

6 LAND, SOILS AND GEOLOGY

6.1 Introduction

6.1.1 Background and Objectives

McCarthy Keville O’Sullivan (MKO), on behalf of Crown Square Ltd, has carried out an assessment of the potential impacts and associated effects of a proposed mixed use development at the Crown Square site in Mervue, Galway City on the land, soil, and geological environment.

This chapter provides a baseline assessment of the environmental setting of the proposed development in terms of land, soils, and geology, and discusses the potential impacts that the construction and operation of the proposed development will have. Where required, appropriate mitigation measures to limit any identified significant impacts to soils and geology are recommended and an assessment of residual impacts and significance of effects provided.

The objectives of the assessment are to:

- Produce a baseline study of the existing terrestrial environment (land, soil and geology) in the area of the proposed project;
- Identify likely significant effects of the proposed project on land, soil and geology during the construction phase, operational phase and decommissioning phase of each aspect of the development;
- Identify mitigation measures to avoid, remediate or reduce significant negative effects and,
- Assess significant residual effects and cumulative effects of each aspect of the proposed project and other local developments.

6.1.2 Statement of Authority

McCarthy Keville O’Sullivan Ltd. (MKO) is a specialist planning and environmental consultancy. Based in Galway but working nationwide, we deliver challenging and complex projects on behalf of our clients. MKO employs 50 people across the company’s four planning, ecology, environmental and ornithology teams. Our multi-disciplinary service offering and broad range of nationwide experience add real value to our client’s projects.

MKO company experience spans the full range of industry sectors, including renewable energy, commercial development, roads and transport infrastructure, ports and marinas, tourism, energy infrastructure, retail, sport and leisure, quarrying and aggregates, manufacturing, education, housing, waste management, water, telecoms and other utilities.

Our areas of expertise and experience include a wide variety of environmental topics, including soils, subsoils and geology. We routinely are involved with carrying out impact assessments for land, soils and geology for a large variety of project types.

This chapter of the EIAR was prepared by Michael Watson PGeo, Professional Geologist with assistance from Dr John Staunton.

Michael Watson completed an MA in Environmental Management at NUI, Maynooth in 1999. He is a professional geologist (PGeo) and full member of IEMA (MIEMA) as well as a Chartered Environmentalist (CEnv). Michael joined McCarthy Keville O’Sullivan Ltd. in 2014 having gained over 15 years’ experience in a Cork based environmental & hydrogeological consultancy firm. John Staunton holds both a BSc (1st class Hons) and a PhD in Environmental Science. Prior to taking up his position with McCarthy Keville O’Sullivan in October 2014, John worked as a research assistant for several soil and hydrogeological contamination research projects being undertaken by the Earth and Ocean Sciences department in NUI Galway.

6.1.3 Relevant Legislation

The EIAR is carried out in accordance with the follow legislation:

- European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2001 - 2018
- Planning and Development Act, 2000, as amended; and,
- The Heritage Council Acts 1995 and 2018

6.1.4 Relevant Guidance

The soils and geology section of this EIAR is carried out in accordance with guidance contained in the following documents:

- Environmental Protection Agency (2017): Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Environmental Protection Agency (September 2015): Draft - Advice Notes on Current Practice (in the preparation of Environmental Impact Statements);
- European Commission (2017), Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report.
- Environmental Protection Agency (2003): Advice Notes on Current Practice (in the Preparation on Environmental Impact Statements);
- Environmental Protection Agency (2002): Guidelines on the Information to be Contained in Environmental Impact Statements;
- Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements; and,
- National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

6.2 Schedule of Works

6.2.1 Desk Study

A desk study of the Crown Square site and the surrounding study area was largely completed in advance of undertaking a walkover survey. The desk study involved collecting all the relevant geological data for the Proposed Development and study area. This included consultation with the following:

- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland - National Draft Bedrock Aquifer map;
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 14 (Geology of Galway Bay). Geological Survey of Ireland (GSI, 2003);
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets; and,

- General Soil Map of Ireland 2nd edition (www.epa.ie).

