9.0 LAND, SOILS AND GEOLOGY

9.1 Introduction

The Lands and Soils Chapter of this EIAR has been prepared by Brendan Keogh (BA BAI PGradDip CEng MIEI) of DBFL Consulting Engineers. Brendan Keogh is a Chartered Professional Engineer with over 15 years experience in the design and construction of civil engineering projects. Projects have included works associated with the commercial, industrial, energy, residential and public infrastructure sectors.

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

In summary, the proposed development ("the site") comprises of the demolition of all existing structures on site and construction of 590 No. residential dwellings (480 No. Build-to-Rent Apartments and 110 No. Build-to-Sell Duplexes) on a 6.05 Ha site.

The development will also consist of the provision of an ancillary amenity block within the central open space which comprises a gymnasium, lobby, kitchenette and lounge at ground floor level and lounge at first floor level in addition to a roof terrace (to serve the Build-to-Rent residents only); a two storey retail/café/restaurant building; a creche and a management suite.

The proposed development will also include the following associated engineering infrastructure:

- Upgrade of existing traffic signals on Scholarstown Road to facilitate the primary vehicle access to the site (including provision of formal signalised crossings for the benefit of both pedestrians and cyclists).
- Upgrading existing pedestrian and cycle facilities along Scholarstown Road.
- Provision of internal site roads including associated footpaths.
- Provision of surface water drainage, foul drainage and water supply infrastructure.

9.2 Methodology

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

- Preliminary Ground Investigation Study;
- Review of information available on the Geological Survey of Ireland (IGSL) online mapping service.

Preliminary Ground Investigations for the proposed development were carried out by IGSL in August 2018 and February 2019 and included the following scope of work:

- 14 No. Boreholes (including 4 No. Rotary Cores)
- 6 No. Window Samples
- 15 No. Trial Pits

- 15 No. Plate Bearing Tests
- 30 No. Dynamic Probes
- 8 No. Infiltration Tests

Refer to Appendix 9.1 and 9.2 Ground Investigation Reports (IGSL, Report No. 21167, Issue Date October 2018 and Report No. 21527, Issue Date March 2019).

9.3 Receiving Environment

9.3.1 Soils

Ground conditions at the site, as observed during Preliminary Ground Investigations, are summarised as follows:

- 0.1m to 0.3m thick topsoil layer overlying;
- 0.3m to 0.9m thin stratum of firm silt/clay with occasional gravel;
- Gravelly Clay with occasional cobbles (to target trial pit depth of 3.0m);
- Made ground (comprising of clay with brick and rubble fragments) was observed at 2 trial pit locations adjacent to the site's eastern boundary to a depth of approx. 2.0m. Gravelly clay was observed below made ground at both locations (as described previously);
- 14 No. boreholes were undertaken as part of the site investigation works and generally observed stiff to very stiff brown laminated silt / clay with fine to medium gravel and occasional cobbles from 3.0m (trial pit target depth) to 8.4m below existing ground level

No Ground water was noted in any of the boreholes or trial pits.

Infiltration tests were carried out at eight locations (sites of proposed attenuation facilities). Tests results indicated infiltration rates (f) ranged from 0.00000 m/min to 0.000092 m/min. Test results indicate that soils are impermeable with no infiltration recorded (typical of the silty clays observed during site investigations).

9.3.2 Geology

Review of GSI's online mapping service ("Bedrock Geology") generally describes geology in the vicinity of the site as "*Deep Marine: Slate, Schist & minor greywacke*" (although a small area adjacent to the site's northern boundary is described as "*Marine basinal facies; Dark-grey argillacerous & cherty limestone & shale*"). Refer to Figure 9.1 below.

GSI have classified the site's groundwater vulnerability as "Low" and have classified underlying aquifers as "Locally Important".

Refer to Chapter 10 (Hydrology) of this EIAR for further comment regarding Hydrogeology.

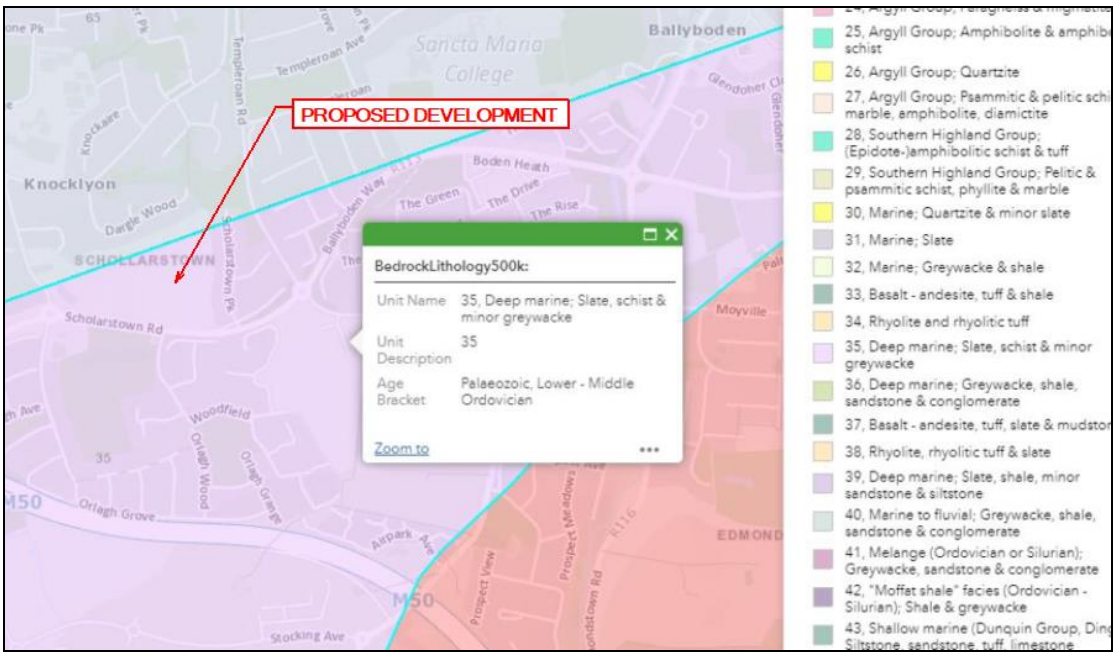

Figure 9.1: Extract from Bedrock Geology Map (source GSI Online Mapping Service)

