

7 Land and Soils

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7.1 Introduction

This chapter of the EIAR has been prepared by DBFL Consulting Engineers.

This chapter of the EIAR comprises an assessment of the likely impact of the proposed development on soils and the geological environment as well as identifying proposed mitigation measures to minimize any impacts.

In summary, the project comprises the development of *452 apartments, 10 houses, 6 bungalows, a café / restaurant, office space, concierge and central residential amenity space on a 2.14 Ha site (approx.)*.

The development shall be served via the existing vehicular access point from Old Bray Road. Associated site and infrastructure works include provision of surface water drainage, foul drainage and water supply connections.

7.2 Study Methodology

Assessment of the likely impact of the proposed development on soils and the geological environment included the following activities:

- Review of Awn's Environmental Due Diligence Report (Appendix 7.1)
- Review of GII's Ground Investigations Report (Appendix 7.2)
- Review of DBFL's Environmental Assessment – Executive Summary (Appendix 7.3)
- Review of GII's Environmental Report (Appendix 7.4)
- Review of information available on the Geological Survey of Ireland (GSI) online mapping service (Quaternary Sediments Map, Bedrock Geology Map and Groundwater Vulnerability Map)

An Environmental Due Diligence report to assess the soil quality beneath the site was carried out by Awn Consulting Limited (AWN) between 9th – 13th March 2018 and included the following scope of works:

- 17 No. Trial Pits
- 4 No. Pilot Holes
- Gas Sampling
- Soil Sample Collection

Refer to Appendix 7.1 Environmental Report (AWN, Issue Date September 2018, TH/18/10021WR02).

Ground Investigations were carried out by Ground Investigations Ireland between February and March 2019 and included the following scope of work:

- 16 No. Trial Pits
- 2 No. Foundation Pits
- 3 No. Infiltration Tests
- 13 No. Window Sample Boreholes
- 12 No. Dynamic Probes
- 9 No. Cable Percussion Boreholes
- 10 No. Rotary Core Boreholes
- 4 No. Plate Bearing Tests
- 4 No. Groundwater Monitoring Wells

Refer to Appendix 7.2 Ground Investigation Report (GII, Issue Date April 2019, Project No. 8354-01-19).

7.3 The Existing Receiving Environment (Baseline)

Soils

Ground Investigations

Ground conditions at the site, as observed during Ground Investigations, are summarized as follows (Refer to Appendix 7.2 Ground Investigation Report – GII, Issue Date April 2019, Project No. 8354-01-19):

- 0.3m thick topsoil layer overlying;
- 0.5m to 1.1m made ground deposits (brown sandy slightly gravelly Clay with frequent cobbles and boulders and occasional fragments of concrete, brick, glass and plastic) overlying;
- Cohesive deposits (brown or brown mottled grey sandy gravelly Clay with occasional cobbles overlying a stiff brown/orange/grey sandy gravelly Clay);
- Granular Deposits were encountered within the cohesive deposits in TP21 and BH02 (grey/brown clayey sandy fine to coarse gravel or gravelly sand);
- The subsoils noted above overly Bedrock (encountered at depths of 2.6m to 12.0m below existing ground);
- Adjacent to the site’s western boundary (the high side of the site), groundwater was observed at approx. 1.0m below existing ground level;
- Adjacent to the site’s eastern boundary (the low side of the site), groundwater was observed at approx. 2.3m below existing ground level;

Infiltration tests were carried out at three locations. the water level dropped too slowly to allow calculation of ‘f’ the soil infiltration rate. Test results indicate that soils are impermeable with no infiltration recorded (typical of the cohesive deposits observed during site investigations).

An area of the site adjacent to the neighbouring filling station (adjacent to the western boundary) had been highlighted in the 2018 AWN Environmental Report as being impacted by hydrocarbons. The AWN report identified that the filling station was the likely source of the impact. Refer to Appendix 7.1 Environmental Reports (AWN, Issue Date September 2018, TH/18/10021WR02

Ground Investigations Ireland subsequently carried out further investigation within the hydrocarbon impacted area to delineate the vertical and lateral extent of the contamination plume. GII confirms that the reduction in degree of impact moving downgradient and away from the filling station suggests that the impact is related to the filling station.

