Consulting Engineers and Mr. Paul Stephenson, BE, MIEI, CEng, Chartered Engineer of Barrett Mahony Consulting Engineers.

This section of the EIAR assesses the impacts that the proposed development at Leopardstown Road, Dublin 18, may have on the Land and Soils (including land take) on the surrounding area during the construction and operational phases. This report also addresses earthworks proposed on site including any cut and fill works required.

7.2 Methodology

The methodology followed for this section is in accordance with the EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports (Draft) 2017, Advice Notes for Preparing Environmental Impact Statements (Draft) 2015 and 2018 DHPLG Guidelines on Environmental Impact Assessment for Planning Authorities and An Bord Pleanála. The following section outlines the legislation and guidelines considered, and the adopted methodology for preparing this chapter.

7.2.1 Guidelines

The following documents were reviewed in the preparation of this chapter:

- Guidelines for the Preparation of Soil, Geology and Hydrogeology Chapters of Environment Impact Statements (Institute of Geologists of Ireland (IGI) 2013);
- Draft Guidelines on the Information to be contained in Environmental Impact Assessments Reports (EPA 2017)
- Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report, European Commission, 2017
- Revised Guidelines on the Information to be contained in Environmental Impact Statements (EPA 2015a);
- Advice Notes for Preparing Environmental Impact Statements (EPA 2015b);

In order to identify the current ground conditions and to establish any potential impacts for the proposed development it is necessary to undertake a desk top review of the existing geological conditions for the subject lands.

7.2.2 Consultation

To establish same information from the following list of statutory bodies were consulted:

- Dún Laoghaire-Rathdown County Council.
- Geological Survey of Ireland.
- Ordnance Survey of Ireland.
- Environmental Protection Agency.
- Office of Public Works.

7.2.3 Desktop Study

The following sources of information were reviewed to evaluate the soils, geological & hydrogeological aspects of the site:

- Site investigation carried out in 2016 and 2020.

- Current & historical Ordnance Survey Maps (1829 – 1842,1837 – 1842 & 1888, 1913),
- Aerial photography (1995 & 2000),
- The Geology of Ireland, Ed. C. H. Holland, (Dunedin Academic Press, 2001),
- Geological maps of the site produced by the GSI,
- Quaternary Maps,
- Bedrock Mapping,
- Groundwater Vulnerability Mapping,
- Aquifer Yield Maps.
- Teagasc & Environmental Protection Agency *Soil Information system*,
- Historic Mines Sites, Inventory & Risk Classification, (EPA & GSI).
- Historic Ground Investigation.

7.2.4 Application of Methodology

The potential impact of the proposed scheme on soils and geology environment has been assessed by classifying the importance of the relevant attributes and quantifying the likely magnitude of any potential impact.

This impact assessment methodology takes on board the broad direction of the Guidelines for the Preparation of Soils, Geology & Hydrogeology Chapters of Environmental Impact Statements (IGI 2013).

7.2.5 Assessment Methodology

The potential impact i.e. significance of the effects of the proposed development is generally understood to mean the importance of the effects (the consequences of the change). Significance is determined by a combination of (objective) scientific and subjective (social) concerns. Effects are assessed on the following.

- Quality (i.e. positive, negative or neutral);
- Significance (imperceptible, slight, moderate, significant or profound);
- Duration (short term, medium term, long term, permanent or temporary);
- Extent and;
- Context.

In the collation of information to describe effects, reference has been made to the criteria set out in Table 3-4 Checklist for Information Required to Describe Effects as set out in the EPA document – Guidelines on the Information to be contained in Environmental Impact Assessment Report DRAFT, August 2017.

Assessment should also take consideration of secondary impacts e.g., deterioration of surface water quality in an area due to site clearance and soil run-off. Finally, cumulative impacts are also to be addressed/considered, i.e., the addition of many minor or significant effects, including those of neighbouring projects to create larger more significant effects.

This document outlines a thirteen-step methodology as per the Guidelines for the preparation of Soils, Geology and hydrogeology Chapters of Environmental Impact Statements, IGI 2013, which has four distinct elements as follows.

- Initial Assessment (Steps 1 – 5);
- Direct & Indirect Site Investigation and Studies (Steps 6 – 9);
- Mitigation Measures, Residual Impacts and Final Impacts Assessment (Steps 10 – 12); and
- Completion of Soils and Geological (Land & Soil) Sections of EIAR. (Step 13).

The initial assessment as outlined in section 7.3 describes the existing land and soil environment and presents a description of the past and present uses of the site and other neighbouring sites.

This section also describes the nature of the site based on both site specific and neighbouring site investigation data from publicly available sources where available.

Section 7.5 lists the predicted impacts associated with the development of the site. The magnitude of the potential impact is ranked in accordance with the IGI Guidelines and this allows the significance of the impact to be determined.

Cumulative impacts are assessed and described in section 7.6. The magnitude and significance of these residual impacts have also been classified in accordance with IGI Guidelines.

Following the assessment of the impacts, specific mitigation measures have been developed to avoid, reduce and if possible, remedy any negative impacts on the land and soils. These are described in section 7.9.

Interactions between the Land & Soils and other relevant chapters are described in 7.11.

7.2.6 Study Area

The soils & geology study area is confined to the client's lands for the submitted application, refer to the planning drawings. The subject lands cover an area of 2.58 hectares.

7.3 Existing Receiving Environment (Baseline Scenario)

The subject site is located on lands within the townland of St. Joseph's House, Leopardstown Road, Dublin 18. The site is bounded by 2 no. access roads. Silver Pines leading to the N31 Brewery Road to the northeast and the R113 Leopardstown Road to the South. The Silver Pines residential development is located to the north and west of the proposed development. The overall site area totals 2.59ha. Part of the site is currently occupied by St. Joseph's House for Adult Deaf and Deafblind and its grounds. Three domestic houses on the north-east and seven more on the south side make up the remainder of the site.

7.3.1 Topography

The site is currently made up of a combination of existing residential housing to the southeast with the existing St. Joseph's House, supplementary buildings and green space making up the remaining western and northern extents of the site. A detailed topographical survey of the existing site has been prepared; a summarised excerpt can be seen in Figure 0:1 below.

There is little variation in ground levels across the site. In broad terms the site generally slopes down from the higher western side of the site to the lower eastern boundary. The difference in ground levels is minimal, with the highest point of the site recorded at approximately +82.84, and the lowest point recorded at +80.66, a difference of 2.18m over a distance of 150m.

There is no significant risk of flooding affecting the proposed development site or flooding of the site drainage network impacting adjoining properties. Therefore, the development is deemed acceptable from a flood risk assessment perspective. This is dealt with in detail in the Barrett Mahony Flood Risk Assessment Report.

Figure 0:1 – Topographical Survey Extract

7.3.2 Topsoil

A site investigation was carried out in September 2016 by Ground Investigations Ireland and in July 2020 by IGSL Ltd, both are included in as included in Appendix 7.1 and 7.2 of this chapter. The site investigation consisted of trial pits, CBR plate test, infiltration testing and associated environmental laboratory testing.

