5.0 LAND, SOILS, GEOLOGY AND HYDROGEOLOGY

5.1 INTRODUCTION

This chapter of the EIAR evaluates the potential effects on the land, soil, geological and hydrogeological aspects of the site and surrounding area.

In assessing likely potential and predicted effects, account is taken of both the importance of the attributes and predicted scale and duration of the likely effects.

This chapter has been prepared by Linganand Jewargi, Civil, Traffic and Transportation Engineer with Cronin & Sutton Consulting Engineers (CS Consulting) and Niall Barrett, Director of Cronin & Sutton Consulting Engineers (CS Consulting). Linganand holds BEng (Hons) and ME degrees in Sustainable Infrastructure from the Technological University of Dublin and is a member of the Institute of Engineers of Ireland. Niall's academic qualifications are Chartered Civil and Traffic and Transport Engineer B.Eng (Hons), CEng, M.I.E.I, Cert Health and Safety, Cert PSDP, Cert RSA and graduated from Napier University, Edinburgh. Upon graduating in 2005 Niall worked for a Traffic and Transport Engineering practice in Ireland for 8 years until 2013.

5.2 STUDY METHODOLOGY

5.2.1 Assessment Methodology

The assessment was carried out in accordance with the following best practice methodology and the following documents:

- Guidelines for the Preparation of Soil, Geology and Hydrogeology Chapters of Environment Impact Statements (Institute of Geologists of Ireland (IGI) 2013);
- Revised Guidelines on the information to be contained in Environmental Impact Statements (EPA 2015a);
- Advice notes for Preparing Environmental Impact Statements (EPA2015b);
- Guidelines on the information to be contained in Environmental Impact Assessment reports (EPA 2022);
- The Site Investigation Reports prepared by Site Investigations Limited.

This assessment takes into account both the significance of an element of the receiving environment and the magnitude of the potential environmental impacts that the proposed activities may have on it.

- The elements of the receiving environment (and impacts) to be assessed include the following:
- The extent of topsoil and subsoil cover and the potential use of this material on site or requirement to remove it off-site as waste for disposal and recovery;
- High yielding water supply springs/ wells in the vicinity of the site to within a 2Km radius and the potential for increased risk presented by the Proposed Development;
- Classification (regionally important, locally important) and extent of aquifers underlying the site perimeter area and increased risks presented to them by the Proposed Development associated with aspects such as for example removal of subsoil cover, removal of aquifer (in whole or part), drawdown in water levels, alteration in established flow regimes and/or change in groundwater quality;
- Natural hydrogeological/ karst features in the area and potential for increased risk presented by the activities at the site;
- Groundwater-fed ecosystems and the increased risk presented by operations both spatially and temporally; and,
- Presence of area of geological heritage and potential to impact on same.

5.2.2 Sources of Information

Desk-based geological information on the substrata (both Quaternary deposits and bedrock geology) underlying the area in which the site is located was obtained through accessing databases and other archives where available. Data was sourced from the following:

- The Geological Survey of Ireland (GSI) well card, groundwater body descriptions, aquifer type, vulnerability, groundwater boreholes, geological heritage database and source protection zones for the area were inspected,
- Teagasc soil and subsoil database;
- Environmental Agency (EPA) - website mapping and database information.

