6.0 LAND, SOILS AND GEOLOGY

6.1 Introduction

This chapter addresses the magnitude of potential impacts to, and the significance of effects on, land, soils and geology from the Carmanhall Road Strategic Housing Development (the 'Proposed Development') on lands located at the former Avid Technology International site on Carmanhall Road, Sandyford Industrial Estate, Dublin 18, (the 'Site' / 'Application Site'). Potential impacts to human health from contaminated land are also addressed as part of the assessment, as are the potential impacts and effects from soils and geology to the Proposed Development. Associated impacts to the water environment and ecology are addressed in separate chapters (Chapters 7 and 5, respectively).

The chapter has been prepared by Anna Goodwin who has 16 years of experience and holds an MSc in Geology and an MSc in Hydrogeology and Steve Mustow who has 30 years of experience and holds an MSc in Aquatic Resource Management and a PhD in Biology.

6.1.1 Technical Scope

The technical scope of this assessment is to consider the potential impacts and effects on soils, land and geology that can be reasonably foreseen as consequences of the normal construction and operation of the Proposed Development. The assessment considers the potential sources of change resulting from Proposed Development activities detailed in the project description (Chapter 3).

The potential for loss of agricultural soils will be considered, as will the potential to impact geologically important sites and land quality. Associated secondary potential impacts of changes to land quality on human health are also considered. It should be noted that this assessment does not, however, constitute a contaminated land risk assessment, a geotechnical/geohazard risk assessment, or detailed quantitative human health risk assessment.

The potential effects associated with hydrogeological and hydrological receptors are considered in Chapter 7 (Water). The effects of the Proposed Development on population and human health are addressed in Chapter 4 (Population and Human Health), although as noted above the potential effects of land quality on human health are considered in the current chapter. Any secondary effects on ecology or biodiversity due to changes in land quality or habitat removal are considered in Chapter 5 (Ecology and Biodiversity).

6.1.2 Geographical and Temporal Scope

The geographical study area for the assessment covers the Proposed Development area (as identified in Figure 6.1 and a buffer zone of 500 m from the development boundary, because most potential effects to geological, land and soil receptors are anticipated to occur within the development footprint or immediately adjacent to it.

The temporal scope of the assessment covers the construction and after-use project phases. A decommissioning phase for the development has not been considered due to the 'permanent' nature of the development. When it is demolished, it is assumed that the legislation, guidance and good practice at that time would require to be followed, and the effects would be likely to be similar to the construction effects, as broadly similar activities would be undertaken.

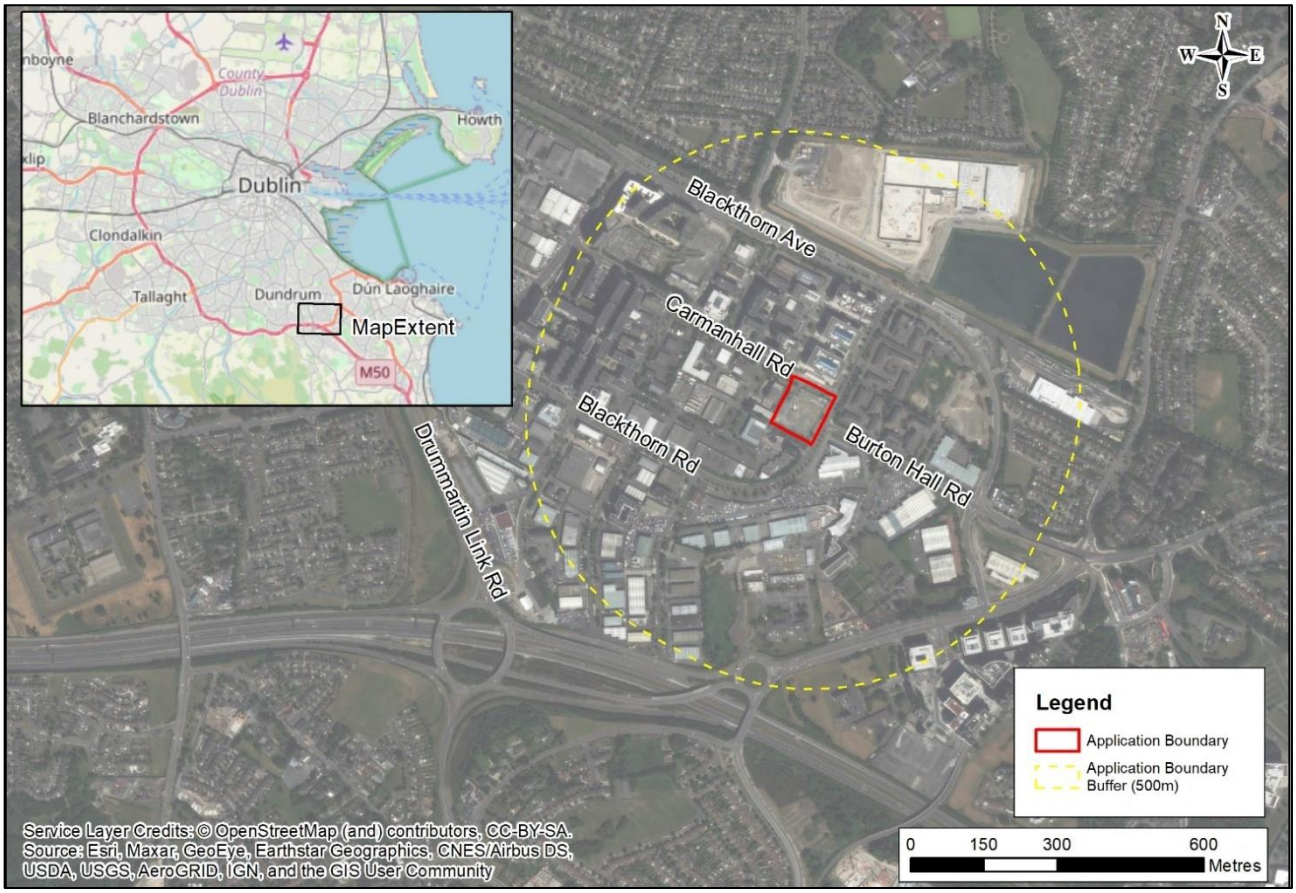

Figure 6.1: Location of the Proposed Development

6.2 Legislative and Policy Context

This section addresses the legislation and guidance that has been considered when preparing this chapter, and key policy context relevant to soils, land and geology that has guided the focus of the assessment. The overarching EIA legislation under which this assessment is required is addressed separately in Chapter 2 (Scope and Methodology).