Trial pits were excavated using a JCB excavator and the overburden across the site presents a high degree of consistency. The made ground extends from ground level down to a depth of 1.6m approx. This made ground predominantly overlies firm to stiff brown sandy gravelly silt / clay, which in turn overlies residual weathered granite.

Environmental testing was carried out on 10no. samples of soil/fill for detailed environmental analysis to RILTA Suite (WAC) parameters. Of the 10no. samples, 9no. recorded no elevated levels of contaminants found and the material can be classified as inert. In 1no. sample, elevated levels of Total Organic Carbon (TOC) and Loss on Ignition (LOI) were recorded.

While the above levels are unlikely to be high enough to warrant a "Hazardous" classification, consultation with the licensed landfill operators will be required with regard to their ability to accept the elevated TOC and LOI.

Table 0.1 – IGSL Trial Pit Record Extract

REF NO.	MADE GROUND (m)	GRAVELLY CLAY (m)	GRANITE SAND (m)	REFUSAL (m)
TP01	0 – 1.60	1.60 – 2.40	2.40	2.40
TP02	0 – 0.60	0.60 – 1.20	1.20 – 1.50	1.50
TP03	0 – 0.20	0.20 – 1.10	1.10 – 2.20	2.20 (w)
TP04	0 – 1.40		1.40 – 1.80	1.80
TP05	0 – 1.60	1.60 – 2.10	2.10	2.10
TP06	0 – 1.40	1.40 – 2.40	2.40 – 2.70	2.70

7.3.3 Bedrock Geology

As discovered during the site investigation works and can be seen in Figure 0:2, the site is predominantly underlain by Granite formed during the Devonian period, which is a geological period spanning 60 million years from 420 to 360 million years ago. This is a strong dense igneous rock which underlies the Dublin / Wicklow mountains and surrounding areas.

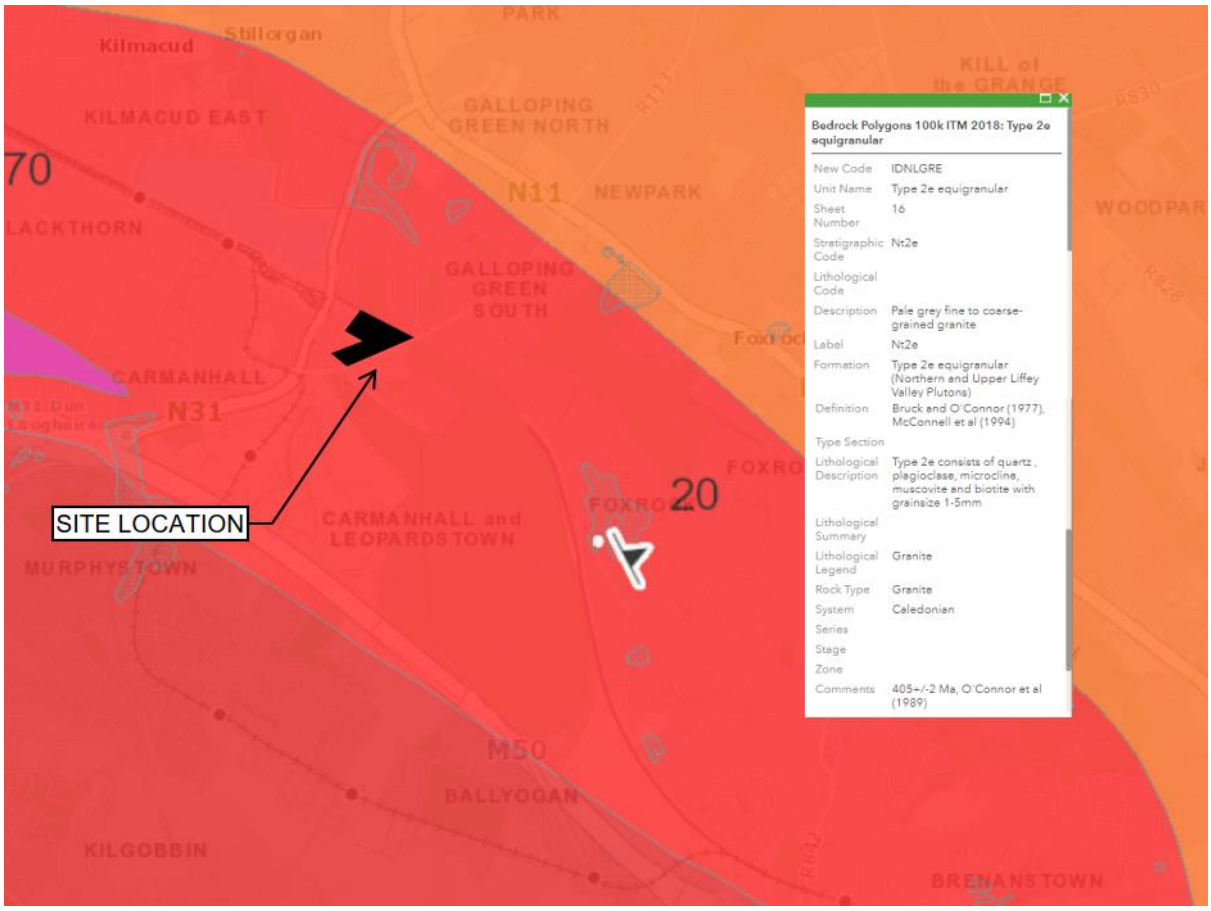

Figure 0:2 – Bedrock Geology (Geological Survey Ireland Extract

7.3.4 Quaternary & Soil

The quaternary period is the most recent stage of the geological time period. It marks the period of the Ice Age and the postglacial period which extends to the present day. Most surface deposits were deposited in the Quaternary Period and provide the parent materials for the soils in the area.

Most sediments of the Quaternary period were deposited during the Ice Age itself either directly from the huge ice sheets or by meltwater from the sheets as they melted. Ice sheets would have slowly eroded the underlying bedrock producing sediment. This sediment may include particles of all sizes ranging from clay to boulders and which when spread over the surface by glacial ice, takes the form

of till (boulder clay). Alternatively, sediment may be carried and sorted by meltwater and deposited as sand and gravel, with silt and clay deposited separately in lake systems or carried away to the sea. Glacial deposits therefore contain fragments of the type of bedrock over which the ice originally passed.

Per Figure 0:3, the site location is situated above Till derived from Limestones, which is a common occurrence in Ireland and particularly in Leinster.

