7 LAND, SOILS & GEOLOGY

7.1 Introduction

This section of the EIAR was prepared by Dr Bill Bates BEng (Hons) MSc PhD CEng MIEI MICE, who has over 25 years' experience in civil engineering and the construction industry.

This section of the EIAR considers the impact on land, soils and underlying geology from the subject development. As outlined previously, the subject development includes the proposed construction of 1034no. housing units together with 6km of access road and associated infrastructure. Further textual detail is provided in Chapter 3: Description of Proposed Development of this EIAR. This section should be read in conjunction with the preliminary design drawings and reports which accompany this planning application.

7.2 Assessment Methodology

The assessment of effects on the baseline Land and Soils environment were assessed in accordance with the guidance published by the Environmental Protection Agency (EPA), Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (Draft - August 2017). Table 3.3 from these guidelines was used as the basis for a common description framework of the effects on the baseline environment.

7.2.1 Data Sources

The online Geological Survey of Ireland (GSI) geological maps and records for the area were inspected for solid geology and quaternary deposits. Maps showing the Quaternary Sediments, Bedrock Geology and Surface Soils are provided in the Appendix 7.1 to this Chapter.

A preliminary site investigation was also carried out for the site by IGSL Ltd in October 2007. A further, more extensive, site investigation was also undertaken in November / December 2018. The results of these site investigations are referred to in this section. Both investigations cover the area of the site. The results of these site investigations are included in the Appendix 7.2 to this Chapter.

7.3 Receiving Environment

7.3.1 Proposed Development

7.3.1.1 Solid Geology (Bedrock)

According to the Geological Survey of Ireland, the generalised bedrock description at the site is "Dark Limestone & Shale (Calp)" (Appendix 7.1 Fig. 1). The site is located on the Lucan Formation. The formation comprises of dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey. There are rare dark coarser grained calcarenitic limestones, sometimes graded, and interbedded dark-grey calcar. There are no identified outcrops on the site.

The historical site investigation undertaken in 2007 indicated that rock was encountered typically within the range of 1.5 to 3.6 metres below ground level. The recent site investigation indicated similar findings ranging from 2.4 to 4.0 metres.

The site is recorded to be within a Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones with an area of 1309 square kilometres. (Appendix 7.1 Fig. 2)

The closest recorded karst landform on the GSI database is approximately 6km from the site at St. Columbs Well in Newtown, County Kildare. (Appendix 7.1 Fig. 3)

There are a number of recorded groundwater borehole and spring type wells within 2km of the extremities of the site (Appendix 7.1 Fig. 4). These are outlined below: -

- Borehole reference (2923SEW006; Clondalkin) is noted as being for industrial use with a yield of approximately 157 cubic metres per day and has a yield class of 'good'. No owner is recorded.
- Borehole reference (2923SEW005; Clondalkin) is noted for industrial use with a yield of 185 cubic metres per day and has a yield class of 'good'. No owner is recorded.
- Borehole reference (2921NEW002; Cheeverstown) is noted as unknown use with a yield of 109 cubic metres per day and has a yield class of 'good'. The owner is recorded as Dublin County Council.
- Borehole reference (2921NEW003; Belgard) is noted for industrial use with a yield of 654 cubic metres per day and has a yield class of excellent. No owner is recorded.
- Spring reference (2923SEW041; Brideswell commons) is noted as a St Bridget's Well with no other recorded data.

The nearest recorded ground water drinking protection area is approximately 10km south west of the site in Kilteel. (Appendix 7.1 Fig. 5).

Groundwater recharge is recorded as 200mm / year maximum for the site (Appendix A Figure 6). Groundwater vulnerability is recorded as high. (Appendix 7.1 Fig. 7).

Further detail on the hydrogeology associated with the aforementioned bedrock layer, and the impact on it, is provided in Chapter 8: Water.

The closest recoded geological heritage feature to the proposed development is Belgard Quarry (SD002) which is approximately 2.5km south east of the site and is recorded as the biggest exposure of the usually poorly exposed Calp Limestone which underlies Dublin. (Appendix 7.1 Fig. 8). The closest operational quarry, according to the GSI database is Belgard Quarry, located in the townland of Fortunestown, approximately 2.5km south-east of the site.

7.3.1.2 Quaternary Geology (Subsoil)

The Quaternary geological period extends from about 1.5 million years ago.

According to the Geological Survey of Ireland, the subsoil within the subject site is generally tills derived from limestone (Appendix 7.1 Fig. 9).

The intrusive site investigation recorded a thin mantle, (approximately 1.5m to 3.6m) of glacial till composed of gravelly sandy clay which is generally in a firm to still condition becoming stiff to very stiff in places. The till overlies an argillaceous limestone bedrock. This data concurs with the records identified on the GSI website.