6.2.1 Legislation and Guidance

In addition to the Regulations that underpin the EIA process (see Chapter 2), this assessment has been made with cognisance to relevant guidance, advice and legislation, including, but not limited to:

- The European Communities (Environmental Liability) Regulations 2008 (as amended) - These Regulations (SI 547/2008) transpose EU Directive 2004/35/CE on environmental liability with regard to the prevention and remedying of environmental damage. The purpose of these Regulations is to establish a framework of environmental liability based on the 'polluter-pays' principle, to prevent and remedy environmental damage. The Environmental Protection Agency (EPA) is designated as the competent authority for all aspects of these Regulations.
- The Environmental Protection Agency Act 1992 and the Protection of the Environment Act 2003 – which detail the requirements associated with general pollution control and activities that come under integrated pollution prevention and control.
- The EPA Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (Draft, August 2017) – which presents key topics of interest, high-level information on the interactions that should be considered in relation to EIA legislation, and overviews on the recommended approach to

describing the baseline environment, completing impact assessments, describing effects, and addressing mitigation and monitoring.

- The EPA Advice Notes for Preparing Environmental Impact Statements (Draft, September 2015).
- Department of Housing, Planning and Local Government. Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (August 2018).
- Gov.uk online guidance, Guidance on Land Contamination Risk Management (LCRM). Available at https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks. Uses a tiered approach to risk assessment, including preliminary risk assessment, generic quantitative risk assessment and detailed quantitative risk assessment.
- The National Roads Authority Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (undated) in relation to aspects to be considered and assessment approach (including relative receptor importance and cross discipline interactions).
- Institute of Geologists of Ireland. Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (April 2013).
- The National Roads Authority Guidelines for the Creation, Implementation and Maintenance of an Environmental Monitoring Plan (undated) in relation to impact mitigation.
- CIRIA C741: Environmental Good Practice on Site (2015, Fourth Edition) in relation to source of impact and mitigation.
- Scottish and Northern Irish Pollution Prevention Guidelines (PPGs) and Guidance for Pollution Prevention (GPPs) – these, although not Irish guidance, provide environmental good practice guidance for activities such as oil and chemical storage, works in or near water, works on construction sites, and dealing with spills and pollution incidents.

6.2.2 Local Policy

The **National Planning Framework (Project Ireland 2040)** includes National Policy Objective 60 to “Conserve and enhance the rich qualities of natural and cultural heritage of Ireland in a manner appropriate to their significance”.

The current local plan is the **Dún Laoghaire-Rathdown Development Plan 2016 to 2022**. A review of this was initiated in January 2020 covering 2022 to 2028. The Draft Plan 2022 – 2028 is on public display online from January 12th, 2021 to April 16th 2021. Under the principles of development within the plan, the planning authority will require adequate and appropriate investigations to be carried out into the nature and extent of any soil contamination and the risks associated with site development work where brownfield development is proposed. Within the Strategic Environmental Assessment Environmental Report (January 2021) that accompanies the Draft Plan 2022 – 2028, the ‘Soil (and Land)’ Component includes the following Strategic Environmental Objectives (SEOs):

- Protect soils against pollution, and prevent degradation of the soil resource
- Promote the sustainable use of infill and brownfield sites over the use of greenfield within the County
- Safeguard areas of prime agricultural land and designated geological sites

6.3 Assessment Methodology and Significance Criteria

6.3.1 Introduction

This section presents the method used to assess the impacts and effects of the Proposed Development on soils, land and geology, and to secondary associated human health receptors. It establishes the stages of the assessment, and the qualitative criteria used to assess impact magnitude and determine the level of effect significance.

6.3.2 Qualitative Assessment Method

The assessment of potential effects has been undertaken using the qualitative assessment method outlined below, and is supported by the baseline condition information, the Proposed Development design and the preliminary Construction Management Plan (pCMP) and Construction Environmental Management Plan (CEMP). Accompanying this EIAR are initial versions of these documents, which will be further developed by the Main Contractor, who will be appointed by the Developer and contracted to undertake the relevant mitigation measures identified in this EIAR during the construction phase). The assessment follows a staged approach. A summary of the stages involved is included below:

1) Confirm baseline conditions – determine baseline and develop conceptual site model by consideration of available records and data sets, site reports and published information.

2) Confirm the key receptors and their value/importance.

3) Qualitatively characterise the magnitude of impacts on the receptors – describe what potential changes could occur to each receptor as a result of the Proposed Development, identify source-pathway receptor linkages, and assign the magnitudes of impact. This stage takes into account embedded design mitigation, good practice in construction environment management and pollution prevention.

4) Determine the initial effect significance of each potential impact on each sensitive receptor.

5) Consider the need for additional mitigation if it is considered necessary to reduce the initial magnitude of the impact and associated effect significance further.

6) Assess the residual impact magnitude and residual effect significance after all mitigation is applied.

Stages 1 and 2 have been completed using published literature and guidance and available information specific to the Proposed Development, which is presented in Chapter 3. For the identification of receptor value/importance that completes Stage 2, and for the description of impact magnitude (Stage 3), a common framework of assessment criteria and terminology has been used based on the EPA's draft Guidelines on the Information to be Contained in EIARs (EPA, 2017)[1], with some modifications made to increase clarity. The descriptions for value (sensitivity) of receptors are provided in Table 6.1 and the descriptions for magnitude of impact are provided in Table 6.2.