6.2.2 Site Investigations

Detailed walkover surveys of the site were completed by MKO on various dates in September and October 2018 including the 28th September 2018, 9th October 2018, 23rd October 2018.

The entire site has been excavated to structural formation level and so the soil, subsoil and bedrock at and around the site are currently exposed and easily visible. As it is not proposed to carry out any further significant excavations, further intrusive investigations are not required. As part of the previous Environmental Impact Statement which was carried out for the previously permitted development on the site, ground investigations were carried out in 2005. 5 no. trial pits were dug on the 16th September 2005 using an excavator to assess the depth to bedrock.

In 2007, immediately prior to construction works commencing, Irish Drilling Ltd carried out a detailed intrusive site investigation comprising the following,

- 16 no. Shell & Auger boreholes and associated sampling
- 7 no. Rotary Core Boreholes to a depth of between 5-14m below ground levels
- 11 no. Trial Pits
- Contamination Testing (carried out by Alcontrol Laboratories).

The Irish Drilling Report is included as Appendix 6-1 of this EJAR.

6.2.3 Impact Assessment Methodology

Using information from the desk study and data from the site investigation, an estimation of the importance of the soil and geological environment within the study area is assessed using the criteria set out in Table 6.1 (NRA, 2008).

Table 6.1. Estimation of Importance of Soil and Geology Criteria (NRA, 2008).

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale.	Geological feature rare on a regional or national scale (NHA). Large existing quarry or pit. Proven economically extractable mineral resource
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and/or soft organic soil underlying site is significant on a local scale.	Contaminated soil on site with previous heavy industrial usage. Large recent landfill site for mixed wastes. Geological feature of high value on a local scale (County Geological Site). Well drained and/or high fertility soils. Moderately sized existing quarry or pit. Marginally economic extractable mineral resource.
Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and/or soft organic soil underlying site is moderate on a local scale.	Contaminated soil on site with previous light industrial usage. Small recent landfill site for mixed Wastes. Moderately drained and/or moderate fertility soils. Small existing quarry or pit. Sub-economic extractable mineral Resource.
Low	Attribute has a low quality, significance or value on a local scale. Degree or extent of soil contamination is minor on a local scale. Volume of peat and/or soft organic soil underlying site is small on a local scale.	Large historical and/or recent site for construction and demolition wastes. Small historical and/or recent landfill site for construction and demolition wastes. Poorly drained and/or low fertility soils. Uneconomically extractable mineral resource.

The statutory criteria (EPA, 2002, 2003, 2015 and 2017) for the assessment of impacts require that likely impacts are described with respect to their extent, magnitude, type (*i.e.* negative, positive or neutral) probability, duration, frequency, reversibility, and transfrontier nature (if applicable). The descriptors used in this environmental impact assessment report are those set out in EPA (2017) Glossary of Impacts as shown in Chapter 1 of this EIAR. In addition, the two impact characteristics proximity and probability are described for each impact and these are defined in Table 6.2.

In order to provide an understanding of this descriptive system in terms of the geological/hydrological environment, elements of this system of description of impacts are related to examples of potential impacts on the geology and morphology of the existing environment, as listed in Table 6.3.

Table 6.2. Additional Impact Characteristics.

Impact Characteristic	Degree/Nature	Description
Proximity	Direct	An impact which occurs within the area of the proposed project, as a direct result of the proposed project.
	Indirect	An impact which is caused by the interaction of effects, or by off-site developments.
Probability	Low	A low likelihood of occurrence of the impact.
	Medium	A medium likelihood of occurrence of the impact.
	High	A high likelihood of occurrence of the impact.

Table 6.3. Impact descriptors related to the receiving environment.

Impact Characteristics		Potential Geological/Hydrological Impacts
Quality	Significance	
Negative only	Profound	Widespread permanent impact on: - The extent or morphology of a cSAC. - Regionally important aquifers. - Extents of floodplains. Mitigation measures are unlikely to remove such impacts.
Positive or Negative	Very Significant/ Significant	Local or widespread time dependent impacts on: -The extent or morphology of a cSAC / ecologically important area. -A regionally important hydrogeological feature (or widespread effects to minor hydrogeological features). -Extent of floodplains. Widespread permanent impacts on the extent or morphology of a NHA/ecologically important area, Mitigation measures (to design) will reduce but not completely remove the impact – residual impacts will occur.