Geological Survey Ireland’s Online Mapping Service

Review of information available on the Geological Survey Ireland’s online mapping service (“Quaternary Sediments”) indicate that the site is underlain by a subsoil layer described as “Till derived from limestones”. Refer to Figure 7.1 below.

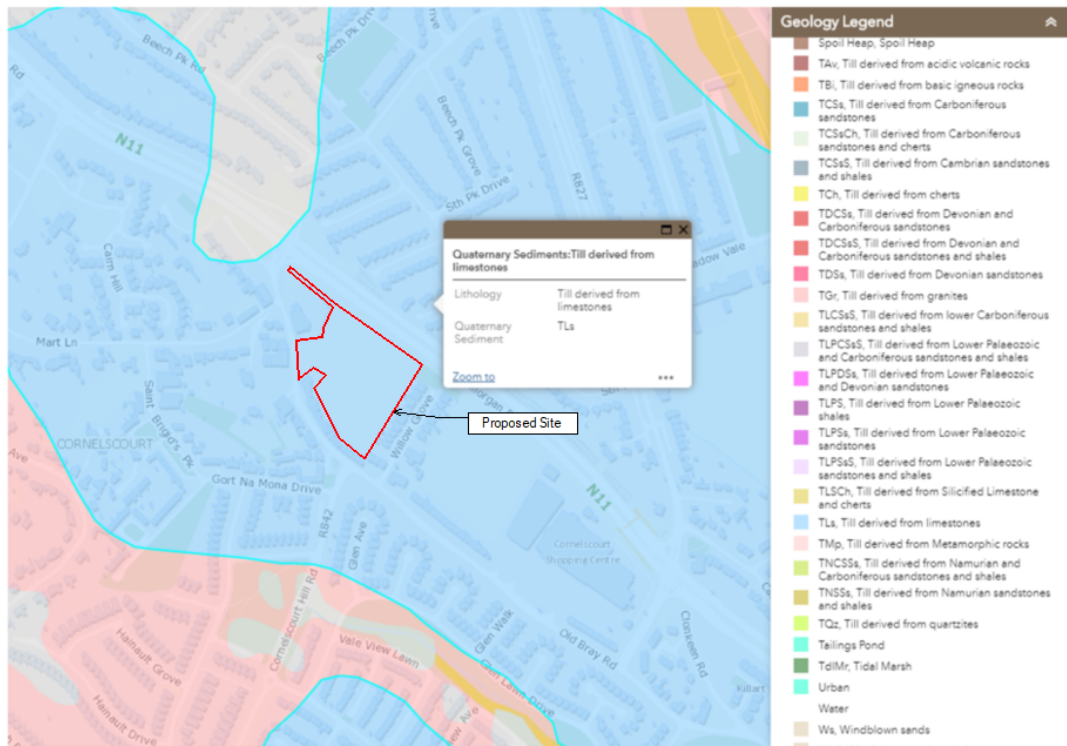


Figure 7.1 - Extract from Quaternary Sediments Map (source GSI Online Mapping Service)

Geology

Review of GSI’s online mapping service (“Bedrock Geology”) describes geology in the vicinity of the site as “Siluro-Devonian granitic rocks & appinite”. Refer to Figure 7.2 below.