The potential for an impact to occur at a receptor has been determined using the understanding of the baseline environment and its properties and consideration of whether there is a feasible linkage between a source of impact and each receptor (i.e. a conceptual site model). This follows the method of preliminary risk assessment that is widely presented in some of the guidance documents listed in Section 6.2.

[1] Environmental Protection Agency (2017) Guidelines on the information to be contained in Environmental Impact Assessment Reports, Draft, August 2017

Table 6.1: Environmental value (sensitivity) and descriptions

Value (sensitivity) of receptor / resource	Typical description
High	High importance and rarity, national scale, and limited potential for substitution. For example: Global/European/National designation Large volumes of nationally or locally important peat Well drained and highly fertile soils Proven economically extractable mineral resource Human health.
Medium	Medium or high importance and rarity, regional scale, limited potential for substitution. For example: Regionally important sites Moderately drained and/or moderate fertility soils.
Low	Low or medium importance and rarity, local scale. For example: Locally designated sites Poorly drained and/or low fertility soils.
Negligible	Very low importance and rarity, local scale.

Table 6.2: Magnitude of impact and typical descriptions

Magnitude of impact (change)		Typical description
High	Adverse	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements. Significant harm to human health - death, disease, serious injury, genetic mutation, birth defects or the impairment of reproductive functions. Significant harm to buildings/infrastructure/plant - Structural failure, substantial damage or substantial interference with any right of occupation.
	Beneficial	Large scale or major improvement of resource quality; extensive restoration; major improvement of attribute quality.
Medium	Adverse	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.
	Beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Low	Adverse	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
	Beneficial	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring.
Negligible	Adverse	Very minor loss or alteration to one or more characteristics, features or elements.
	Beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.

The assessment of magnitude of impact considers whether the change that causes the impact is positive or negative, and whether the impact is direct or indirect, short- medium- or long-term, temporary or permanent, and if it is reversible.

For the purposes of this assessment, a direct impact is one that occurs as a direct result of the Proposed Development and is likely to occur at or near the development itself. Indirect impacts (or secondary/tertiary impacts) are those where a direct impact on one receptor has another knock-on impact on one or more other related receptor(s) (e.g. the Proposed Development results in a change in land quality, which then has an indirect impact on human health). Indirect impacts can occur within the study area or away from the Proposed Development.

For the purposes of this assessment, the following definitions of duration have been used:

- Temporary – effect likely to last less than 1 year without intervention (i.e. less than the construction phase);
- Short term – effect likely to last 1 to 7 years without intervention;
- Medium term – effect likely to last 7 to 15 years without intervention;
- Long term – effect likely to last 15 to 60 years without intervention; and
- Permanent – effect likely to last over 60 years without intervention.

An irreversible impact is defined as a change to the baseline that would not reverse itself naturally. Such impacts will usually be long-term and irreversible, such as the removal of best and most versatile agricultural soils. A reversible impact is defined as a change to the baseline conditions that would reverse naturally once the source of the impact is exhausted or has stopped.

6.3.3 Significance Criteria

The approach followed to derive effects significance from receptor value and magnitude of impacts (Stage 4) is shown in Table 6.3. Where Table 6.3 includes two significance categories, reasoning is provided in the text if the lower of the two significance categories is selected. A description of the significance categories used is provided in Table 6.4.

Table 6.3: Significance Matrix

	Magnitude of Impact (Degree of Change)				
Environmental value (Sensitivity)		Negligible	Low	Medium	High
	High	Slight	Slight or moderate	Moderate or large	Profound
	Medium	Imperceptible or slight	Slight or moderate	Moderate	Large or profound
	Low	Imperceptible	Slight	Slight	Slight or moderate
	Negligible	Imperceptible	Imperceptible or slight	Imperceptible or slight	Slight

Table 6.4: Significance categories and typical descriptions

Significance Category	Typical Description
Profound	An effect which obliterates sensitive characteristics.
Large	An effect which, by its character, magnitude, duration or intensity alters a significant proportion of a sensitive aspect of the environment.
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.

Significance Category	Typical Description
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Imperceptible	An effect capable of measurement but without significant consequences.

Residual adverse effects of 'large' or 'profound' significance are considered to be 'significant' for the purposes of this assessment.

If required following the assessment of the level of effect significance, additional mitigation measures are presented that will be used to avoid, prevent or reduce the magnitude of the potential impact (Stage 5). The significance of the effect taking into account the additional mitigation is then assessed (Stage 6) to give the residual effect significance. Any monitoring that will be required to measure the success of the mitigation is also presented in residual impacts and effects tables (Stage 7) (see Section 6.7).

The effects of the Proposed Development are also considered cumulatively with those that could foreseeably result from other known developments in the assessment study area that are going through the planning process (see Chapter 16).

6.4 Baseline Conditions

This Section presents baseline information on soils, land use, land quality and geology. Information about the water environment (including hydrogeology) is included in Chapter 7.

6.4.1 Soils and Land Use

There is no soil cover mapped on Site; only made ground (EPA, 2020).

The Proposed Development is in an urban area where land use is mixed (industrial, commercial and residential). There are no waste facilities, or dump sites mapped within the study area (EPA, 2020).

There are a number of historical maps available for the area (Ordnance Survey of Ireland, 2020) including:

- 6" historical map (1837-1842)
- 25'' OSI maps (1888-1913)
- 6" Cassini Map (1830s to 1930s)

All of the maps show the area as agricultural / pasture. Historical land use is likely to have been agricultural prior to development of the industrial estate (date unknown). Online mapping shows development on the Site since at least 1995 (Ordnance Survey of Ireland, 2020). The warehouse shown in those images was demolished some time between June 2018 and July 2019.

The most recent former occupier of the Site was Avid Technologies International, which is a technology and multimedia company. It is unknown what activities were undertaken on the Site, or what materials were used or stored there. Whilst building materials may have contained asbestos in the past, the Site has been demolished to ground level with no stockpiled waste material remaining on site. Fuels or other substances may have been stored in bulk on site.