Positive or Negative	Moderate	Local time dependent impacts on: - The extent or morphology of a cSAC / NHA / ecologically important area. - A minor hydrogeological feature. - Extent of floodplains. Mitigation measures can mitigate the impact OR residual impacts occur, but these are consistent with existing or emerging trends
Positive, Negative or Neutral	Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Positive, Negative or Neutral	Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Neutral	Imperceptible	No impacts, or impacts which are beneath levels of perception, within normal bounds of variation, or within the bounds of measurement or forecasting error.

6.3 Existing Environment

6.3.1 Site Description and Topography

The proposed development site is located in Mervue, in Galway City. The total above ground site area for the current planning application (Phase 2) measures approximately 2.0 ha while the ground and basement works area extends to approximately 5.1 ha in total.

Development permitted under a previous planning permission was previously commenced and substantial works were completed in 2008. Soils and subsoils were stripped and bedrock excavated with between approximately 6-7m of excavations across the site footprint. The excavation was partially infilled with a two-story concrete frame adjacent Monivea Road as well as some sections of basement slabs and foundations. Following the onset of the economic recession, development was put on hold and the site was hoarded up. The site is currently a recently reactivated construction site

The general topography of the site excluding the excavation is largely flat. Levels vary on Joyce's Rd from 28-29m AOD (above ordnance datum) and rise to approximately 30.5m AOD on Monivea Road at the eastern extremity of the site. The excavated site area has been reduced to formation level for the original basement which was at an FFL of 23.3m AOD.

The overall local topography outside the excavated site generally slopes from northeast to southwest with areas to the north and south of the site sloping to the north and south respectively. The dominant land use on the bordering land is residential housing to the south, and commercial and industrial to the east, west and north.

6.3.2 Soils and Subsoils

According to GSI mapping (www.gsi.ie), the site is dominated by Made Ground (Made), with surrounding areas also including Karstified limestone bedrock at

surface (KaRck) and Limestone till (Carboniferous) (TLs), though these are mainly to the north and further east. Made ground dominates to the south and southwest. Some other subsoil types are found in the wider area, including undifferentiated alluvium.

The mapped subsoil type (www.gsi.ie) for the proposed site indicate that the majority of the site is underlain by made ground (Made) with some areas of raised peat in the southwest of the site. The local subsoils map is shown as Figure 6.1.