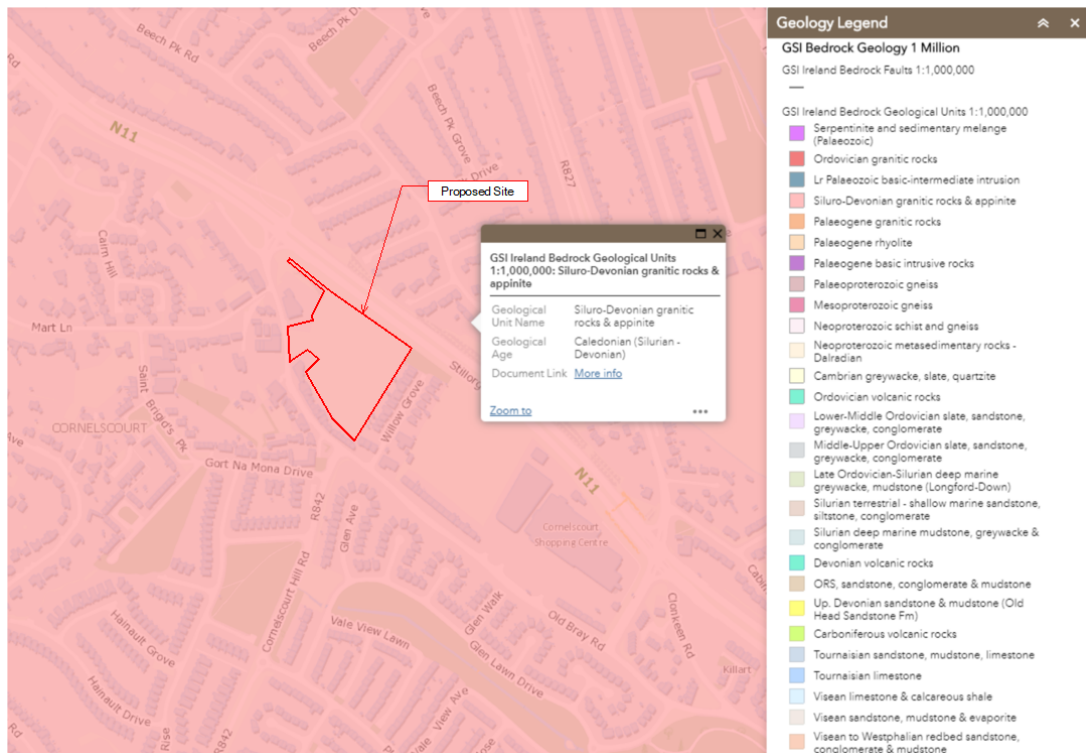


Figure 7.2 - Extract from Bedrock Geology Map (source GSI Online Mapping Service)

GSI have classified the site's groundwater vulnerability as "Moderate" for the majority of the site with "High" in a small portion of the site (adjacent to the site's southern corner). Refer to Figure 7.3 below.

GSI also classified underlying bedrock aquifer as "Poor Aquifer – Bedrock which is generally unproductive except for local zones".

Refer to Chapter 8.0 (Water) of this EIAR for further comment regarding Hydrogeology.