Given the current agricultural use for the area, it is unlikely that the sub-soils are contaminated. There is also no knowledge of historical pollution at the site. This would suggest that the soil environment, for the most part, may be classified as inert and any material requiring disposal would be low risk.

Further detail on the hydrogeology associated with the aforementioned subsoil layer, and the impact on it, is provided in Chapter 8: Water.

According to the GSI database the proposed development is within an area that is designated as having a "Low" susceptibility to landslides, with the closest recorded landslide event being at Bohernabreena River Valley, approximately 6km south of the proposed site.

7.3.1.3 Surface Geology (Topsoil)

The topsoils covering the proposed site, according to the Geological Survey of Ireland, are a mixture of "shallow poorly drained mineral (mainly basic)" and "mineral poorly drained (mainly basic)". (Appendix 7.1 Fig. 10).

The soil group within the "shallow poorly drained mineral (mainly basic)" area consists of Grey Brown Podzolics, Brown Earths(medium-high base status).

The soil group within the "mineral poorly drained (mainly basic)" area consist of Surface water Gleys, Ground water Gleys.

The site is currently undeveloped and is greenfield. Historically, it was likely utilised for agricultural purposes and it is unlikely that the surface soils would be contaminated. There is also no knowledge of historical pollution at the site. This is confirmed by the intrusive site investigations carried out in 2007 and 2018. This would suggest that the soil environment, for the most part, may be classified as inert and any material requiring disposal would be low risk.

Notwithstanding the above, and following a site walkover, it was noted that there is evidence of industrial fly tipping at the site. This was raised initially as part of a geophysical survey of the site seeking areas of archaeological interest. The material is recorded as modern ferrous debris including burnt out cars, prams, mattresses etc. Assessment of the underlying soils as part of a follow up intrusive site investigation late 2018 did not show any signs of significant contamination.

The preliminary site investigations observed a layer of topsoil ranging in thickness between 0.2 and 0.4m. This was later confirmed as part of a detailed intrusive investigation undertaken in 2018.

7.3.1.4 Land Use

The application area, for the most part, comprises of greenfield lands used historically for agricultural purposes. The lands are currently unused and have been zoned under the current County Development Plan 2016 – 2022 for the provision of new residential communities in accordance with approved area plans. An approved masterplan for the site was developed by South Dublin County Council and is adopted in the most part for this submission.

7.4 Characteristics of the Proposed Development

7.4.1 Proposed Development

The subject development seeks planning permission for the following principal components (Additional detail is provided in Chapter 3: Description of Proposed Development of this EIAR): -

- Construction of 1034no. residential units made up of a mixture of individual housing units and apartments.
- On site vehicle circulating roads and streets with associated car parking provision
- A mix of independent pedestrian and cyclist infrastructure together with shared street spaces
- Drainage and water supply infrastructure to accommodate the residential status of the site.
- Lighting, power and communications infrastructure to accommodate the residential status of the site.

7.4.1.1 Construction Stage

During construction stage the site will be stripped of topsoil, in a phased basis, and then subsoil and bedrock will be excavated to reduce the levels to formation for the construction of residential housing and access roads. The site will be further reduced in level to allow for the installation of water supply, drainage, power and communications conveyance infrastructure and will be installed in line with the phased housing block development.

Provisionally estimated quantities of excavated material are outlined below for the general formation of the roads and platforms for housing as well as the sub formation infrastructure including the foul and surface water drainage network.

Area	Stripped Top Soil (cubic metres)	Excavated Sub Soil (cubic metres)	Excavated Bedrock (cubic metres)
Road and Housing Formation	54,318	38,681	424
Sub formation Infrastructure	N/A	75,455	3,652

Table 7.1: Excavated (Cut) Material Volumes.

It is anticipated that the majority of excess topsoil material will be re-distributed within the works area. It is further anticipated, based on early 3Dmodelling of the site, that there will be a slight short fall of approximately 361 cubic metres in general fill requirements for the purposes of establishing working sub-formations. Therefore, some sub soil material will need to be imported.

In addition to the establishment of sub-formation levels with excavated material, additional quantities of well graded granular material will be required as engineering capping and sub base under roads or hardcore under new housing to establish final formation level.

Taking into account bulking and re-compaction requirements for re-use of material arisings, the following table outlines a provisional estimate for classified material required by the permanent works. The table differentiates materials taken from stockpile or imported.

	FROM STOCKPILE		IMPORTED[a]
Area	Top Soil (cubic metres)	Sub Soil /Bedrock (cubic metres)	Imported Material (cubic metres)
Sub Formation Infrastructure (Pipes/Manholes/ SuDs,etc)	N/A	N/A	56,500[a]
To Sub Formation	N/A	118,572	361[b]
To Formation	54,318	N/A	59,773[c]

[a] Imported materials for sub formation infrastructure will be well graded material for backfilling or single sized material for bedding and surrounding of pipes.