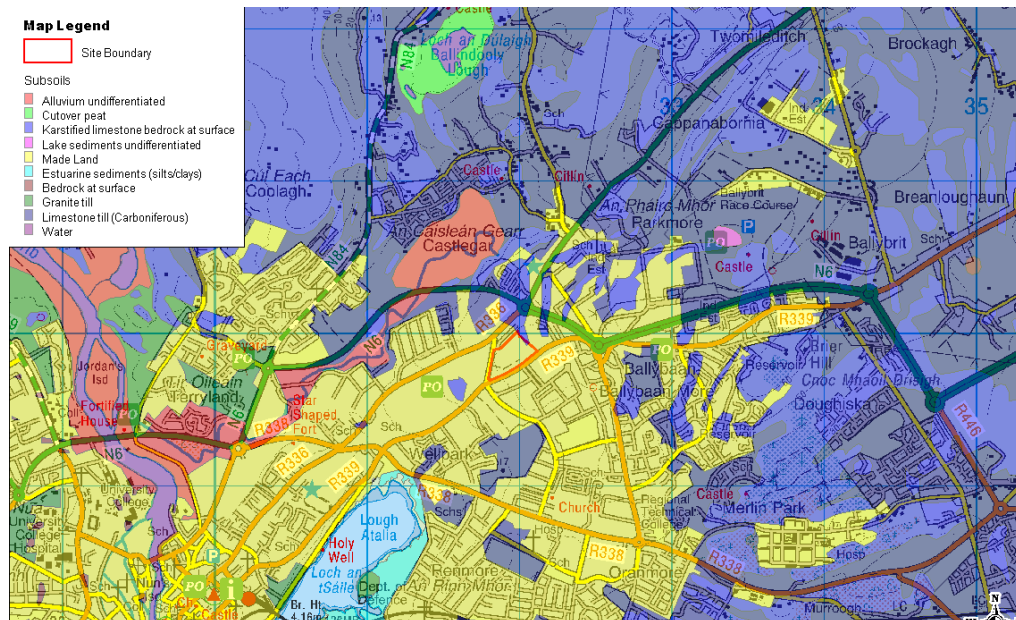


Figure 6.1 Local Subsoils Map

The actual geology of the site is evident due to the excavations already completed and also the results of the Site Investigations carried out in 2005 and in 2007. Any soils and subsoils present around the perimeter of the site comprise topsoil over gravelly sandy Clay with cobbles. The subsoil depth ranges from c0.5m on the eastern boundary to c4m along the southern boundary. The previous site investigations indicate subsoil depths of c 1m towards the north eastern boundary and c4.5m close to the southern boundary.

6.3.3 Bedrock Geology

Based on the GSI bedrock map of the region, the Proposed Development site is underlain by the Burren Formation which, at the proposed development site, comprises Visean Limestones (undifferentiated). The limestones are classified by the GSI as a Regionally Important Aquifer – Karstified (conduit) (Rkc). The aquifer in this area is shown as extremely vulnerable, with an area of rock at surface to the northeastern end of the site.

A bedrock geology map of the area is attached as Figure 6.2.

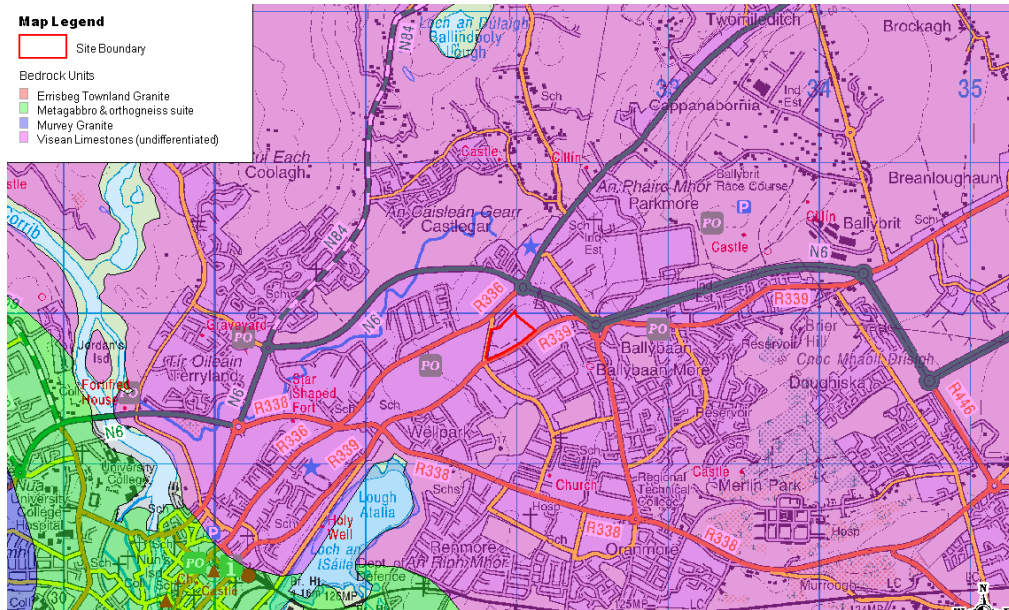


Figure 6.2 Bedrock Geology Map

As the soils, subsoils and up to 4m of bedrock has already been excavated from the site the existing bedrock geology is clearly visible. The bedrock comprises strong, grey thickly bedded fine to medium grained Limestone through the site. The bedding is horizontal and c1-1.5m thick in places. Staining from shallow subsurface flow is evident along the western boundary.