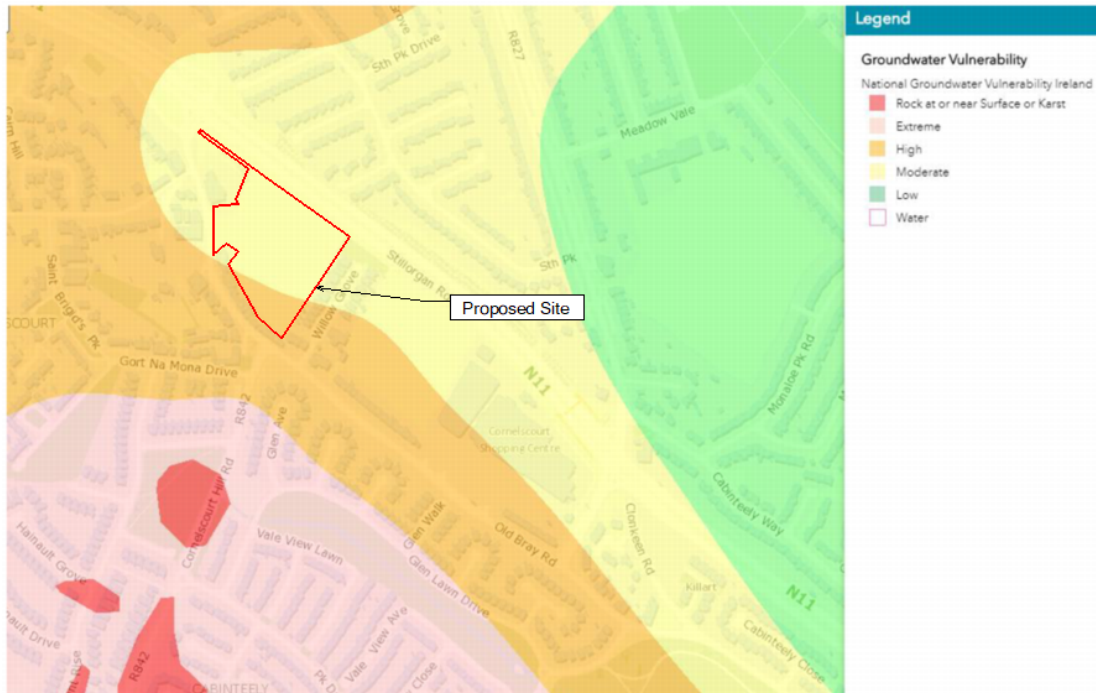


Figure 7.3 - Extract from Groundwater Vulnerability Map (source GSI Online Mapping Service)

7.4 Characteristics of the Proposed Development

The current proposal provides for a Build to Rent development consisting:

- 468 residential units (452 apartments and 16 houses) as follow:
 - 41 no. studio apartment units,
 - 257 no. 1 bed apartment units,
 - 136 no. 2 bed apartment units;
 - 18 no. 3 bed apartment units;
 - 10 no. 3 bed semi-detached house units; and
 - 6 no. 1 bed bungalow units.
- A café / restaurant of c. 140 sq m; office space of 149 sq m; concierge of c. 149 sq m; and a residential tenant amenity space of c. 458 sq m is also proposed.
- 274 Car Parking Spaces (273 at basement level and 1 at surface level)
- 12 Motor Cycle Spaces
- 616 Bicycle Parking Spaces
- Public Open Space
- Vehicular Access
- Basement Areas
- Sub Stations and 3 Switch Rooms
- All Associated Site Development Works

Site development works will include stripping of the 0.3m thick topsoil layer. It is expected that a portion (approximately 50%) of the stripped topsoil will be reused on site (incorporated into landscaping) with remaining topsoil being disposed of at a licenced waste receiving facility (subject to the approval of the facility operator in accordance with their facility permit or licence).

Excavation of subsoil layers will be required in order to allow road construction, basement and foundation excavations, drainage and utility installation and provision of underground attenuation of surface water.

Importation of fill will be required beneath apartments, houses and roadways (structural fill).

Due to relatively high level of groundwater encountered in the boreholes (refer to Section 7.3) there may be a need to dewater the basement excavation during construction.

As noted previously, an area of the site adjacent to the neighbouring filling station (adjacent to the western boundary) has been impacted by hydrocarbons. Investigation within the hydrocarbon impacted area confirms that the reduction in degree of impact moving downgradient and away from the filling station suggests that the impact is related to the filling station. Two locations have been identified where these materials should be excavated and removed from site in the event of residential development. If these materials are excavated and removed from site they should be classified as and disposed of as hazardous. The natural subsoils outside the impacted area have been assessed and are suitable for removal to a suitably licenced inert facility.

In general, the designed basement level, ground floor levels and external pavement levels have been designed to follow the natural topography of the site, therefore minimising the need for cut fill operations to enable development.

7.5 Potential Impact of the Proposed Development

Construction Stage

Stripping of Topsoil

Removal of the existing topsoil layer will be required. As noted previously, approximately 50% of stripped topsoil will be reused on site (incorporated into landscaping) with remaining topsoil being disposed of at a licenced waste receiving facility (subject to the approval of the facility operator in accordance with their facility permit or licence).