9.4 Characteristics of the Proposed Development

Site development works will include stripping of the 0.1m to 0.3m thick topsoil layer. The majority of topsoil will be reused on site (incorporated into landscaping of back gardens and public open spaces), however, some topsoil will be removed from site. Also refer to Section 9.5.1.1 below.

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

In general, the designed road levels and finished floor levels follow the natural topography of the site, therefore, minimising the need for cut / fill operations to enable development.

Underlying subsoil layers generally comprise of gravelly clay with occasional cobbles or silty clays with fine to medium gravel and occasional cobbles. This material is expected to be suitable for reuse as non-structural fill (e.g. build-up of back gardens areas or build-up of open spaces). Also refer to Section 9.5.1.2 below.

Importation of fill will be required beneath houses, driveways and to roadways (structural fill). Further information regarding importation of fill is included in Section 9.5.1.3 below. This material will be sourced from quarries that have all required licenses, planning permissions etc.

9.5 Identification of Likely Significant Impacts

9.5.1 Construction Phase

9.5.1.1 Stripping of Topsoil

Removal of the existing topsoil layer will be required. As noted previously, the majority of topsoil will be reused on site (incorporated into landscaping of back gardens and public open spaces).

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.

1. Table 9.1 Preliminary Estimated topsoil volumes (+/- 10%)

	Volume (m^3)
Topsoil strip (100mm to 300mm)	16,000
Topsoil reuse (landscape of gardens, open space etc.)	10,000
Removal of topsoil from site	6,000

9.5.1.2 Excavation of Subsoil Layers

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

Underlying subsoil layers generally comprise of gravelly clay with occasional cobbles or silty clays with fine to medium gravel and occasional cobbles. This material is expected to be suitable for reuse as non-structural fill (e.g. build-up of back gardens areas or build-up of open spaces).

2. Table 9.2 Excavation of Subsoil / Reuse of Excavated Material (+/- 10%)

	Volume (m^3)
Cut (excavation of subsoil layers as described in 5.5.1.2 above)	35,000
Reuse of Excavated Material as Non Structural Fill	11,000
Removal of excavated material from site	24,000

9.5.1.3 Imported Fill

Importation of fill will be required beneath road pavement, under floor slabs and for drainage and utility bedding and surrounds. This material will be sourced from quarries that have all required licenses, planning permissions etc.

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.

3. Table 9.3 Imported Fill (+/-) 10%

	Volume (m^3)
Fill (Total)	26,000
Reuse of Excavated Material as Non Structural Fill (ref. Table 9.2)	11,000
Imported Fill (granular material beneath road pavement, under floor slabs and for drainage and utility bedding and surrounds)	15,000

9.5.1.4 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.

9.5.1.5 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

9.5.1.6 Geological Environment

Any excavations associated with development of the site are expected to be relatively shallow and are not expected to impact on the underlying geology.

9.5.2 Operational Phase

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

9.5.3 'Do Nothing' Scenario

There will be no impact on soils and the geological environment if the development does not proceed (other than those associated with Archaeological Investigations carried out in 2018 and 2019, refer to EIAR Chapter 5 – Archaeology).

9.6 Ameliorative, Remedial or Reductive Measures

9.6.1 Construction Phase

9.6.1.1 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.

9.6.1.2 Excavation of Subsoil Layers

Excavation of existing subsoil layers has been minimised. Cut type earthworks operations will not be required to achieve designed site levels.

Disturbed subsoil layers will be stabilised 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).

9.6.1.3 Imported Fill

As noted in section 9.5.1.3 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.

9.6.1.4 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.

9.6.1.5 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.

Refuelling and servicing of construction machinery will take place in a designated hardstand area which is also remote from any surface water inlets (when not possible to carry out such activities off site).

9.6.1.6 Geological Environment

No mitigation measures are proposed in relation to the geological environment.

9.6.2 Operational Phase

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.

9.6.3 'Do Nothing' Scenario

No mitigation measures are proposed in relation to soils and the geological environment if the development does not proceed.

9.7 Predicted Impact of the Proposed Development

9.7.1 Construction Phase

Implementation of the measures outlined in Section 9.6.1 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.

9.7.2 Operational Phase

There are no predicted impacts arising from the operational phase.

9.7.3 'Do Nothing' Scenario

There are no predicted impacts should the proposed development not proceed.

9.8 Monitoring

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

- Adherence to Preliminary 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.).

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

9.9 Reinstatement

All temporary construction compounds 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.

9.10 Interactions and Potential Cumulative Impacts

9.10.1 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.

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 as well as removal of some trees, vegetation etc.

9.10.2 Potential Cumulative Impacts

Other developments currently under construction and other committed development in the vicinity of the site have been considered and 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.