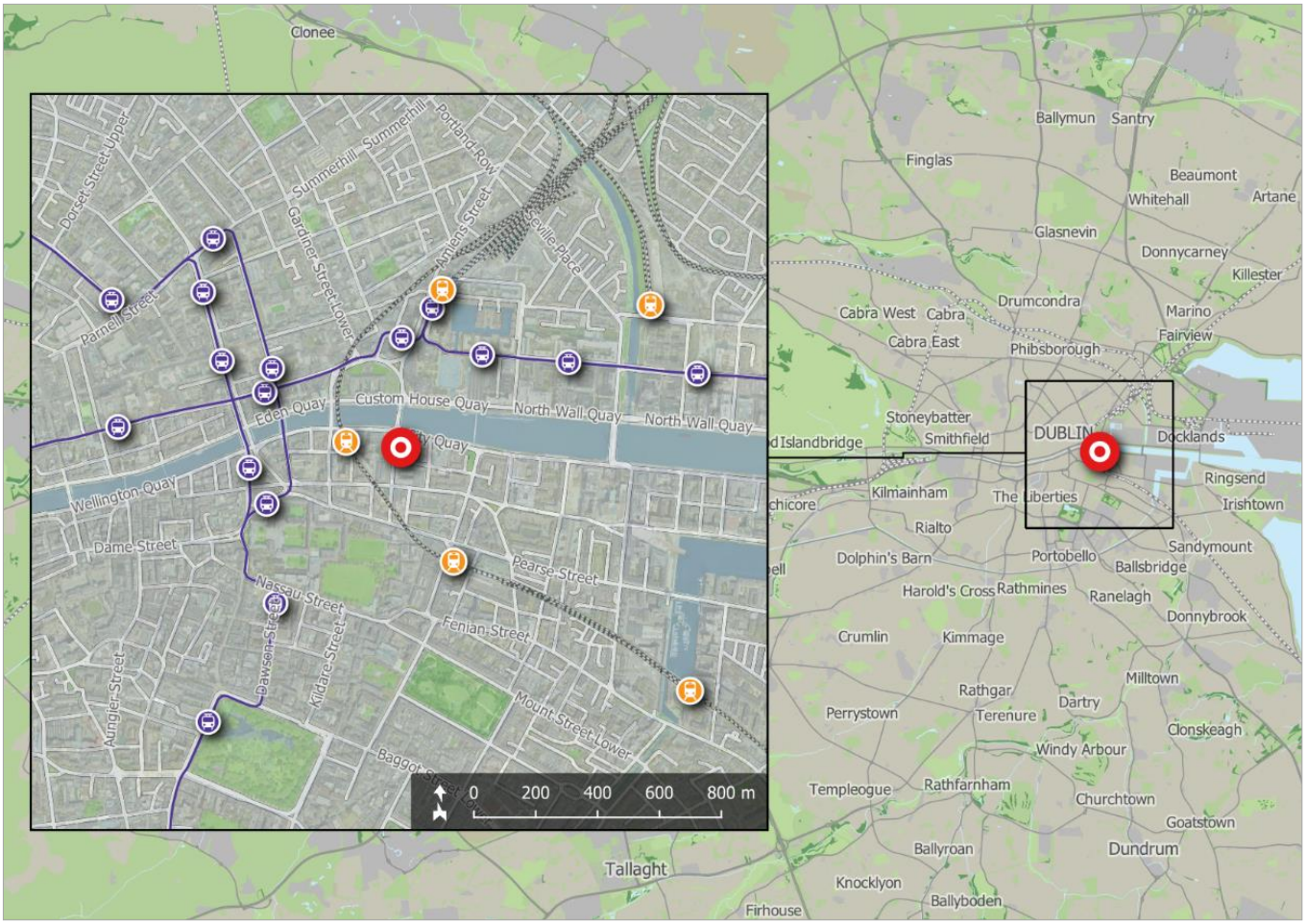
Information on the proposed design including civil engineering works is outlined in the planning drawings and the Engineering Services Report prepared by CS Consulting which is included with the planning submission.

5.3 RECEIVING ENVIRONMENT (BASELINE SITUATION)

5.3.1 Site Area Description

The site of the proposed development lies immediately to the south of the River Liffey. The lands primarily comprise the former City Arts Centre Building and associated hard standing bounded to the north by City Quay, to the west by Moss Street, and to the south by Gloucester Street South. The City Quay Covid testing centre and City Quay National school are situated along the eastern boundary of the subject lands.