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.

Topsoil Strip (300mm thick layer)	5,000
Topsoil Reuse (landscaping of open spaces etc.)	2,500
Disposal of Topsoil	2,500

Table 7.1 - Preliminary Estimated Topsoil Volumes (+/- 10%)

Excavation of Subsoil Layers

Excavation of existing subsoil layers will be required in order to allow road construction, basement construction, foundation excavation, drainage and utility installation and provision of underground attenuation of surface water. Underlying subsoil materials generally comprise of sandy / gravelly clays (refer to Section 7.3).

Due to the proposed site layout (basement construction with ground floor levels and external pavement levels designed to follow the natural topography of the site), there is limited potential for reuse of excavated material as non structural fill. As such, it is proposed to remove all excavated material from site to a licenced waste receiving facility (subject to the approval of the facility operator in accordance with their facility permit or licence).

Cut (excavation of subsoil layers as described above)	20,000
Disposal of Excavated Subsoil	20,000

Table 7.2 - Excavation of Subsoil / Reuse of Excavated Material (+/- 10%)

As noted in Section 7.3 and Section 7.4, an area of the site adjacent to the neighbouring filling station (adjacent to the western boundary) has been impacted by hydrocarbons.

Refer to Appendix 7.2 Ground Investigation Report (GII, Issue Date April 2019, Project No. 8354-01-19) and Appendix 7.3 Environmental Assessment Executive Summary (DBFL, Issue Date June 2019) for information relating to the extent of hydrocarbon impacted material on site and classification of subsoils that may require disposal following excavation.

Refer to Table 7.3 and Figure 7.4 for a summary of subsoil volumes impacted by hydrocarbon which are affected by the proposed development (source of information GII Ground Investigation Report and DBFL Environmental Assessment Executive Summary).

	Volume (m ³)
Hazardous Material (within structural footprint)	95
Contaminated Non-Hazardous Material (within structural footprint)	320
Contaminated Non-Hazardous Material (outside structural footprint)	210