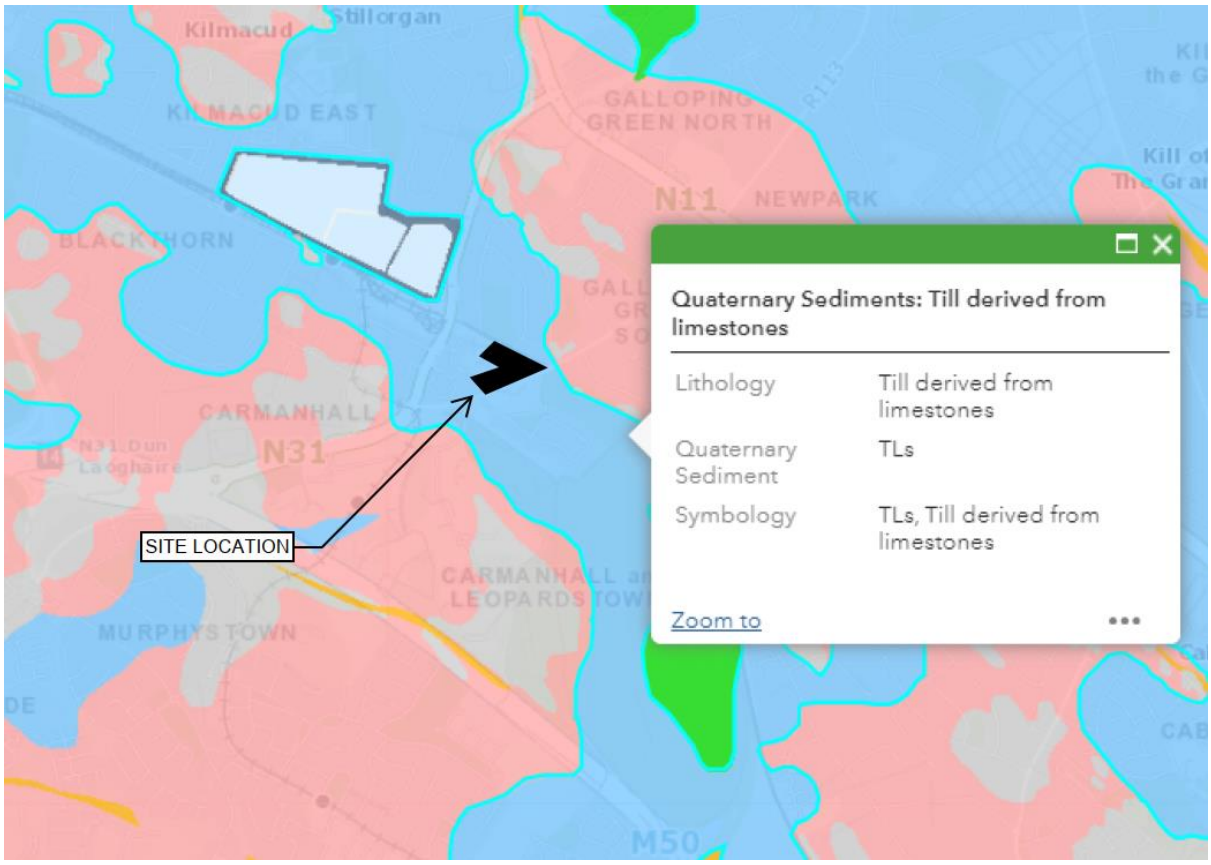

Figure 0:3 - Quaternary Soil Deposit (Geological Survey Ireland Extract)

7.3.5 Hydrogeological aspects

Groundwater can be defined as water that is stored in, or moves through, pores and cracks in sub soils. Aquifers are rocks or deposits that contain sufficient void spaces, and which are permeable enough to allow water to flow through them in significant quantities. The potential of the rock to store and transport water is governed by permeability, of which there are two types, intergranular and fissure permeability. Intergranular permeability is found in sediments, sands, gravels and clays. Fissure permeability is found in bedrock, where water moves through (and is stored in) cracks, fissures, planes and solution openings.

When considering groundwater, it is important to consider the underlying geology, its complexity including faults, the large amounts of water and rainfall available for recharge and the overlying Quaternary deposits. The bedrock geology of this area is defined as the Maulin formation, part of the Wicklow/Dublin granite massif. The bedrock mapping for the area as defined in the GSI is included as above.

The Geological Survey of Ireland has devised a system for classifying the aquifers in Ireland based on the hydrogeological characteristics, size and productivity of the groundwater resource. The three main classifications are Regionally Important Aquifers, Locally Important Aquifers and Poor Aquifers.

In Figure 0:4 – Groundwater Aquifer Figure 0:4 the site area is classified by the GSI as a Poor Aquifer. A Poor Aquifer has poorly connect fractures, fissures and joints, with low permeability. The overall

storage capacity, recharge acceptance, length of flow path and baseflow are the lowest of all the aquifers. Rainwater falling on parts of the site will be drained into the groundwater system via soakaways/permeable paving on site. Ground water on the site naturally drains towards the sea, approx. 2km east of the site.

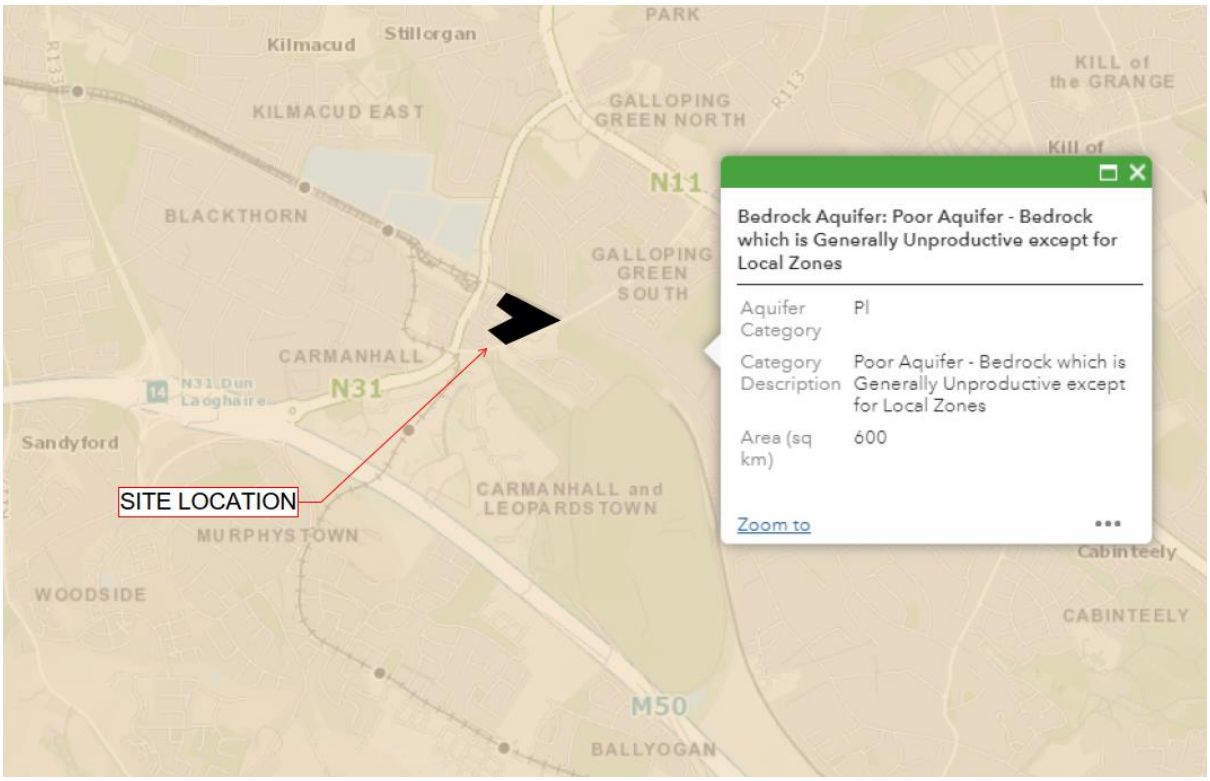

Figure 0:4 – Groundwater Aquifer

7.3.5.1 Groundwater Vulnerability

Aquifer or groundwater vulnerability is a relative measure of the ease with which the groundwater could be contaminated by human activity and depends on the aquifer's intrinsic geological and hydrogeological characteristics. The vulnerability is determined by the permeability of any overlying deposits. For example, bedrock with a thick, low permeability, clay-rich overburden is less vulnerable than bedrock with a thin, high permeability, gravelly overburden. Groundwater vulnerability categories are defined by the GSI as:

- X - Extreme rock at or near surface or karst
- E - Extreme
- H - High
- M - Moderate
- L – Low

Table 0.2 – Aquifer Vulnerability Criteria (DELG/EPA/GSI, 1999)

These categories are used for mapping purposes and in the assessment of risk to ground waters. The

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High Permeability (sand/gravel)	Moderate Permeability (e.g. sandy subsoil)	Low Permeability (e.g. Clayey subsoil, clay, peat)	(Sand/gravel aquifers only)	(<30 m radius)
Extreme (E)	0 – 3.0 m	0 – 3.0 m	0 – 3.0 m	0 – 3.0 m	-
High (H)	>3.0 m	3.0 - 10.0 m	3.0 – 5.0 m	>3.0 m	N/A
Moderate M)	N/A	> 10.0 m	5.0 – 10.0 m	N/A	N/A
Low (L)	N/A	N/A	>10.0 m	N/A	N/A
Notes: (1) N/A = not applicable (2) Precise permeability values cannot be given at present (3) Release point of contaminants is assumed to be 1-2 m below ground surface					

classifications are based on the thickness and permeability of the sub-soils overlying the aquifer. The GSI has classified the aquifer vulnerability underlying the site into "H" (high) which infers bedrock is present within 3 to 10m of the surface below moderately permeable till. Groundwater was noted in TP03 at a depth of 2.7m, and rock was not encountered at refusal depths of 1.5m to 2.7m below ground in the other trial pits. Rotary coreholes identified the rock depth in the northern part of the site found Granite rock at 2.1 to 2.7m below ground level. Boreholes in the southern half have not yet been completed.

Where ground conditions are suitable, sustainable drainage systems (SuDS) can be used to manage and promote soakaway applications, which allow surface water to infiltrate into the ground, replenishing natural water courses and aquifers. The infiltration rate on this site has been tested in the site investigation with soakaway tests in accordance with BRE365 guidance. An infiltration rate of $5.68x10^{-6}$m/s was obtained in a soakaway test at a depth of 2.25m.

Although seepage was noted at 2.2mBGL in the soakaway pit, IGSL have confirmed that this a localised perched flow, and not the groundwater table. They allowed the pit to stand for 30 minutes prior to filling, and the flow quickly dissipated, leaving the bottom of the hole dry.

This infiltration process also helps to maintain the groundwater recharge which would otherwise be reduced by the development. It prevents shallow soils from drying out, and thereby protects local biodiversity and amenity.

The drainage proposals for the eastern part of the site aim to provide aquifer recharge by discharging surface water collected into a soakaway into ground. A significant portion of the whole site is either green space, permeable paving or compacted gravel which will also recharge the ground. Given the residential use the pollution index of the collected surface water discharging to the ground is "low" or "very low" as per the Ciria SuDS Manual. The SuDS interception features as well as the depth of soil and weathered rock through which the water will flow through before reaching the rock aquifer, will provide adequate natural filtration in accordance with the best practice guidelines of Sustainable Drainage Systems (SuDS), to ensure no suspended solids reach the aquifer below. Therefore, the aquifer will not be affected by the proposed new site in terms of water quality or water quantity. It is acknowledged that a slightly concentrated recharge flow will occur; however, this will not have an impact on the groundwater table due to the permeable overburden and surrounding topography.

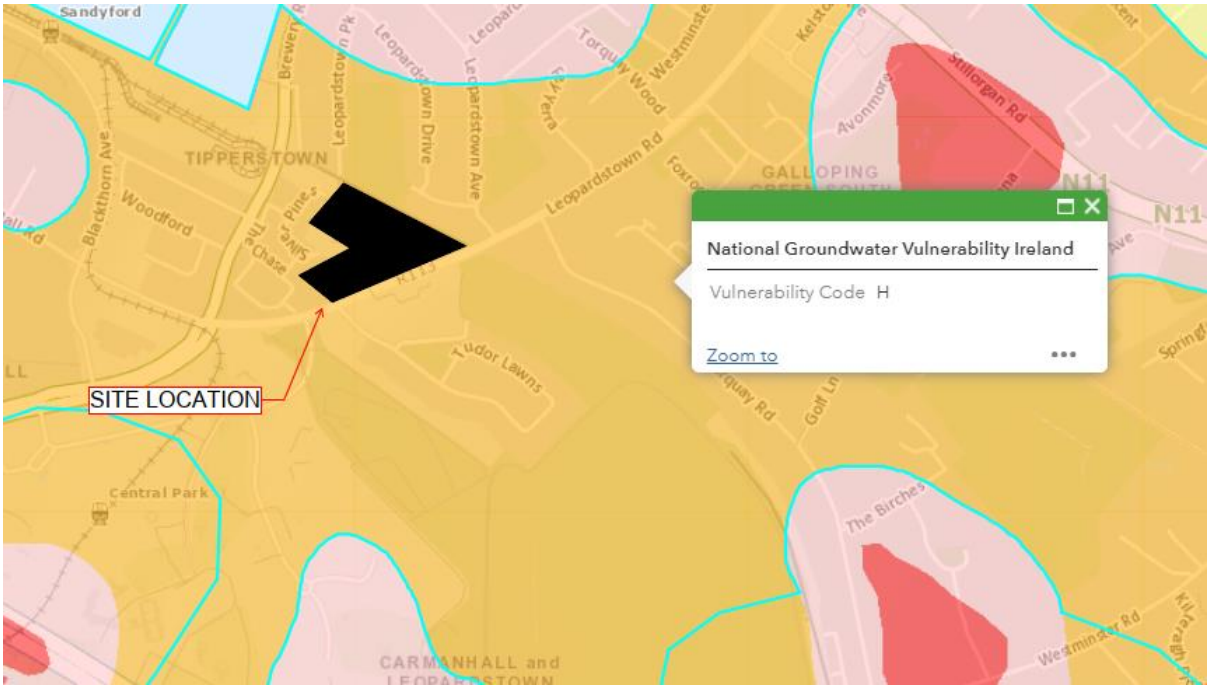

Figure 0:5 – Groundwater Vulnerability

7.3.5.2 Local groundwater usage and source protection area:

The GSI online map identified no domestic wells within the region of the site, or any other source protection requirements.