6.4.2 Mapped Superficial (Subsoil) Geology and Bedrock Geology

The mapped Quaternary sediments comprise Till derived from limestones, and the mapped bedrock geology comprises granites of the Northern and Upper Liffey Valley Plutons Formation (GSI, 2020). The depth to

bedrock is mapped as potentially being within the top 1 m, but local variations may occur. The subsoil mapping for the study area is presented in Figure 6.2. The bedrock geology mapping for the study area is presented in Figure 6.3.

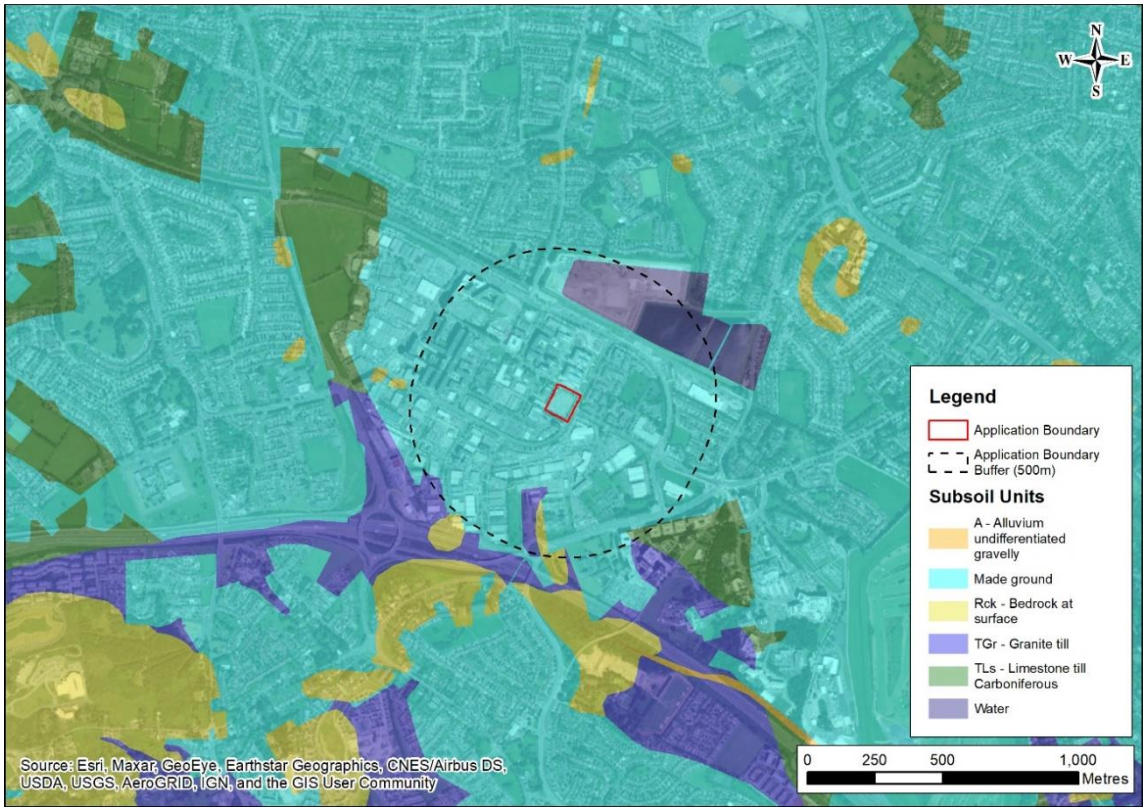

Figure 6.2: Subsoil Mapping in Study Area

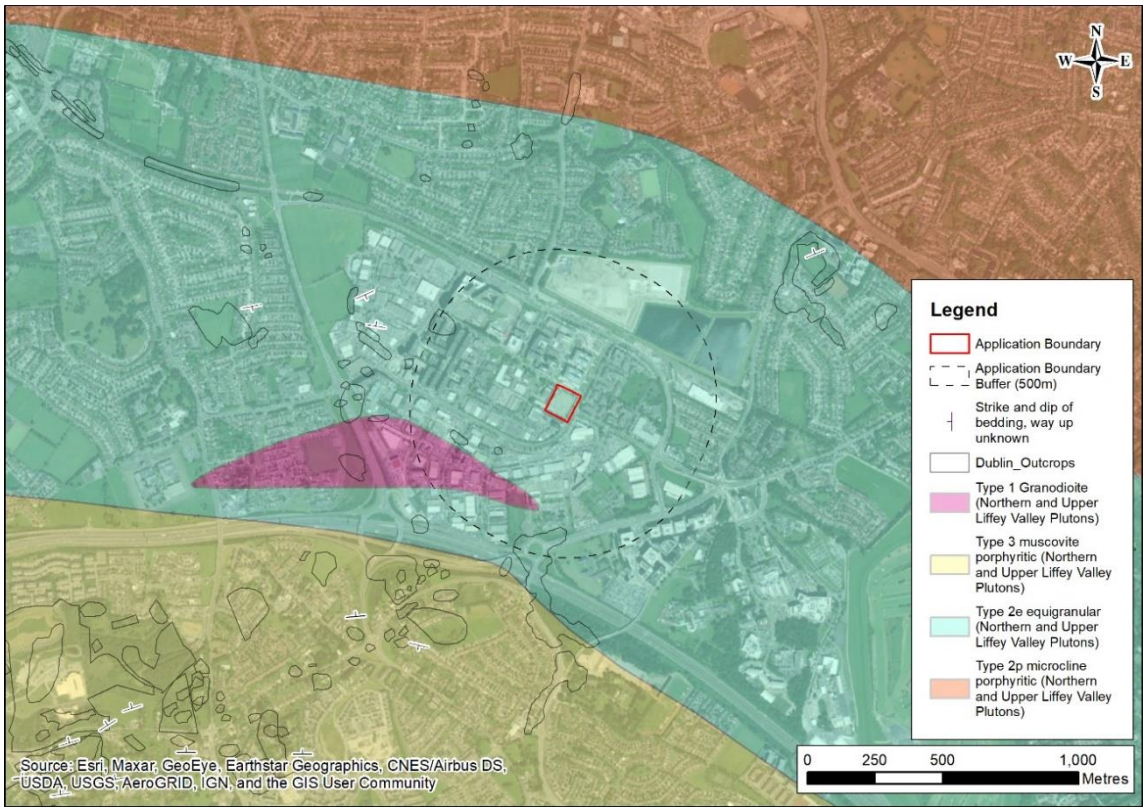

Figure 6.3: Bedrock Geology Mapping in Study Area

6.4.3 Site Geology

A site investigation was undertaken in 2020 (AECOM Consulting Engineers, 2020). Intrusive works comprised four cable percussion boreholes of 200 mm diameter (BH01 to BH04) that were located in the corners of the Site, two 78 mm diameter rotary core boreholes (RC02 and RC04), and 12 trial pits (TP01 to TP12). Ground gas monitoring was also undertaken, and soil samples were taken for geotechnical and environmental laboratory analysis.

At the cable percussion borehole locations Tarmac up to 20 cm thick was logged at the surface in some places and there was fill material (Made Ground) to between 1.0 m below ground level (bgl) and 1.9 m bgl. This material was described as clay with gravel, clayey gravel or gravelly sand with some brick and concrete and occasional wood, plastic and metal. Below the fill, stiff to very stiff brown and grey sandy gravelly clay was logged to between 7.3 m bgl and 11.2 m bgl. This was interpreted as Glacial Till/Boulder Clay. These findings were also supported by the trial pit observations.

The rotary core boreholes were drilled through the Glacial Till and into granite bedrock below. The granite was described as weak to medium fractured, and was encountered at 8.7 m bgl in RC02. Very weathered granite was encountered in RC04 at 11.1 m bgl.

The geological succession encountered at the Site corresponds with the mapped geology.

The results of the ground gas monitoring (carbon dioxide, oxygen and methane) showed there was negligible gas and it was concluded in the AECOM report that no safety issues relating to ground gas were identified.

The results of the chemical tests for sulphate, chloride and pH indicated no special foundation precautions required to deal with sulphate or chloride aggression (AECOM, 2020). Made ground/fill samples were taken down to a depth of 1 m bgl and were tested for waste acceptance criteria. It was concluded in the AECOM report that the material would be likely to be acceptable as waste at inert sites (although it was considered that a Waste Characterisation Assessment might be required by landfill operators in the event of major excavation). No asbestos traces were identified.

6.4.4 Geological Assets and Geohazards

There are no active quarries or mineral sites at or near the Proposed Development (GSI, 2020).