[b] Imported material to sub formation will be classified engineering material similar to that within the site.

[c] Imported material to formation will typically be well graded stone for use as engineered capping material under road alignment and hard-core material for building floor plate and hardstand areas.

Table 7.2: Placed (Fill) Material Requirements.

At this stage of the design process it is not anticipated that any material excavated will be removed from the site and will be used in the formation of the works as far as possible.

7.4.1.2 Operational Stage

There is no further removal of materials during the operational phase of the project.

7.5 Potential Impact of the Proposed Development

7.5.1 Proposed Development

7.5.1.1 Construction Stage

The construction of the proposed housing development, with associated infrastructure, will require excavation of topsoil and upper sub soil layers, quantities of which have been outlined previously.

Topsoil and sub soils are both finite resources. Topsoil is an important component of most landscape schemes within construction projects. It provides an anchorage and oxygen for plant roots, slowly releases nutrients and, in conjunction with the underlying subsoil, retains moisture to sustain plant growth during dry periods. Removing this surface and sub soil resource will likely have a moderate and negative effect over the entire site. The effect will be permanent but reversible. Measures, outlined subsequently, will be employed to reduce the residual effect on the surface and sub soil geology.

The majority of sub surface infrastructure and foundations will be at relatively shallow depths. However, a waste water pumping station and installation of deep sewers is required as part of the site infrastructure in order to service the entire site. Therefore, the removal of approximately 4075 cubic metres of bedrock is required. This will be crushed, processed and installed as part of the works. Hence, this will have a localised negative impact on this resource.

Other potential effects to the underlying soil and geology from construction of the proposed development include accidental spillage of fuels, oils, paints and solvents. While this is unlikely, it could have a temporary localised negative impact on soil, bedrock and groundwater quality, if allowed to infiltrate to ground without immediate remediation. Measures outlined later will ensure that the residual effect is minimised. Further consideration of the impacts on hydrogeology are addressed in Chapter 8: Water.

7.5.1.2 Operational Stage

During operation of the site, there is no further direct effect on the surface soil, sub soil and bedrock geology as any effect will have occurred in construction. However, there are indirect effects resulting from the increase in quantity and quality of the surface water run-off as a result of the loss in natural permeability of the soil mass resulting from the construction of housing, roads and associated footpath and cycleway infrastructure. Further consideration of this effect is addressed in section 5.3 of this EIAR.

With respect to land use the site historically is noted as agricultural. However, it has not been utilised in this form for many years. Nonetheless, the agricultural land use resource will be partly reduced as a result of the proposed development. The proposed development will result in a loss of approximately 35 hectares. However, according to information available from the Central Statics Office website, there is 37,963 hectares of agricultural land available in County Dublin. The construction of the development would represent less than 0.09% of the agricultural land in County Dublin. Therefore, the effect on the land use is not considered significant in this context.

Furthermore, under the current County Development Plan 2016-2022 the site is identified for the provision of new residential communities in accordance with approved area plans.

It is therefore considered that any direct effect on soils and geology in the operational phase of the development is unlikely.

7.5.1.3 Do-Nothing Impact

The proposed site is located in an area zoned under the current County Development Plan 2016-2022 for the provision of new residential communities in accordance with approved area plans.

If this particular development was not to proceed, it is likely that a similar development would be developed at the site. Therefore, the impact on topsoil, subsoil and bedrock associated with this development is likely to occur at the site at some stage in the future.

7.6 Ameliorative, Remedial or Reductive Measures

7.6.1 Proposed Development

7.6.1.1 Construction Stage

The following measures are designed to address the impacts of construction activities, associated with the development, on soils, geology and land use.

At detail design stage a number of measures will be employed to minimise impact on the land use and soil resource.

- The width of the roads will be minimised to fit with current urban road policy, resulting in reduced effect.
- A comprehensive cut and fill assessment, based on a systematic site investigation of the entire site development, will be undertaken to balance the amount of material excavated and replaced, ultimately reducing the amount of material leaving the subject site as waste.
- The detail design will also seek to minimise the amount of material to be imported. (Any material that is to be imported will be purpose specified engineered material). At this stage a soil resource plan will also be developed for the site identifying the specific soil make up for the site at the locations of excavation. It will provide a clear breakdown of materials and how they can be incorporated into the works or disposed safely offsite in accordance with the Site Waste Management Plan.

Planned construction works will be carried out with the least feasible disturbance of soils. It is envisaged that the majority of excavated materials will be retained and re-used as part of the designed works. Provisional quantities were outlined previously to illustrate this.