Figure 5.1. Site Location



source: EPA, OSI, OSM Contributors, Google

The development site encompasses the existing registered addresses of 1-4 City Quay (D02 KT32) and 5 City Quay (D02 PC03). The site is located at the junction of City Quay and Moss Street the site extends to 0.22 hectares. The site is also bounded to the south by Gloucester Street South. This site is fully hardstanding. The location of the proposed development site is shown in **Error! Reference source not found.** above; the indicative extents of the development site, as well as relevant elements of the surrounding road network, are shown in more detail in Figure 5.2. **Error! Reference source not found.**

Figure 5.2. Site extents and Environs (approximate boundaries denoted with red below)

source: OSI, OSM Contributors, Google

5.3.2 Existing Site Condition

The subject development site is brownfield. Several derelict structures are present in the northern part of the site; the remainder comprises hardstanding that is currently in use as a commercial car park, accessed from City Quay.

The receiving environment in terms of land, soils, geology, and hydrogeology is described in the following sections.

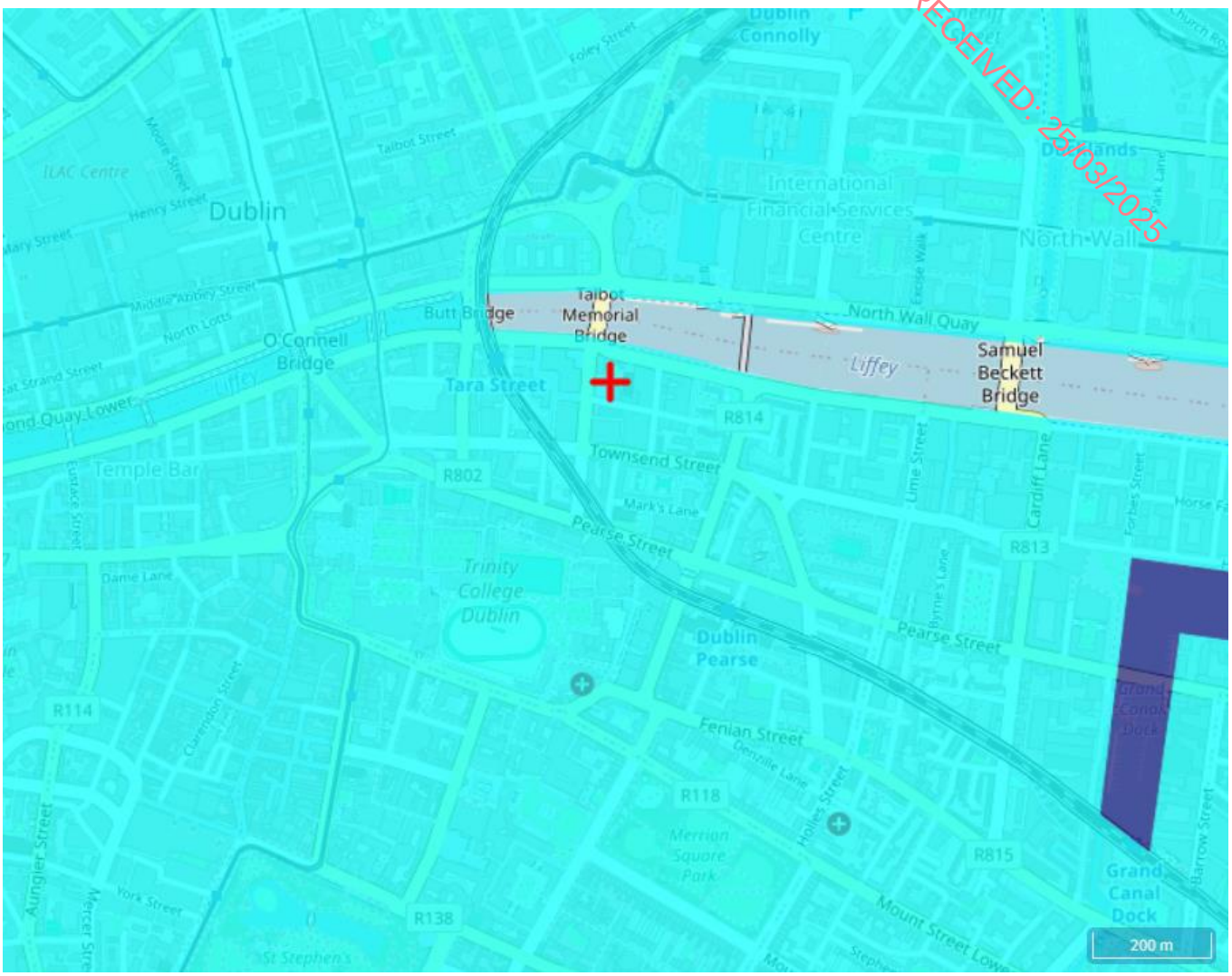
5.3.3 Topography

The topography of the proposed development site is generally flat with the elevation of the site ranging from 2.97mOD to 3.01 mOD.

5.3.4 Soils

Review of the soil maps from the EPA online map tool indicate that the soil type in the vicinity of the subject development site is predominantly Made Ground. Please refer to FIGURE.

Figure 5.3. Soils Map



source: EPA, OSM Contributors

5.3.5 Quaternary Deposits

The GSI bedrock map indicates that the majority of the site and surrounding area is underlain by Dark Limestone and Shale associated with the Lucan Formation. The subsoil is primarily made ground.

5.3.6 Site Investigations

2 no. site investigation reports have been extracted from DCC Planning reg. ref. 4672/22. The details of these site investigations are given below:

Site investigations were carried out in January 2020 by Site Investigations Limited (SIL). The fieldworks comprised the use of a cable percussive borehole. All fieldwork was carried out in accordance with the following relevant design standards:

- BS 5930:2015, Engineers Ireland GI Specification and Related Document 2nd Edition 2016
- Eurocode 7: Geotechnical Design.

Laboratory testing has been performed on representative soil samples recovered from the boreholes and these were completed in accordance of BS 1377: 1990.