Landslides/mass movements typically occur due to erosion of features such as cliffs, or due to factors such as slope, saturation/drainage, vegetation, soil structure and loading/disturbance on sites with unconsolidated deposits such as peat. The Proposed Development is in a low landslide susceptibility area (GSI, 2020).

6.4.5 Radon

The Radon Map for Ireland (EPA, 2020) indicates that the Proposed Development is located in an area where between 5% and 10% of homes are estimated to be above the radon reference level. All new homes in High Radon Areas need to be installed with a radon barrier. A High Radon Area is classified by the EPA as any area where it is predicted that 10% or more of homes will exceed the Reference Level of 200 becquerel per cubic metre (Bq/m3). The Proposed Development is not located in a High Radon Area.

6.4.6 Designated Geological Sites

There are no geological sites of interest at, or within 0.5 km of, the Proposed Development (EPA, 2020).

6.4.7 Selection of Sensitive Receptors

No geological heritage sites or mineral sites have been identified as part of the baseline. The superficial tills are unlikely to represent a future resource and the bedrock geology beneath the Site that could be used as a

crushed rock resource is ubiquitous across Ireland. Therefore, the impacts to, and effects on, geological sites and mineral or aggregate reserves have not been considered further in this assessment.

There is no indication that the Proposed Development would sterilise any limited geological resources and there are no soils (agricultural or not) mapped at the Site, so the use or sterilisation of natural resources, loss of organic matter, soil erosion, or soil compaction is not considered further.

Land quality assessment work to date (AECOM, 2020) does not indicate any widespread contamination at the Site. The historical industrial/commercial use of the land could mean previously unidentified contamination might be present. The Proposed Development should not lead to new contamination. Therefore, land quality within, and immediately adjacent to, the Proposed Development will be the main receptor considered during the construction phase and the operational phases of the assessment. Associated potential impacts to human health will also be considered in both phases.

Taking account of the above and the receptor classification method described in Section 6.3, the receptors carried forward in this assessment and their assigned importance are presented in Table 6.5.

Table 6.5: Soil, Land and Geology Receptors

Receptor	Importance and Reasoning
Land (soil/sub-soils) at and immediately adjacent to the Proposed Development	Negligible (no designation, no rarity, local importance)
Human Health (workers during construction and after-use occupiers)	High (human health receptor)

6.5 Characteristics of the Proposed Development

6.5.1 Proposed Development Plans

Construction of the Proposed Development is expected to last for approximately 24 months. The operational phase of the Proposed Development will follow and will be of a 'permanent' duration (i.e. lasting greater than 60 years).