6.3.4 Geological Heritage and Designated Sites

There are no recorded Geological Heritage sites within the proposed development area. The closest geological heritage site is the Roadstone Quarry on the Tuam Road (IGH 8 Lower Carboniferous), which is located approximately 2km northeast of the site.

Approximately 1 km to the southwest of the proposed site is the Galway Bay Complex SAC (Code: 000268) and the Inner Galway Bay SPA (Code: 004031).

6.3.5 Ground Contamination

There are no known areas of soil or ground contamination on the site. During the site walkovers, no areas of particular contamination concern were identified. Any material on the site appears to be excavated rock type material, concrete or other inert building material left from historic construction activity. Some steel also remains on the site, mostly in the form of reinforcing bars for concrete, shipping containers (used as site buildings) and parts of plant such as tower cranes.

The 2007 site investigation included ground gas sampling at 7 boreholes on two occasions and no evidence of any contamination was found. Soil samples were also collected from 6 no locations and sent to Alcontrol Laboratories for testing. Low levels of contamination were found at 1 location at the western boundary however the levels were within acceptable limits for the development. It is not unusual for localised areas of contamination to be present during the development of any brownfield site. It is understood that any contamination arising during the construction project in c 2008 was segregated and removed offsite in accordance with best practice and relevant waste management legislation and supervised by Galway City Council. The existing site does not have any visual or olfactory evidence of

contamination and water sampling completed in October 2018 confirms that there is no residual contamination issues.

According to the EPA online mapping (<http://gis.epa.ie/Envision>), there are no licenced waste facilities on or within the immediate environs of the proposed development site.

There are no historic mines at or in the immediate vicinity of the site that could potentially have contaminated tailings.

6.3.6 Economic Geology

The GSI Online Minerals Database accessed via the Public Data Viewer shows no quarries within the proposed development area.

The GSI online Aggregate Potential Mapping Database shows that the proposed development site is not located within an area mapped as being of Very High or High granular aggregate potential (i.e. potential for gravel reserves). The site has already been excavated as part of historic construction activity, so the available reserves of stone are already depleted. The development value of the land due to its city location outweighs any potential value of the site for the extractive industry.

6.4 Characteristics of the Proposed Development

The proposed development is described in Chapter 3 and will generally comprise the following:

1. A residential scheme comprising 288 no. apartments and amenity accommodation with a gross floor area of 32,379 sqm, which will include:
 - Block G (104 no. units); Block H (136 no. units) and Block J (48 no. units).
 - 75 no. one-beds (26%); 185 no. two-beds (64.2%); and 28 no. three-bed units (9.7%)
 - Ancillary residential amenity areas (1,275 sqm).
 - Block G extends to eight-storeys, Block H extends to seven-storeys and Block J extends to five-storeys.
 - External balconies are provided on all elevations.
2. A commercial scheme with a cumulative gross floor area of 4,096 sqm, which will include:
 - A neighbourhood facility comprising a restaurant (500 sqm), café (50 sqm), local convenience store (225 sqm), a pharmacy (200 sqm), 5 no. retail/commercial units (797 sqm in total), a crèche (310 sqm)
 - A fitness/leisure facility (1,140 sqm); and
 - A medical centre (655 sqm).
3. Public realm and landscaping works, including pedestrian and cyclist linkages.
4. Vehicular access to the double basement permitted under Pl Ref 18/363 and the allocation of 288 no. car parking spaces located on the lower basement level to service the residential units. Visitor car parking will be provided on the upper basement level and will be managed in accordance with an Operational Management Plan and a Mobility Management Plan.
5. The provision of a dedicated cyclist ramp and 733 no. secure bicycle parking spaces located in the upper basement permitted under Pl Ref 18/36 (comprising 529 no. residential; 144 visitor parking and 60 no. bicycle parking spaces to service the neighbourhood facility).

6. All other associated site development, plant and servicing works.
7. The application will be supported by an Environmental Impact Assessment Report and a Natura Impact Statement.