Cable percussion boring was undertaken at 3 No. locations using a Dando 150 rig and constructed 200mm diameter boreholes. Prior to drilling commencing, a hand dug inspection pit was excavated to check for underground services.

The boreholes terminated at similar depths from 8.90mbgl (metres below ground level) to 9.1 0mbgl when obstructions were encountered. Bulk disturbed samples were recovered at regular intervals and returned to SIL for laboratory testing.

A second round of site investigations were carried out in April and May 2022 by Ground Investigations Ireland (GII). The purpose of these site investigations was to investigate subsurface conditions. The scope of the works for the April and May investigations undertaken for this project included the following and these are in addition to January 2020 investigations:

- Carry out 3 no. rotary core boreholes to a maximum depth of 12.30m BGL
- Installation of 3 no. groundwater monitoring wells, 3 no. groundwater data loggers and 1 no. barologger
- Groundwater laboratory testing.

Please refer to Appendix 5.1 for details of site investigations undertaken.

5.3.6.1 Ground Types encountered during Site Investigations

As noted above, site investigations were undertaken in 2020 and 2022 by Site Investigations Limited and Ground Investigations Ireland respectively. Below is a summary of ground types encountered in the exploratory holes, in approximate stratigraphic order.

- Surfacing: encountered in all the exploratory holes and was present to a maximum depth of 0.15m BGL.
- Made Ground: encountered beneath the surfacing and was present to a depth of between 2.8 and 3.8m BGL generally, with possible made ground noted to a maximum depth of 5.3m BGL. Made ground deposit were described as brown/grey clayey gravelly SAND with frequent red brick and concrete fragments on greyish brown sandy gravelly CLAY with organic matter.
- Granular Deposits: the granular deposits were generally described as grey slightly clayey slighty sandy subrounded to rounded fine to coarse GRAVEL. The granular deposits varied in depth around the site.
- Cohesive Deposits: the cohesive deposits were generally described as grey sandy gravelly CLAY. The strength of the cohesive deposits was generally stiff from a depth of 3.8m BGL.
- Bedrock: The rotary core boreholes recovered Weak to Medium Strong to Strong thinly laminated grey fine to medium grained LIMESTONE interbedded with weak to medium strong thinly laminated fine0grained Mudstone. The depth to rock varies from 8.3m BGL to a maximum of 9.8m BGL.