Table 7.3 - Summary of Subsoil Volumes Impacted by Hydrocarbon

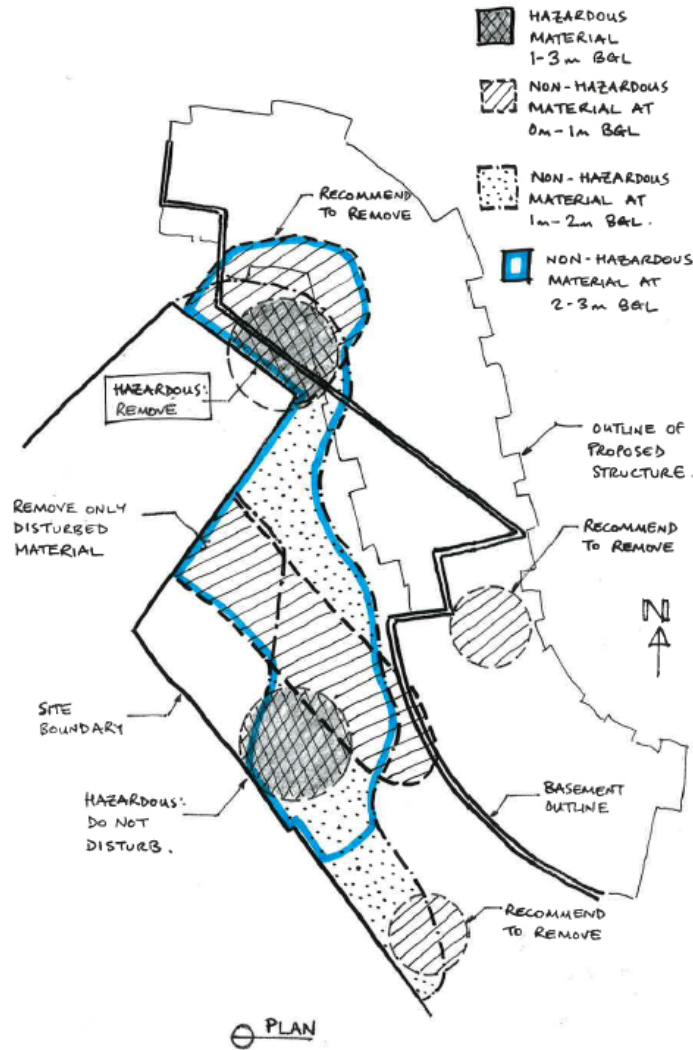


Figure 7.4 - Location of Hazardous and Non-Hazardous Contaminated Material

Imported Fill

Materials imported to site for use as fill will be natural stones sourced from locally available quarries or materials that have been approved as by-products by the EPA in accordance with the EPA's criteria for determining a material is a by-product, per the provisions of article 27(1) of the European Communities (Waste Directive) Regulations, 2011.

Imported fill materials will be granular in nature and used in the construction of road pavement foundations, drainage and utility bedding and surrounds.

Materials will be brought to site and placed in their final position in the shortest possible time. Any imported material will be kept separate from the indigenous arisings from the site.

All excavation to accommodate imported material will be precisely co-ordinated to ensure no surplus material is brought to site beyond the engineering requirement.

	Volume (m ³)
Imported Granular Material (Total)	6,500

Table 7.4 - Imported Granular Material (+/- 10%)

Construction Traffic

Earthworks plant (e.g. dump trucks) and vehicles delivering construction materials to 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.

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
- Use of cement and concrete during construction works

Geological Environment

Due to the proposed site layout (basement construction with ground floor levels and external pavement levels designed to follow the natural topography of the site), any excavations are expected to be relatively shallow and are not expected to impact on the underlying geology.

Operational Stage

On completion of the construction phase, there will be no further impact on soils and the geological environment.

7.6 Potential Cumulative Impacts

Other developments currently under construction and other committed development in the vicinity of the site are likely to have similar impacts during the construction phase in relation to soils and geology.

Should the construction phase of any developments coincide with development of the site, potential cumulative impacts are not anticipated once similar ameliorative, remedial and reductive measures are implemented.

7.7 Do Nothing Scenario

There will be no impact on soils and the geological environment if the development does not proceed.

7.8 Risks to Human Health

Risks to Human Health associated with works during the construction phase in relation to land and soils include:

- Work which puts persons at risk of burial under earthfall e.g. during basement excavation.
- Works that could undermine existing foundations
- Works in relation to subsoils impacted by hydrocarbons
- Contact with existing underground services e.g. gas leaks or electrocution.
- Access and egress from the site and interface with site staff and / or the public e.g. Risk of slips, trips and falls
- Dust generation
- Use of machinery and plant e.g. risk of injury to personnel and damage to plant and machinery due to improper use.

7.9 Mitigation Measures

Construction Stage

Stripping of Topsoil

Stripping of topsoil will be carried out in a controlled and carefully managed way and coordinated with the proposed staging for the development. At any given time, the extent of topsoil strip (and consequent exposure of subsoil) will be limited to the immediate vicinity of active work areas.

Topsoil stockpiles will be protected for the duration of the works and not located in areas where sediment laden runoff may enter existing surface water drains.

Topsoil stockpiles will also be located so as not to necessitate double handling.

Surface water runoff from areas stripped of topsoil will be directed to on-site settlement ponds where measures will be implemented to capture and treat sediment laden runoff prior to discharge of surface water at a controlled rate.

On-site settlement ponds are to include geotextile liners and riprapped inlets and outlets to prevent scour and erosion.

Excavation of Subsoil Layers

Excavation of existing subsoil layers has been minimised as the proposed basement level, ground floor levels and external pavement levels have been designed to follow the natural topography of the site.