The site has already been excavated to formation level and so minimal further excavations are required. Minor excavations will be required including for new foundation pads and demolition of unusable foundations will be completed. Phase 1 of the development (which includes Commercial Offices (Blocks A-E), Hotel and Site Infrastructure, including all basement structures for the entire site) has received permission, and will be constructed regardless of whether this currently proposed phase 2 is permitted or not.

The construction process and components are described in Chapter 3 and will be generally as follows,

- Temporary site accommodation & welfare facilities
- Final breaking/trimming of rock to formation
- Pads/foundations
- Lower basement drainage
- Lower basement slab
- Rising elements lower basement / upper basement
- Upper basement slab
- Rising elements upper basement / podium
- Podium / Ground floor slab
- Residential/commercial superstructure
- Residential/commercial façade / roof
- Boundary treatments
- Completion of vehicular access, car and cycle parking
- Residential/commercial fitout
- Podium slab / courtyard hard/soft landscaping

Foul Water Drainage

All foul water from the development will discharge to the public foul water sewer network by gravity or pumped via an external below ground drainage system. The foul water drainage is discussed further in Section 7.3.15 of this EIA.

Surface Water Drainage

All surface water from the development will discharge to the public storm water sewer network by gravity or pumped via an external below ground drainage system. The surface water drainage is discussed further in Section 7.3.15 of this EIA.

6.5 Potential Impacts of the Proposed Development

6.5.1 Do Nothing Scenario

The site currently comprises an excavated partially constructed commercial development which was hoarded up for many years and has recently been reactivated as a construction site for Phase 1 of the site masterplan. Phase 1 of the development (which includes Commercial Offices (Blocks A-E), Hotel and Site Infrastructure, including all basement structures for the entire site) has received permission, and will be constructed regardless of whether this currently proposed phase 2 is permitted or not. The potential impacts are considered to be not significant on Land, Soils & Geology.

6.5.2 Likely Significant Effects and Mitigation Measures – Construction Stage

The likely significant effects of the proposed development and mitigation measures that will be put in place to eliminate or reduce them are shown below. These relate to the construction stage. It should be noted that the main potential impacts on the soils and geology environment will occur during the construction stage.

6.5.2.1 Soil/Subsoil Excavation and Bedrock Excavation

Minor excavation of existing subsoil and bedrock will be required for site levelling, for the installation of foundations for foundation pads, service trenching and the development of the proposed landscaping measures. This will result in a permanent relocation of small volumes of soil and subsoil at most excavation locations. The excavated materials will include existing topsoil/subsoil, and some limestone bedrock.

Mechanism: Extraction/excavation.

Receptor: Land, topsoil, subsoil and bedrock.

Potential Impact: Negative, slight, direct, likely, permanent impact on soil, subsoil and bedrock.

6.5.2.1.1 Mitigation Measures

- Excavated (existing) overburden material will be reused on site, where possible;
- A minimal volume of topsoil and subsoil will be removed to allow for infrastructural work to take place due to optimisation of the development layout by mitigation by design i.e. it is not proposed to excavate further into the bedrock or expand the footprint of the development; and,
- Construction of service trenching, pumping station and surface water attenuation features will generate excess material, and all excess material will be used locally within the site for landscaping.

6.5.2.1.2 Residual Impact

Negative, direct, slight, likely, permanent impact on topsoil, subsoils and bedrock.

6.5.2.1.3 Significance of Effects

No significant effects on land, topsoil, subsoils or bedrock are anticipated.

6.5.2.2 Contamination of Soil/Subsoil/Bedrock by Leakages and Spillages

Pathway: Topsoil, subsoil and bedrock pore space/fractures.

Receptor: Topsoil, subsoil and bedrock.

Potential Impact: Negative, direct, moderate, short term, unlikely impact on topsoil, subsoils and bedrock.