7.3.6 Recharge:

Effective rainfall is the amount of rainfall available as either recharge to ground or run-off to surface water after evaporation taken up by plants and is 83mm/yr. The recharge coefficient, which is the proportion of effective rainfall to recharge groundwater, is estimated at 20% on the site, indicative of the very low permeability poor aquifer classification of the underlying bedrock (as distinct from the moderate permeability of the overburden into which the soakaway will discharge). Recharge is the amount of rainfall that replenishes the aquifer, it is a function of the effective rainfall, the permeability and thickness of the subsoil and the aquifer characteristics.

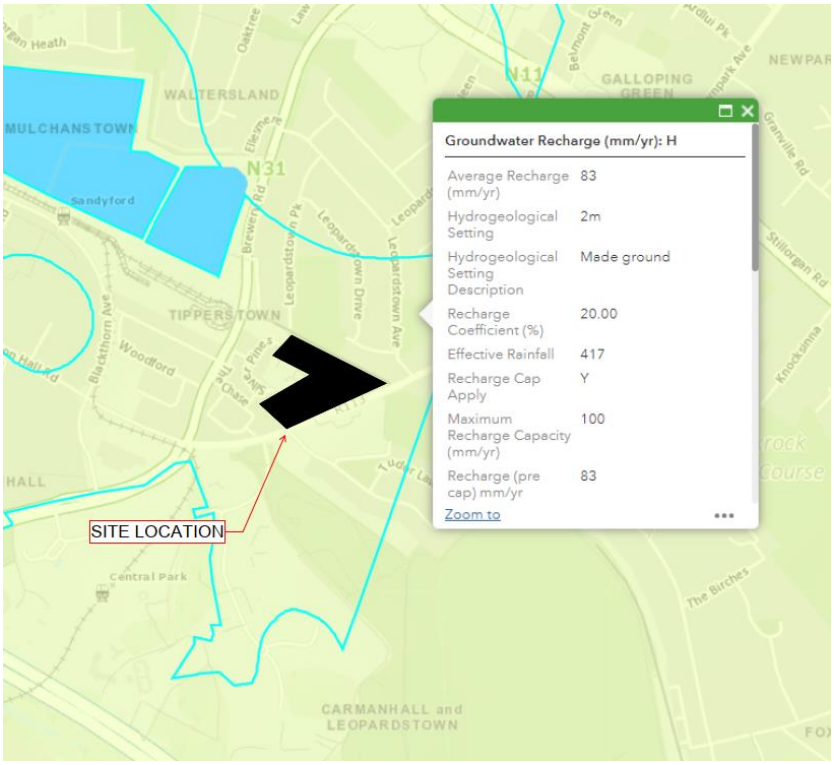

Figure 0:6 – Extract from GSI Groundwater Recharge Map

7.3.7 Site Hydrogeology:

The soakaway proposed is on the upslope side of the basement and due to concerns relating to the discharge of surface water into this area, and the potential restriction of the natural flow path caused by the new basement, a third-party Hydrogeological review was commissioned. This was carried out by IE Consulting, and resulted in the following outcome:

- The primary groundwater flow is in the granular weathered layer overlying the granite bedrock.
- Due to potential for the basement to be founded in rock, the groundwater flow may be cut off, and so an alternative solution should be provided to maintain the flow path.
- Drainage trenches outside the basement walls, connected by a network of pipes crossing under the basement was used to facilitate the natural flow.

IE Consulting have reviewed this proposal as well as the soakaway design and have approved it's suitability on the basis of maintaining the existing groundwater regime.

7.3.7.1 Groundwater Quality:

Under the requirements of the Water Framework Directive, the groundwater body was classified as having an overall good status for water quality and quantity 2013 - 2018. Please refer to Figure 0:6, EPA map extract below.

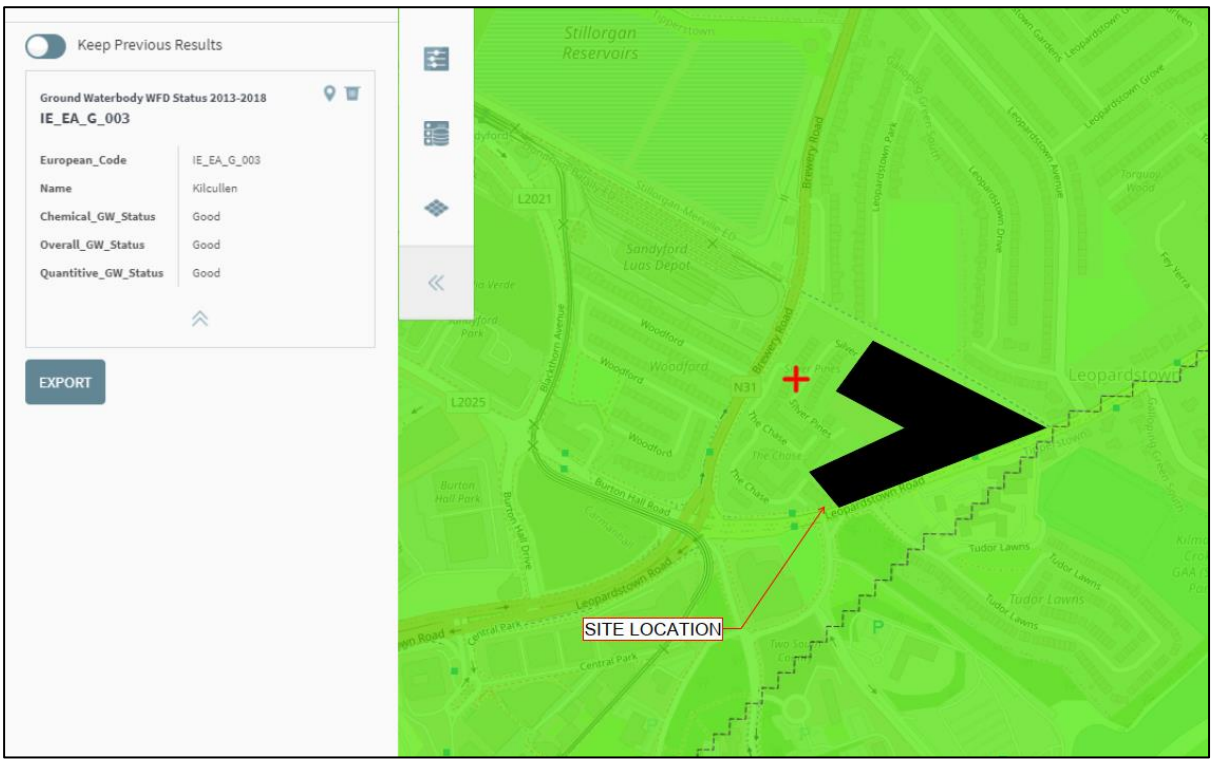

Figure 0:7 – EPA Map Extract

7.3.7.2 Groundwater Flood Risk:

Groundwater flooding can occur during lengthy periods of heavy rainfall, typically during later winter/early spring when the groundwater table is already high. A detailed flood risk assessment has been carried out in accordance with OPW guidelines and is submitted as part of this planning application. This document has found that "*there is no significant risk of flooding affecting the proposed development site or flooding of the site drainage network impacting adjoining properties. Therefore, the development is deemed acceptable from a flood risk assessment perspective*".