Disturbed subsoil layers will be stabilized as soon as practicable (e.g. backfill of service trenches, construction of road capping layers, construction of building foundations and completion of landscaping). The duration that subsoil layers are exposed is to be minimised in order to mitigate against weather effects.

Similar to comments regarding stripped topsoil, stockpiles of excavated subsoil material will be protected for the duration of the works. Stockpiles of subsoil material will be located separately from topsoil stockpiles.

Measures will be implemented to capture and treat sediment laden surface water runoff (e.g. sediment retention ponds, surface water inlet protection and earth bunding adjacent to open drainage ditches).

As noted in Section 7.3, Section 7.4 and Section 7.5 an area of the site adjacent to the neighbouring filling station (adjacent to the western boundary) has been impacted by hydrocarbons. It is proposed to remove subsoil impacted by hydrocarbons which are affected by the proposed development (refer to Table 7.3).

The Contractor is to provide a Method Statement (to be agreed prior to commencing any works on site) for works in the vicinity of areas impacted by hydrocarbons including but not limited to details of their proposed specialist sub-contractors, proposals for containment of contamination, proposal for removal of hydrocarbons from dewatered groundwater prior to discharge, co-ordination of contamination removal with other site works, proposed licenced waste receiving facility and compliance with relevant legislation including HSA publications and the Waste Management Act.

Imported Fill

As noted in section 7.5 above, importation of fill to site will be required.

No large or long-term stockpiles of fill material will be held on the site. At any time, the extent of fill material held on site will be limited to that needed in the immediate vicinity of the active work area.

Smaller stockpiles of fill, where required, will be suitably protected to ensure no sediment laden runoff enters existing surface water drains. Such stockpiles are to be located in order to avoid double handling.

Construction Traffic

Earthworks plant and vehicles delivering construction materials to site will be confined to predetermined haul routes around the site.

Vehicle wheel wash facilities will be installed in the vicinity of any site entrances and road sweeping implemented as necessary in order to maintain the road network in the immediate vicinity of the site.

Dust suppression measures (e.g. dampening down) will be implemented as necessary during dry periods.

Accidental Spills and Leaks

In order to mitigate against spillages contaminating underlying soils, all oils, fuels, paints and other chemicals will be stored in a secure bunded hardstand area.

When not possible to carry out such activities off site, refuelling and servicing of construction machinery will take place in a designated hardstand area which is remote from any surface water inlets.

Geological Environment

As noted in Section 7.9.1.2, the Contractor is to provide a Method Statement (to be agreed prior to commencing any works on site) for works in the vicinity of areas impacted by hydrocarbons including proposals for containment of contamination and removal of hydrocarbons from dewatered groundwater prior to discharge.

Risks to Human Health

- Contractor to prepare Method Statement, method statement to be agreed with PSDP.
- Contractor/PSCS to implement safe systems of construction including but not limited to battering the sides of trench excavations and installation of excavation shoring systems.
- Full precautions to be taken when working in vicinity of boundary structures for protection of same. Method and sequence of construction to be agreed with design team prior to commencement of work. Contractor's Temporary Works Designer to prepare Method Statement and Temporary Works Cert to ensure stability of excavations and adjacent structures.
- As noted in Section 7.9., The Contractor is to provide a Method Statement (to be agreed prior to commencing any works on site) for works in the vicinity of areas impacted by hydrocarbons including but not limited to details of their proposed specialist sub-contractors, proposals for containment of contamination, proposal for removal of hydrocarbons from dewatered groundwater prior to discharge, co-ordination of contamination removal with other site works, proposed licenced waste receiving facility and compliance with relevant legislation including HSA publications and the Waste Management Act.
- Contractor to obtain utility company network plans and arrange observation as required.
- Contractor to locate and record all services on site prior to commencement of excavations.
- Contractor to prepare and implement a Construction Traffic Management Plan that will be agreed with the Design Team and local authority and which will ensure the safety of the public during construction.
- Contractor must supervise vehicle movements to and from the site during construction in order to ensure that this traffic management plan is fully implemented. Plan to include deliveries to the site, staff parking, works outside the defined site such as utility connections.
- Public pedestrian routes to be established at site entrance as required.
- All personnel using machinery/plant to have undergone training on the use of said machinery/plant. Ongoing site supervision to be undertaken to ensure all use of machinery/plant is in accordance with the training undertaken.
- Contractor's employees to be provided with all required PPE in accordance with Safety, Health and Welfare at Work Act, 2005.