The Proposed Development will comprise of:

(i) construction of a Build-To-Rent residential development within a new part six, part eight, part nine, part eleven storey rising to a landmark seventeen storey over basement level apartment building (40,814sq.m) comprising 428 no. apartments (41 no. studio, 285 no. one-bedroom, 94 no. two-bedroom & 8 no. three-bedroom units) of which 413 no. apartments have access to private amenity space, in the form of a balcony or lawn/terrace, and 15 no. apartments have access to a shared private roof terrace (142sq.m) at ninth floor level;

(ii) all apartments have access to 2,600sq.m of communal amenity space, spread over a courtyard at first floor level and roof terraces at sixth, eighth and ninth floor levels, a 142sq.m resident's childcare facility at ground floor level, 392sq.m of resident's amenities, including concierge/meeting rooms, office/co-working space at ground floor level and a meeting/games room at first floor level, and 696sq.m of resident's amenities/community infrastructure inclusive of cinema, gym, yoga studio, laundry and café/lounge at ground floor level. The café/lounge will primarily serve the residents of the development and will be open for community use on a weekly/sessional basis;

(iii) provision of 145 no. vehicular parking spaces (including 8 no. mobility parking spaces, 2 no. club-car spaces and 44 no. electric charging spaces), 5 no. motorcycle parking spaces, bin stores, plant rooms,

switch room and 2 no. ESB sub-stations all at ground floor level; provision of bicycle parking (752 no. spaces), plant and storage at basement level; permission is also sought for the removal of the existing vehicular entrance and construction of a replacement vehicular entrance in the north-western corner of the site off Carmanhall Road;

(iv) provision of improvements to street frontages to adjoining public realm of Carmanhall Road & Blackthorn Road comprising an upgraded pedestrian footpath, new cycling infrastructure, an increased quantum of landscaping and street-planting, new street furniture inclusive of bins, benches and cycle parking facilities and the upgrading of the existing Carmanhall Road & Blackthorn Road junction through provision of a new uncontrolled pedestrian crossing; and,

(v) All ancillary works including provision of play equipment, boundary treatments, drainage works - including SuDS drainage, landscaping, lighting, rooftop telecommunications structure and all other associated site services, site infrastructure and site development works. The former Avid Technology International buildings were demolished on foot of Reg. Ref. D16A/0158 which also permitted a part-five rising to eight storey apartment building. The development approved under Reg. Ref. D16A/0158, and a subsequent part-seven rising to nine storey student accommodation development permitted under Reg. Ref. PL06D.303467, will be superseded by the Proposed Development.

The plant located in the basement will include heating, water tanks, elements of the ventilation system, switch rooms and parts of the fire-fighting systems (i.e. the sprinkler tanks).

The elevation of the floor of the basement will be at 80.3 metres above Ordnance Datum (m AOD). The ground floor will be at 84.5 m AOD and the surrounding land at about 86.0 m AOD. As current ground elevations are typically around 85 m AOD to 86 m AOD, the development of a basement level will involve the excavation of material.

It is proposed to discharge surface water from the Proposed Development to the existing 450 mm diameter concrete surface water sewer in Carmanhall Road, via a new connection. It is proposed to decommission the existing connection in Blackthorn Drive (AECOM, 2021). All surface water from the Site will discharge to the public network after flowing through the proposed petrol interceptor, where hydrocarbons are removed. Permeable paving is proposed on the access road and 2 no. parking spaces, outside of the under-croft car park. This will reduce the volume and frequency of runoff and will provide a treatment medium. However, infiltration is not proposed, and the system will be lined to prevent ingress from groundwater.

Wastewater drainage is proposed to connect to the existing 225 mm diameter clay wastewater sewer in Arkle Road, as instructed by the Confirmation of Feasibility from Irish Water.

No discharges to ground are planned during any of the project stages.

The Operational Management Strategy Report (Aramark, 2020) states that a property management agent will consult and advise on the operational management strategy. A property management agent will manage the estate and common areas on behalf of the landlord, including maintenance, landscaping and waste storage/management. Plant will be maintained in accordance with manufacturer guidelines. Parking places will only be used for parking (i.e. no other purpose).

6.5.2 Embedded Mitigation

This initial assessment of the significance of potential effects resulting from the Proposed Development takes into consideration any embedded design and commonly undertaken good practice mitigation. The elements of the Proposed Development design and good working practices that reduce the potential for impacts to soils and geology include the following:

- To reduce the impact of the Proposed Development on land and soils, the proposed basement depth was optimised to keep the excavations required to a minimum, and hence this will reduce the amount of material to be exported off-site. It is proposed that where materials are to be exported off-site, a local, appropriately permitted/licenced disposal facility will be chosen where feasible to reduce the carbon footprint associated with the transport and handling of the material.
- No soil or backfill material is anticipated to need to be imported for construction purposes. Materials already on site will be reused where possible. Should any material need to be imported, it will be of a suitable quality that will not lead to ground contamination. Any imported material will come from a suitable source where the quality of the material will have been confirmed prior to acceptance.
- There will be no underground storage tanks, other than those for water attenuation.
- There will be no septic tanks during construction or after-use that could result in leaks to ground. Welfare facilities for construction workers will include portable toilets. Waste from these will be disposed of off-site.
- The completed development will be connected to mains water and foul sewer.
- There are no planned discharges to ground during construction, which will reduce the potential for impacts to land quality.
- There will be no on-site concrete batching.
- Any waste removal will be managed and undertaken by a competent contractor appointed by the Main Contractor according to best practice and disposed of accordingly by a licensed waste disposal contractor.
- The removal of soils from the Site will be carried out in accordance with the Construction Demolition Waste Management Plan (CDWMP). Soils for removal may be suitable for re-use, recovery or disposal subject to further analysis and assessment. Further in-situ testing of these soils will be required and will be conducted by a suitably qualified consultant and overseen by the Main Contractor.
- Excavations will be left open and exposed for as little time as possible, which will reduce the potential for instability, and reduce the potential for leaving pathways open for contamination between the surface and sub-surface.
- Stockpiles will be evaluated and monitored by the Main Contractor and kept stable for safety and to minimise erosion.
- Refuelling and the addition of hydraulic oils or lubricants to vehicles or generators will take place on-site using a mobile bowser fuelling plant (i.e. no bulk fuel storage tanks will be used). This will only take place in designated areas. The designated areas will have impermeable surfaces, any fuel/oils that enter the drains will be intercepted, and the refuelling areas will be equipped with easily accessible spills kits that staff have been trained to use. Any flexible pipe, pump, tap or valve will be fitted with a lock and will be secured when not in use. Portable generators or similar fuel containing equipment will be placed on suitable drip trays.
- The Main Contractor will prepare a Construction Management Plan (CMP) and a Construction Environmental Management Plan (CEMP). The CMP and CEMP set out how the construction of the Proposed Development will be managed. The CMP and CEMP are living documents and will go through iterations before works commence and during the works. The CMP/CEMP will include widely used good practice measures to avoid or reduce the potential impact of construction works on workers, members of the public and the environment. These will include, but not be limited to, the following:
  - All construction works will be conducted in accordance with the appropriate site rules.