7.3.8 Contaminated land

The National Waste Collection Office (NWCPO) issue waste collection permits for all waste management regions in Ireland. According to EPA Mapping there are no waste licensed IPC facilities on the proposed site.

7.4 Characteristics of the Proposed Development

Chapter 3 provides a full description of the proposed development. In addition, the Construction and Environmental Management Plan (CEMP) describes the construction strategy. In summary the development will consist of a new residential and mixed use scheme to include apartments, residential amenity space, a café and a childcare facility. A detailed description is now set out as follows:

The proposal provides for the demolition of 10 no. properties and associated outbuildings at 'Madona House' (single storey), 'Woodleigh' (2 storeys), 'Cloonagh' (2 storeys), 'Souk El Raab (2 storeys), 'Wellbrook' (2 storeys), 'Calador' (2 storeys), 'Alhambra' (2 storeys), 'Dalwhinnie' (2 storeys), 'Annaghkeen' (1-2 storeys) and 'The Crossing' (single storey) (combined demolition approx. 2,291.3 sq m GFA).

The new development will provide for (a) the refurbishment, separation and material change of use of Saint Joseph's House (a Protected Structure, RPS No. 1548) from residential care facility to residential use and a childcare facility; and (b) the construction of a new build element to provide for an overall total of 463 no. residential units, residential amenity space and a café.

The overall development proposal shall provide for the following:

- Block A (5 storeys) comprising 49 no. apartments (13 no. 1 bed units, 33 no. 2 bed units and 3 no. 3 bed units);
- Block B (4 - 7 storeys) comprising 88 no. apartments (28 no. 1 bed units, 57 no. 2 bed units and 3 no. 3 bed units);
- Block C (5 - 7 storeys) comprising 115 no. apartments (26 no. studio units, 26 no. 1 bed units and 57 no. 2 bed units and 6 no. 3 bed units);
- Block D (5 - 10 storeys) comprising 157 no. apartments (36 no. studio unit, 40 no. 1 bed units and 81 no. 2 bed units), residential amenity areas of approx. 636 sq m and a café of approx. 49 sq m;
- Block E (Saint Joseph's House) (2 storeys) comprising 9 no. apartments (8 no. 2 bed units and 1 no. 3 bed units) and a childcare facility of 282 sq m with associated outdoor play areas of approx. 130 sq m;
- Block F (3 - 6 storeys) comprising 45 no. apartments (23 no. studio units, 10 no. 1 bed units; and 12 no. 2 bed units);

Each new build residential unit (in Blocks A, B, C, D and F) has an associated area of private open space in the form of a terrace/balcony. Open Space proposals for Saint Joseph's House (Block E) include a mixture of private terrace/balcony areas and communal open space areas.

The extent of works proposed to Saint Joseph's House (a Protected Structure) include:

- The demolition of a single storey office, conservatory, glazed link, external store, external enclosed escape stairs with associated canopies, toilet extension and 3 no. associated outbuildings to the west of Saint Joseph's House (demolition total approx. 173.4 sq m GFA);
- The removal of external steel gates, all external steel escape stairs, canopies, existing disabled access ramps, concrete steps, an external wall and associated roof area;
- Relocation of external granite steps and the provision of a new raised entrance terrace, concrete steps and ramp areas;
- Replacement of existing rooflights, the addition of roof lights, part new roof / new zinc roof, new external wall and roof to the east of the structure;
- The provision of new door and window openings;
- Modifications to internal layout including the removal of walls and partitions and the addition of new dividing walls.

The Residential Amenity Areas of approx. 636 sq m proposed in Block D comprise a residential club house/multi purpose room, library/reading room, lounge area, concierge area, office area, post room, fitness club, all at ground floor level of Block D. A terrace lounge area is proposed at fifth floor level of Block D. 2 no. roof garden areas are also proposed at fifth floor level of Blocks C and D (approx. 400 sq m and 408 sq m respectively).

Open Space (approx. 9,885 sq m) is proposed in the form of (a) public open space areas (approx. 6,680 sq m) which include a public plaza/court area, a main area of public open space (including a play area and outdoor gym area) and woodland trail; and (b) all communal open space areas (approx. 3,205 sq m) which include areas adjacent to Saint Joseph's House (Block E), Block D and Block F, a courtyard and play area located between Blocks A and B and roof terraces at fifth floor level of Blocks C and D. Visual amenity open space areas (approx. 1,000 sq m) are also proposed at various locations throughout the development.

Basement Level (approx. 9,445 sq m) is proposed with residential access from Blocks A, B, C, D and F. Bin storage areas, water storage areas, and part attenuation are located at this level. 2 no. ESB Substations, 1 no. ESB Kiosk, 2 no. Switch Rooms, waste storage areas for Block E (Saint Joseph's House) and bicycle storage areas are proposed at surface level.

A total of 259 no. car parking spaces (232 no. at basement level and 27 no. at surface level) are proposed. At basement level, a total of 30 no. electric vehicles and 202 no. standard parking spaces are provided for. A total of 968 no. bicycle spaces (816 no. at basement level and 152 no. at surface level), dedicated cycle lift and 10 no. motorcycle spaces (all at basement level) are also proposed.

Proposals for vehicular access comprise 1 no. existing vehicular access point via Silver Pines (an existing all movement junction onto Brewery Road) and 1 no. new vehicular access point at the general location of 'Annaghkeen' at Leopardstown Road (a new Left In / Left Out junction arrangement). The new access point along Leopardstown Road will replace 9 no. existing access

points at 'Woodleigh', 'Cloonagh', 'Souk El Raab', 'Wellbrook', 'Calador', 'Alhambra', 'Dalwhinnie', 'Annaghkeen' and 'The Crossing'. The internal permeability proposed will provide linkages for pedestrians and cyclists to Leopardstown Road and adjoining Greenway. Proposals also provide for the relocation of an existing bus stop along Leopardstown Road.

The associated site and infrastructural works include provision for water services; foul and surface water drainage and connections; waste water pumping station; attenuation proposals; permeable paving; all landscaping works including tree protection, tree removal and new tree planting; green roofs; boundary treatment; internal roads and footpaths; and electrical services.

7.5 Potential Impact of the Proposed Development

7.5.1 Construction Stage

To facilitate the proposed development land take will be required that will change the existing use of the site from the existing combination of greenfield and residential, to predominantly residential. The existing top soil will be stripped and sub-soil will be removed to facilitate the construction of the development.

Should material be required to be removed from the subject site it will be done so in accordance with current legislation.

As part of the proposed apartment buildings, a large underground basement will be constructed and as such a large volume of material will need to be excavated. Refer to Table 0.3 for further details.

Care will be required for the environmental management of the site to ensure that no potential contamination issues are experienced which may impact on the overall groundwater quality.