Operational Stage

On completion of the construction phase no further mitigation measures are proposed as there will be no further impact on soils and the geological environment.

7.10 Predicted Impacts of the Proposed Development

Construction Stage

Implementation of the mitigation measures outlined in Section 7.9 will ensure that the potential impacts of the proposed development on soils and the geological environment do not occur during the construction phase and that any residual impacts will be short term.

Operational Stage

There are no predicted impacts arising from the operational phase.

7.11 Monitoring

Construction Stage

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

- Adherence to Outline Construction Management Plan
- Construction monitoring of the works (e.g. inspection of existing ground conditions on completion of cut to road formation level in advance of placing capping material, stability of excavations etc.).
- Inspection of fuel / oil storage areas.
- Monitoring cleanliness of adjacent road network, implementation of dust suppression and provision vehicle wheel wash facilities.
- Monitoring of contractor's stockpile management (e.g. protection of excavated material to be reused as fill, protection of soils for removal from site from contamination)
- Monitoring sediment control measures (sediment retention ponds, surface water inlet protection etc.)
- A dust management/monitoring programme should be implemented during the construction phase of the development.
- The quantities of material removed from site and their destination to be recorded (inert, contaminated non-hazardous and hazardous).
- Source of imported aggregates to be approved by the engineer prior to delivery to site

Operational Stage

No ongoing monitoring is proposed on completion of the construction phase.

7.12 Reinstatement

All temporary construction compounds and site entrances are to be removed upon completion of the construction phase. Such areas are to be reinstated in accordance with the landscape architects plan and engineer's drawings.

All construction waste and / or scrapped building materials are to be removed from site on completion of the construction phase.

Oil, fuel etc. storage areas are to be decommissioned on completion of the construction phase. Any remaining liquids are to be removed from site and disposed of at an appropriate licenced facility.

All sediment control measures (e.g. sediment retention ponds) are to be decommissioned on completion of the construction phase. Such areas are to be reinstated in accordance with the landscape architects plan and engineer's drawings.

7.13 Interactions

Traffic and Transportation

Delivery of materials to site (e.g. aggregates for road construction, concrete for foundations, delivery of construction plant to site) will lead to potential impact on the surrounding road network.

Water and Hydrology

Stripping of topsoil will result in exposure of the underlying subsoil layers to the effects of weather and construction traffic and may result subsoil erosion and generation of sediment laden surface water runoff.

The presence of groundwater at bedrock level will necessitate dewatering during construction.

Waste Management

Oil, fuel etc. storage areas are to be decommissioned on completion of the construction phase. Any remaining liquids are to be removed from site and disposed of at an appropriate licenced facility.

Noise and Vibration

Development of the site will result in a level of construction related noise and vibration.

Air Quality

Dust generation can also occur during extended dry weather periods as a result of construction traffic.

Flora and Fauna

Removal of the existing topsoil layer will be required across the site.

7.14 Difficulties Encountered

No particular difficulties were encountered during preparation of this chapter. The analysis reported within this chapter is based upon site specific environmental and ground investigation reporting as well as publicly available information from Geological Survey of Ireland.

7.15 References

Environmental Report (AWN, Issue Date September 2018, TH/18/10021WR02).

Ground Investigation Report (GII, Issue Date April 2019, Project No. 8354-01-19).

Environmental Assessment Executive Summary (DBFL, Issue Date June 2019).

Environmental Assessment Report (GII, Issue Date March 2019, Project No. 8354-01-19).