6.5.2.2.1 Proposed Mitigation Measures

- All plant and machinery will be serviced before being mobilised to site;
- No plant maintenance will be completed on site, any broken down plant will be removed from site to be fixed;
- Refuelling will be completed in a controlled manner using drip trays at all times;
- Mobile bowsers, tanks and drums will be stored in secure, impermeable storage areas away from open water;
- Fuel containers will be stored within a secondary containment system, e.g. bunds for static tanks or a drip tray for mobile stores;

- Containers and bunding for storage of hydrocarbons and other chemicals will have a holding capacity of 110% of the volume to be stored;
- Ancillary equipment such as hoses and pipes will be contained within the bund;
- Taps, nozzles or valves will be fitted with a lock system;
- Fuel and chemical stores including tanks and drums will be regularly inspected for leaks and signs of damage;
- Drip-trays will be used for fixed or mobile plant such as pumps and generators in order to retain oil leaks and spills;
- Only designated trained operators will be authorised to refuel plant on site;
- Procedures and contingency plans will be set up to deal with emergency accidents or spills; and,
- An emergency spill kit with oil boom, absorbers *etc.* will be kept on-site for use in the event of an accidental spill. A specific team of staff will be trained in the use of spill containment.

Highest standards of site management will be maintained and utmost care and vigilance followed to prevent accidental contamination or unnecessary disturbance to the site and surrounding environment during construction. A named person will be given the task of overseeing the pollution prevention measures agreed for the site to ensure that they are operating safely and effectively.

6.5.2.2.2 Residual Impact

Negative, Imperceptible, direct, short term, unlikely impact.

6.5.2.2.3 Significance of Effects

No significant effects on land, soils, subsoils or bedrock are anticipated.

6.5.2.3 Soil and Subsoil Compaction

Mechanism: Excavation / handling / storage.

Receptor: Land, topsoil, subsoil.

Potential Impact: Negative, direct, slight, likely impact on topsoil and subsoils.

6.5.2.3.1 Proposed Mitigation Measures

The underlying in-situ soils and subsoils will be subject to a certain amount of compaction, but this will be unavoidable.

Any infill material/landscaping that is required will be placed and levelled in appropriate lift thicknesses to ensure the material is not over compacted thereby retaining its drainage properties.

6.5.2.3.2 Residual Impact

Negative, slight, direct, likely impact on topsoil and subsoils.

6.5.2.3.3 Significance of Effects

No significant effects on land, soils, subsoils are anticipated.

6.5.2.4 Assessment of Human Health Effects

Potential health effects arise mainly through the potential for soil and ground contamination. Residential and commercial developments are not a recognized source of significant potential pollution and so the potential for effects during the operational phase are negligible.

Hydrocarbons will be used onsite during construction. However, the volumes will be small in the context of the scale of the project and will be handled and stored in accordance with best practice mitigation measures. The potential residual impacts associated with soil or ground contamination and subsequent health effects are negligible.

6.5.3 Potential Cumulative Impacts

No significant cumulative impacts on land, soils and geology environment are anticipated during the construction or operation phases as long as mitigation measures outlined are put in place. The Phase 1 development also included for the completion of all groundworks required for the entire development. This initial Phase 1 development will have no significant cumulative effect as it refers to the same groundworks. No additional significant groundworks will be carried out as part of the Phase 2 of the overall development.

6.5.4 Likely Significant Effects and Mitigation Measures – Operational Stage

No impacts on soils and geology are anticipated during the operational phase. The operational stage of the proposed development consists of the typical activities in a commercial and residential area and will not involve further disturbance to the topsoil, subsoils and geology of the area.

No significant cumulative impacts on the land, soils and geology environment are envisaged during the operational stage.

6.5.5 Conclusion

Due to the nature of the proposed development and the projects history, excavations and ground disturbance are not generally required for the current proposal. The current proposal will build up from the existing ground levels and so there is limited potential for effects on land, soils and geology.

All excess material excavated for foundation pads or stripped for landscaping purposes will be used for reinstatement and landscaping works around the site at the during the construction phase. Storage and handling of hydrocarbons/chemicals will be carried out using best practice methods and with a full suite of mitigation measures and procedures.

No significant impacts on the land, soil and geology of the site will occur.