Potential impacts of the proposed development during the construction are:

- Approximately 5,250m³ (approximately 0.3m depth across the site) of topsoil shall be excavated from the existing ground level in order to form a building platform for the new buildings and associated roads infrastructure. This will result in the exposure of the subsoil to various elements including weather and construction traffic. Therefore, the impact may be characterised as a likely, short term, slight, adverse impact on the natural strength of the subsoil and subsequently resulting in deeper foundations being required.
- Approximately 22,312m³ (based on the formation depth of the proposed basement and estimated rock head level. Approximately 3.5m depth of existing subsoil, weathered rock and solid rock across the basement area) shall be excavated from the existing site in order to facilitate the construction of the new proposed basement soakaways and attenuation tanks. This will result in the exposure of the bedrock geology to various elements including weather and construction traffic. Therefore, the impact may be characterised as a likely, short term, moderate, adverse impact on the existing bedrock.
- Rutting and deterioration of the topsoil layer and any exposed subsoil layers or bedrock by earthworks plant and construction traffic. As such, the impact may be characterised as likely, short term, moderate, adverse impact on subsoil, the consequence of which will be erosion and generation of sediment laden runoff.
- Earthworks are required in the open space areas to accommodate underground surface water soakaway systems and other SuDS features. This landscaping activity will likely have a moderate, positive, permanent, impact on the soil and ground profile. Earthworks to road infrastructure is also required due to the existing steep topography of the site for access.
- During the construction period, large machinery and associated fuel and fuel storage will be present on site. As a result, accidental spills and leaks (e.g. storage of oils and fuels on site), use of cement and concrete during construction works are inevitable during the construction phase. Therefore, the unlikely impact may be characterised as a likely, short term, moderate, slight impact on subsoil and ground water.

- Approximately 2,700m³ of fill (generally comprising normal stone used in the construction of roads, footpaths and buildings) will be required across the development. Therefore, the likely impact may be characterised as, permanent, slight impact on subsoil and ground water.

7.5.1.1 Stripping of Topsoil

Removal of the existing topsoil layer will be required across the site. Stripping of topsoil will result in exposure of the underlying subsoil layers to the effects of weather and construction traffic and may result in subsoil erosion and generation of sediment laden runoff.

7.5.1.2 Excavation

Excavation of existing subsoil layers will be required to allow road construction, basement construction, foundation excavation, drainage and utility installation and provision of surface water attenuation facilities.

Where feasible, excavated material will be reused as part of the site development works (e.g. use as fill material beneath roads) however, unsuitable excavated subsoil is expected and will have to be removed to an approved landfill.

Table 0.3 – Excavation amounts

Item	Topsoil (m^3)	Soil (m^3)
Site Strip	5,250	-
Subsoil (& Weathered Rock)	-	22,312
Rock	-	7,070

7.5.1.3 Construction Traffic

Earthwork's plant (e.g. dump trucks) and vehicles delivering construction materials to and from the site (e.g. road aggregates, concrete deliveries etc.) have potential to cause rutting and deterioration of the topsoil layer and any exposed subsoil layers, resulting in erosion and generation of sediment laden runoff. This issue can be particularly noticeable at site access points (resulting in deposition of mud and soil on the surrounding road network). Dust generation can also occur during extended dry weather periods as a result of construction traffic.

7.5.1.4 Accidental Spills and Leaks

During the construction phase there is a risk of accidental pollution from the sources noted below. Accidental spills and leaks may result in contamination of the soils underlying the site.

- Storage of oils and fuels on site.
- Oils and fuels leaking from construction machinery.
- Spillage during refuelling and maintenance of construction machinery.

7.5.1.5 Geological Environment

It is not envisaged that the excavations will have any discernible impact on the geological environment. When bedrock is encountered it will be crushed, screened and tested for use within the designed works.

7.5.2 Operational Stage

Once the development is completed the operational impacts on the land and soils would be minimal. The biggest risk item is cross contamination of ground water from the operational phase of the development from accidental oil spillages. Refer to the mitigation section below for proposed remedial issues.

7.6 Potential Cumulative Impacts

Cumulative phase looks at the increased overall implications the proposed development may have on the environment in cumulation with existing and permitted development in the area. The primary potential cumulative operational impact considered is the local increase in hard standing and subsequent decrease in local groundwater recharge. In the case the discharge to the public surface water sewer is kept at the greenfield runoff rate, which prevents any cumulative impact on the downstream watercourse environment. For more detail see the Civil Engineering Infrastructure Report and Flood Risk Assessment Report by Barrett Mahony Consulting Engineers included as part of this planning application.

Cumulative impacts, if any, will be limited to the construction stage and will, therefore, be temporary to short-term in duration. Appendix 2.1, submitted as part of this application, has highlighted 25no. applications in the local area. Per the map below (Figure 0:8) there are several permitted and proposed planning applications within 1km that may have a cumulative effect on the Land and Soils, when combined with the proposed development. These developments are shown in Table 0.4:

Figure 0:8 – Planning Applications within 1km of the site.

Table 0.4 – Sites with Potential for Cumulative Effects on Land & Soils

No.	Planning Reference	Brief Summary*	Cumulative Effect	Justification
2	D19A/0972 & ABP 3007574/20	Demolition of existing structures and construction of several 3-storey residential buildings	Negative, imperceptible, short term	The site is located +300m away from the proposed site and involves minimal groundworks.
3	D21A/0294	Demolition of existing structures and construction of several 3-storey residential buildings	Negative, imperceptible, short term	The site is located +375m away from the proposed site and involves minimal groundworks.
15	D17A/1060 & ABP 301661-18	Demolition of existing structures and construction of 3no. commercial buildings ranging from 5-6 storeys with basement car parking	Negative, imperceptible, short term	The site is located +250m from the subject site. There are several primary roads and existing structures between the two sites and any combined effect on the Land & Soils is unlikely to occur.
16, 17, 19, 20, 21	D15A/0695, D17A/0944, D18A/1240, D20A/0422, D21A/0465	Demolition of existing structures and construction of 3 5-storey office buildings ranging from 5 storeys with basement car parking	No effect	The site is located +225m away from the proposed site. The building has been constructed and therefore any risks to Land & Soils are limited.
18	D18A/0707	Demolition of existing structures and construction of 3no. 5-storey office buildings ranging from 5 storeys with basement car parking	No effect	The site is located +300m away from the proposed site. The below ground building elements have been constructed and therefore any risks to Land & Soils are limited.
22, 23, 24, 25	D19A/0298, D19A/0328, D15A/0464, D15A/0350	Installation of PV Panels, 3m high storage sheds and 1no. storey extension	No effect	The site is located +75m away from the proposed site. The construction work is minimal and any risks to Land & Soils are limited.

*For full description please refer to appendix 2.1

As long as mitigation measures for the developments are carried out as permitted, there will be no significant cumulative impacts on the land, geological and hydrogeological environment. Should any future developments be under construction or planned in the vicinity of the site, potential cumulative impacts are not anticipated once similar mitigation measures are implemented.

7.7 Do Nothing Scenario

In the absence of the proposed development being constructed, the permitted development (D17A/0337/PL06D.249248) would likely be implemented. The seven large, detached houses on large plots fronting Leopardstown Road (i.e. the part of the site added subsequent to the granting of the above permission) would remain in use as individual dwellings. The impact in this instance from a land and soils perspective would be to limit the basement excavation, groundwater recharge, and other implications presented above to the footprint of St Josephs House, Block A, Block B, and surrounds.