Each classification of excavated material will be stored in separate stockpiles in accordance with the soil resource plan. All excavated materials will be visually assessed for signs of possible contamination such as staining or strong odours. This will be outlined in the Site Waste Management Plan. Should any unusual staining or odour be noticed, samples of this soil will be analysed for the presence of possible contamination in order to ensure that historical pollution of the soil has not occurred. The material will be classified and disposed of in accordance with current best practice and as directed by the Waste Management Act of 1996 and associated amendments.

All stockpiled material will be stored away from receiving watercourses with run-off from the stockpiles directed to temporary holding lagoons for filtration prior to entry to the receiving watercourse.

To minimise any impact on the underlying subsurface strata from material spillages, all oils, solvents and paints used during construction will be stored within specially constructed dedicated temporary bunded areas. Oil and fuel storage tanks shall be stored in designated areas with an impervious base. These areas shall be bunded to a volume of 110% of the capacity of the largest tank/container within the bunded area(s) (plus on allowance of 30 mm for rainwater ingress). Filling and draw-off points will be located entirely within the bunded area(s). Drainage from the bunded area(s) shall be diverted for collection and safe disposal.

Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, will take place in a designated area, off site, away from surface water gullies or drains. The vehicles will never be left unattended during refuelling. Spill kits and hydrocarbon adsorbent packs will be stored in this area and operators will be fully trained in the use of this equipment.

All associated hazardous waste residual materials will also be stored within temporary bunded storage areas prior to removal by an appropriate EPA or South Dublin County Council approved waste management contractor for off-site treatment/recycling/disposal.

7.6.1.2 Operational Stage

There is no direct impact on the soils in operation. However, there is an indirect impact of poor-quality surface water runoff impacting on the subsoil. Appropriate measures for reducing this impact are considered in Chapter 8: Water of this EAIR.

7.7 Residual Impact of the Proposed Development

7.7.1 Proposed Development

7.7.1.1 Construction Stage

Provided the aforementioned ameliorative, remedial or reductive measures are incorporated as part of the construction phase, the residual impact during construction on the topsoil and subsoil resource within the bounds of the subject site will not be significant. It is worthy of note that the design intention is to retain the majority of arising material within the site using the sub soil material as part of the topographical reorientation of the site and topsoil materials for landscape modelling.

7.7.1.2 Operational Stage

Provided the aforementioned ameliorative, remedial or reductive measures are incorporated as part of the operational phase, the residual impact post development on the topsoil and subsoil resource within the bounds of the subject site will not be significant in the context of similar land and soils available around the county.

7.7.1.3 Worst Case Impact

The majority of the aforementioned ameliorative, remedial or reductive measures are design solutions that will be managed through the design and construction process and enforced as part of an agreed development plan with South Dublin County Council.

Notwithstanding the above, the likely worst-case effects that may arise during construction will be mixing of excavated materials or spillage of liquid products within the site. The mixing of soils is unlikely and if it were to occur would not pose a significant effect on the environment as it has already been removed.

The spillage of fuel and oil products has the potential to contaminate the upper soil layers, but it will be localised and a temporary emergency plan would have to be in operation and coordinated with the Local Authority.

In the operational phase, the risk of spillage is the only effect that can impact on the land and soil resource in the context of the housing development. However, the effect would be short term and localised and would be manged as part of the Local Authority's emergency plan for spillage on their adopted road network.

7.8 Monitoring

7.8.1 Proposed Development

7.8.1.1 Construction Stage

As part of the design process a preliminary soil resource and waste management framework plan will be developed and agreed with the environmental section of South Dublin County Council as part of the design compliance process. This will then be further developed by the works contractor and agreement reached on how the resource will be managed. A clear reporting strategy will be developed and used to monitor all materials excavated, stockpiled or disposed of as waste. This will be monitored continuously by the site management team and checked periodically by representatives from the design team.

7.8.1.2 Operational Stage

There is no further monitoring of the soil resource or land use considered a requirement during operation.

7.9 Reinstatement

7.9.1 Proposed Development

7.9.1.1 Construction Stage

Normal post construction reinstatement will take place on completion of the works. This will include placement of sub soil and topsoil in accordance with the requirements of the soil resource plan and taking full cognisance of the measures outlined in this EIAR.

7.9.1.2 Operational Stage

There is no further reinstatement of the soil resource or land use considered a requirement during operation.

7.10 Difficulties Encountered

Although every effort has been made to ensure the accuracy of the data published on the Geological Survey of Ireland online mapping portal, the GSI accept no responsibility for the accuracy of the data presented.

The site investigations, while extensive and reflective of the makeup generally, only represent a small proportion of the overall site area.