- Appropriate Personal Protection Equipment (PPE) will be used by all construction workers. Selection of PPE will depend on the quality of the land being worked and the method by which any contamination present could impact workers (e.g. ingestion, dermal contact, inhalation).
- Hazardous materials will be labelled clearly, transported with care by competent and trained persons, and stored in dedicated areas in appropriately bunded containers. Any liquid accumulating within the bunds, or secondary containment systems, will be disposed of at a suitably authorised facility.
- Maintenance checks and procedures will be completed to reduce the potential for leaks and spills from plant and substance storage.
- Method statements will be prepared and followed for the management, storage, testing and disposal of waste (including excavated materials).
- Water (from run-off, rainfall and groundwater seepage) will be managed during construction to enable the construction of the Proposed Development, maintain stability, and to protect construction workers from unstable excavations.
- Pollution management measures will be implemented to prevent contamination by machinery pollutants, such as fuels, oils and lubricants during construction and operation activities. These measures will be informed by guidance provided in relevant documents, such as the CIRIA guides to environmental good practice on site.
- Other information on good practice to reduce the potential for environmental pollution that will be consulted includes the following documents developed by the Environment Agency (England and Wales), the Scottish Environment Protection Agency and the Northern Ireland Environment Agency:
  - PPG 1 General guide to the prevention of pollution;
  - GPP 2 Above ground oil storage;
  - PPG 6 Working at construction and demolition sites;
  - GPP 8 Safe storage and disposal of used oils;
  - GPP 13 Vehicle washing and cleaning;
  - GPP 21 Pollution incident response planning;
  - PPG 22 Dealing with spills; and
  - PPG 26 Safe storage - drums and intermediate bulk containers.

6.6 Potential Effects

The main potential impacts and associated effects that will be considered in the assessment relate to the following:

- Activities or events that might impact land quality during construction (e.g. leaks and spills from machinery or stored substances, or discharges);
- Mobilisation of existing contamination by construction works (e.g. earth movements, excavation and foundation construction) should there be historical contamination at the Proposed Development, which could impact workers and land quality;
- Dewatering during construction that could lead to destabilisation and/or subsidence of unconsolidated soils and sub-soils;

- Importation of material that could be unsuitable for the intended after-use;
- Activities that might impact land quality or development occupiers during operation (e.g. leaks and spills); and
- Fuel and chemical storage during operation – general maintenance activities.

These are considered and assessed in the following sections.

6.6.1 Construction Phase Impacts

General earthworks (e.g. excavation, soil movement, ground compaction, stockpiling, reprofiling) have the potential to affect human health of workers if they were to become unstable. The stability of excavations and stockpiles will be monitored and managed by the Main Contractor, who will be obliged to do so in line with relevant legislation, the CMP and the contract, so the potential impact is predicted to be **negligible (adverse).**

Dewatering may be required during construction. Based on the project description and the groundwater encountered during site investigation works, this would be limited in inflow rate and within the top metre or two from the ground surface rather than within deeper saturated aquifer systems. This would lead to drainage of pore water and changes in effective stress that can lead to destabilisation and/or subsidence of unconsolidated soils and sub-soils. This, in turn, could result in a source of impact to construction workers. The potential for this will be addressed at the design stage and water management will be addressed in the CMP/CEMP. Any effects that will be managed will be local. Therefore, the predicted potential impact on both soils and human health is **negligible (adverse).**

Excavation work could lead to the disturbance and mobilisation of existing ground contamination. This could impact existing land quality or construction workers. Land quality assessment work to date (AECOM, 2020) does not indicate widespread contamination at the Site. Where required, appropriate PPE will be used by construction workers and this will be specified in the CMP. The land quality at the Site is unlikely to be fully characterised by the previous investigation work, so previously unidentified contamination could be present given the historical industrial/commercial use of the land. Therefore, the predicted potential impact on adjacent land quality and human health is **low (adverse)**.

Although not currently intended, if material is imported as part of the construction process, leaching from the import and use of contaminated soil/infill materials has the potential to impact existing land quality or construction workers. The embedded mitigation associated with assessment of the suitability and quality of any imported materials means the predicted potential impact on adjacent land quality, development features and human health is **negligible (adverse)**.

Fuel and other substance leaks or spills from stored substances or from machinery/equipment used during development could affect the chemistry of the soil. There will be no underground tanks, no septic tanks, refuelling will take place using a mobile bowser fuelling plant and only in designated areas suitable for refuelling, the CMP/CEMP will include maintenance and management procedures, there are no planned discharges to ground, and hazardous materials will be managed and stored appropriately. The predicted potential impact on land quality is **negligible (adverse).**

Wheel washing may take place on site during construction to reduce the deposition of material on surrounding roads. It is assumed that the wheel wash would be supplied from the mains and would be reused as much as possible. The water and sludge that collects in the wheel wash has the potential to become contaminated with material washed off the vehicles. If this was to be discharged or leak to ground, this could affect the chemistry of the ground. Without management, localised land quality changes could occur. The predicted impact to land quality is **low (adverse)**.

Welfare facilities will include portable toilet facilities; the waste from which will be disposed of off-site. Leaks from these to ground could affect land quality. Good practice construction site pollution prevention guidance will be followed and there will be no discharges to ground. The predicted impact potential impact on land quality is **negligible (adverse).**

6.6.2 Operational/After-use Phase Impacts

The proposed after-use of the Proposed Development is as rented residential housing and associated amenities (e.g. recreational spaces, parking, café and communal facilities).