7.8 Risks to Human Health

A potential risk to human health due to the associated works during construction is the direct contact, ingestion or inhalation of receptors (i.e. construction workers) with any soils which may potentially contain low level hydrocarbon concentrations from Site activities (potential minor leaks, oils and paint).

No human health risks associated with long term exposure to contaminants (via. direct contact ingestion or inhalation) resulting from the proposed development are anticipated.

7.9 Mitigation Measures

7.9.1 Construction Stage

A Construction and Environmental Management Plan (CEMP) is included in the planning application material. This report will be developed by the Contractor and will be submitted to the local authority prior to commencement on site.

In order to reduce the impacts on the soils, geology and hydrogeological environment a number of mitigation measures will be adopted as part of the construction works on site, as set out in the CEMP. The measures will address the main activities of potential impact which include:

- Control of soil excavation and export from site.
- Sources of fill and aggregates for the project.
- Fuel and Chemical handling, transport, and storage; and
- Control of Water during Construction.

The Construction and Environmental Management Plan (CEMP) sets out how the construction of the project will be managed in a safe and organised manner by the Contractor. The CEMP sets out requirements and standards which must be met during the construction stage and includes the relevant mitigation measures outlined in the EIAR and any subsequent conditions relevant to the project.

Care will be required for the environmental management of the site to ensure that no potential contamination issues are experienced which may impact on the overall groundwater quality.

Potential issues can be mitigated against by ensuring that CEMP is adhered to prevent accidental onsite oil spillages and the regular maintenance of onsite plant to eliminate potential risks.

Soil stripping, earthworks and stockpiling of soil will be carried out during the works. Stockpiles have the potential to cause negative impacts on air and water quality. The effects of soil stripping and stockpiling will be mitigated through the implementation of an appropriate earthworks handling protocol during construction as set out in the CEMP Report. It is anticipated that any stockpiles will be formed within the boundary of the excavation and there will be no direct link or pathway from this area to any surface water body. It is anticipated that only local/low level of stockpiling will occur as the bulk of the material will be excavated either straight into trucks for transport off site or will be reused in other areas of the site as fill.

Dust suppression measures (e.g. damping down during dry periods), vehicle wheel washes, road sweeping, and general housekeeping will ensure that the surrounding environment is free of nuisance dust and dirt on roads as set out in the CEMP report.

The following mitigation measures as set out in the CEMP Report will be taken at the construction site in order to prevent any spillages to ground of fuels and prevent any resulting soil and/or groundwater quality impacts:

- Designation of bunded refuelling areas on the site (if required).
- Provision of spill kit facilities across the site.
- Where mobile fuel bowsers are used the following measures will be taken.
- Any flexible pipe, pump, tap or valve will be fitted with a lock and will be secured when not in use.
- All bowsers to carry a spill kit and operatives must have spill response training; and
- Portable generators or similar fuel containing equipment will be placed on suitable drip trays.

In the case of drummed fuel or other potentially polluting substances which may be used during construction the following measures will be adopted:

- Secure storage of all containers that contain potential polluting substances in a dedicated internally bunded chemical storage cabinet unit or inside concrete bunded areas;

- Clear labelling of containers so that appropriate remedial measures can be taken in the event of a spillage;
- All drums to be quality approved and manufactured to a recognised standard;
- If drums are to be moved around the site, they should be done so secured and on spill pallets; and
- Drums to be loaded and unloaded by competent and trained personnel using appropriate equipment.

7.9.2 Operational Stage

During the operational phase of the proposed development there is limited potential for site activities to impact on the geological environment of the area.

Following best practice, as noted above, the potential for the ground water to become polluted via oil spills will be reduced as far as is practical using an oil separator to take run off from carparking areas and passing through same prior to disposal.

7.10 Monitoring

7.10.1 Construction Stage

Proposed monitoring by the contractor during the construction phase in relation to the soil and geological environment are as follows:

- Adherence to the "*Construction & Environmental Management Plan (CEMP)*". The developer will be responsible for ensuring adherence with this report. If construction works are not in accordance with the plan, then the developer will ensure that this is remedied.
- Construction monitoring of the works (e.g. inspection of existing ground conditions on completion of cut to road sub-formation level in advance of placing capping material, stability of excavations etc.).
- Inspection of fuel / oil storage areas. If these are found to be sub-standard then the developer will ensure that they are made fit for purpose.
- Monitoring cleanliness of adjacent road network, implementation of dust suppression and provision of vehicle wheel wash facilities. If these measures are found to be inadequate and the adjacent road network is negatively impacted, the developer will ensure that this is remedied and will ensure that dust suppression measures are implemented more regularly and all vehicles exiting the site use vehicle wheel wash facilities provided.
- Monitoring of contractor's stockpile management (e.g. protection of excavated material to be reused as fill; protection of soils from contamination for removal from site).
- Monitoring sediment control measures (sediment retention ponds, surface water inlet protection etc.). The developer is responsible for ensuring that these measures are fit for purpose. If they are found to be inadequate, then the development will ensure that they are made good and fully utilised.
- Soil removed during the construction phase will be monitored to maximise potential for re-use on site.
- The quantities of topsoil, subsoil and rock removed off site will be recorded.
- Appropriate signage shall be erected on all access roads in the vicinity of the site to inform HGV drivers that engines shall not be left idling for prolonged periods and that the use of horns shall be banned at all times.

7.10.2 Operational Stage

Proposed monitoring during the operational phase in relation to the water and hydrogeological environment are as follows:

- A management company on site will ensure the system is regularly inspected and maintained. Areas of the site with significant SuDS features will remain in the charge of this company.
- The performance of all SuDS features will be monitored by the management company during the life of the development.

- Monitoring of the installed gullies will be required to prevent contamination and increased runoff from the site.

7.11 Reinstatement

As part of the project there will be several open space green areas provided for residents and visitors. Please refer to the landscape drawings submitted as part of this application for further details.

7.12 Interactions

There are interactions between land and soils, water and material assets and built assets (traffic).

There are interactions between land and soils and water, with changes in depth and type of overburden impacting the protection provided to aquifers. The likely impact will be neutral, permanent and slight.

There are interactions between land and soils and water, with some surface water conveyed and stored in SuDS features such as soakaways and discharging to the ground where possible, replicating the existing greenfield site drainage as closely as possible. The likely impact will be permanent, slight and neutral.

There are interactions between lands and soils and material assets, with the construction of drainage, utilities and rock excavation for basement impacting the quantity of soil and subsoil as these materials will be removed to facilitate construction. The likely impact will be permanent slight, permanent and negative.

There are interactions between lands and soils and material assets, with the delivery of stone fill under buildings and roads and footpaths resulting in additional construction vehicles on roads adjacent to the site. The likely impact will be negative, temporary and slight.

7.13 Difficulties Encountered

No difficulties were encountered while developing this report.

Appendix 7.1 – Site Investigations

Appendix 7.2 – Ground Investigations Report

Appendix 7.3 – Soil Infiltration Test