There is the potential that discharges to ground, or leaks, could lead to local land quality being affected. Such discharge or leaks could originate from sewerage; drainage from areas of hard-standing; and transport, storage and handling of waste and hazardous substances such as fuel for the Proposed Development's systems. The potential impact from sanitary waste will be mitigated by connection to mains sewer. Drainage from hard-standing will be attenuated via permeable paving and swales, and all surface water from the Site will discharge to the public network after flowing through the proposed petrol interceptor, where hydrocarbons are removed. An operational management strategy will be developed that covers operational property management. With these embedded measures the predicted potential impact on land quality is **negligible (adverse)**.

The evaluation of effects takes into account the predicted impact magnitude combined with receptor sensitivity. The evaluation of effect significance from each of the initial construction and after-use impacts (taking account of embedded mitigation) discussed above is presented in Table 6.6. As can be seen from Table 6.3, any negligible initial impact magnitude will result in a slight, not significant or imperceptible level of effect significance, which are all 'not significant'. Therefore, Table 6.6 only includes those sources of impact that may result in a low to high initial impact magnitude.

Table 6.6: Evaluation of Initial Impacts and their Effect Significance

Project Phase	Receptor	Sensitivity	Source of Impact/Description of Change*	Impact Magnitude*	Level of Effect *
Construction	Land	Negligible	Disturbance and mobilisation of existing ground contamination	Low (adverse)	Slight
			Discharge of wheel washing water/sludge	Low (adverse)	Slight
	Human Health	High	Disturbance and mobilisation of existing ground contamination	Low (adverse)	Moderate

* Taking account of embedded mitigation

6.6.3 'Do-Nothing' Scenario

In the event that the Proposed Development does not progress (i.e. the Site remains undeveloped with the previous building demolished), there are unlikely to be impacts on the geological, land or soil environment in the area of the Project Site.

Derelict and vacant land can encourage fly tipping, so there is some potential for pollution incidents to occur and land quality to be adversely impacted if the Proposed Development did not proceed.

6.7 Mitigation and Management

6.7.1 Mitigation

Additional mitigation and/or management is intended to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment. The initial assessment of potential effects (taking into account embedded mitigation) has not identified any significant adverse effects. However, to further mitigate the initial effects associated with land quality and human health, the following additional mitigation will take place:

- If evidence of previously unidentified potential contamination (either visual or olfactory) is identified during construction works, construction good practice and management procedures will be followed that may include investigation and assessment works.
- Any sludge collected from wheel wash used during construction will be tested and disposed of to an appropriate waste disposal facility. No used water or settled solids will be disposed of to land without prior consent of the EPA.

After-use phase occupiers of the Proposed Development will be responsible for managing their activities and applying for (and working within the constraints of) any environment authorisations or consents required for their operations. If the requirements of relevant regulations, licenses and permits (e.g. integrated pollution prevention and control under The Environmental Protection Agency Act 1992 and the Protection of the Environment Act 2003) are adhered to, the magnitude of impact and likelihood will be reduced to acceptable levels.

6.7.2 Monitoring

No monitoring requirement is foreseen to maintain and protect the conditions of the land, soil and geology. Any monitoring associated with licences or permits will be detailed within the licences or permit documentation.

6.7.3 Residual Effects

A summary of the sources of impact, predicted magnitudes of residual impact (accounting for embedded mitigation and additional mitigation) and subsequent residual effect significance is presented in Table 6.7. In all cases the residual effect is **Not Significant and not greater than Slight.**

Table 6.7: Evaluation of Predicted Residual Impacts and their Effect Significance

Project Phase	Receptor (importance)	Potential Source of Impact	Direct or Indirect	Duration*	Reversible or Irreversible	Summary of Combined Mitigation (embedded and additional)	Residual Magnitude of Impact (direction)	Residual Effect Significance
Construction	Land/soil quality (negligible)	Disturbance and mobilisation of existing ground contamination	Direct	Permanent	Reversible	Procedure for dealing with previously unidentified contamination during construction.	Negligible	Not significant/ Imperceptible
		Discharge of wheel washing water/sludge	Direct	Permanent	Reversible	No discharges to ground. Good practice pollution prevention measures. Waste management procedures.	Negligible	Not significant/ Imperceptible
	Human Health - construction workers (high)	Contact with existing ground contamination (e.g. ingestion, dermal contact, inhalation)	Indirect	Permanent	Reversible or irreversible	Procedure for dealing with previously unidentified contamination during construction. Use of appropriate PPE.	Negligible	Not significant/ Slight

* Maximum duration without intervention

6.8 Difficulties Encountered

No particular difficulties were encountered in undertaking the assessment of soils, land and geology.

6.9 Summary and Conclusions

This assessment considers the potential impacts and effects on soils, land and geology that can be reasonably foreseen as consequences of the normal construction and operation of the Proposed Development during the construction and after-use phases.

The main receptors identified that required to be assessed were land (soil/sub-soils) at and immediately adjacent to the Proposed Development and human health (workers during construction and after-use occupiers), that could be secondarily affected by changes to soils/sub-soils.

No geological heritage sites or mineral sites have been identified as part of the baseline. The superficial tills are unlikely to represent a future resource and the bedrock geology beneath the Site that could be used as a crushed rock resource is ubiquitous across Ireland. Therefore, the impacts to, and effects on, geological sites and mineral or aggregate reserves were not considered further in this assessment.

There is no indication that the Proposed Development would sterilise any limited geological resources and there are no soils (agricultural or not) mapped at the Site, so the use or sterilisation of natural resources, loss of organic matter, soil erosion, or soil compaction were not considered further in this assessment.

Known design and construction management mitigation measures were accounted for in an assessment of initial impacts and effects. Where additional mitigation measures could be incorporated to reduce the initial impacts and effects, these were identified and included in an assessment of residual impacts and effects.

In summary, the significance of residual effects on soils and geology (and on human health from soils and geology) resulting from the different potential sources of change are predicted to be **no higher than slight adverse** and, therefore, **not significant** in terms of this assessment.

6.10 References

AECOM Consulting Engineers, 2020: Report on a Site Investigation at Former Avid Site, Sandyford. June 2020. Report 22455.

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