5.3.6.2 Environmental Quality

Soil samples were collected during the 2020 ground investigations. Environmental testing was carried out on three samples from the investigation to determine if the material is hazardous or non-hazardous and then the leachate results were compared with the published waste acceptance limits of BS EN 12457 -2 to determine whether the material on the site could be accepted as 'inert material' by an Irish landfill.

The Waste Classification report created using HazWasteOnline ™ software shows that the material tested is classified as hazardous material. All three samples recorded elevated levels of lead with BH01 and BH03 recording elevated levels of zinc. A trace sample of chrysotile (white asbestos) was present in the soil sample extracted from BH02.

It is recommended that any MADE GROUND excavated on site should be stockpiled separately to natural soils to avoid any potential cross contamination of the soils prior to removal from site.

5.3.6.3 Groundwater Conditions

Groundwater details in the borehole during the fieldworks are noted on the log in Appendix 5.1. At the end of the completed fieldwork, the highest water level was recorded at 3.0m BGL.

As part of site investigations carried out in 2022 by GII, standpipes were installed in each of the boreholes to allow the equilibrium groundwater level to be determined. Groundwater levels across the site are generally 3.29m BGL to 3.78m BGL. There is no apparent tidal influence on the groundwater levels at the site.

5.3.6.4 Groundwater Quality

As part of site investigations carried out in 2022 by GII, 3no. groundwater monitoring wells were installed to examine the underlying groundwater quality at the site by GII under the supervision of Byrne Looby.

Groundwater samples were collected from each of the groundwater monitoring wells that was installed within the proposed development site. Therefore, three (3) no. groundwater samples were collected in total. Overall, the groundwater sample was found to be within the permissible parameters for the presence of metals and volatile organic compounds. The groundwater sample from BH01 was found to contain an EPH concentration of 3,330 ug/l which exceeds the EPA Interim Guidance value. Additionally, high concentrations of chloride, sodium and sulphate were encountered at BH02 and BH03.

5.3.7 Groundwater Wells

The GSI provides a record of wells drilled in Ireland. The information provided by GSI shows that the most proximate wells to the subject development site are located approximately 1000m to the east of the proposed development, 1100m to the west of the development site and 850m to the north-west of the proposed development.

Figure 5.4. Wells and Springs in the vicinity of the proposed development

source: GSI

5.3.8 Aquifer Classification and Water Body Status

Groundwater can be defined as water that is stored in, or moves through, pores and cracks in sub-soils. Aquifers are rocks or deposits that contain sufficient void spaces, and which are permeable enough, to allow water to flow through them in significant quantities.

The major bedrock aquifer underlying the site has been classified by GSI as a Locally Important (Lg) Gravel Aquifer which is moderately productive in local zones only.

In addition, no groundwater source protection zones, which are zones defined by the GSI within which development is limited in order to protect groundwater from potential pollution, are identified by the GSI under the site or in the immediate vicinity. There are no karst features in the area.

5.3.9 Aquifer Vulnerability

GSI maps indicate that the aquifer vulnerability is considered 'Low'.

5.4 DO NOTHING SCENERIO

Should the proposed development not take place, the land, soils, geology and hydrogeology will remain in their current state. The site will remain as a brownfield development.

5.5 CHARACTERSISTICS OF THE PROPOSED DEVELOPMENT

The proposed building extends to 14 floors above ground floor and also contains 2no. basement levels. The building structure is reinforced concrete columns with flat-slab post-tensioned floors on foundations bearing on rock. It is proposed to construct 2 basement levels, the lower of which provides 11 car parking spaces including 2 disabled accessible spaces and 3 motorbike spaces. A detailed development description is provided in Chapter 2 (Description of the Proposed Development). The characteristics of the proposed development with regard to the land, soil, geological and hydrogeological environment are outlined below.

5.5.1 Construction Activities

- Site clearance and enabling works.
- Additional removal of shallow made ground and superficial deposits for foundations and civil engineering works.
- Excavation for two (2) no. basement levels.
- Temporary storage of fuel will be required on site for construction traffic.
- Small localised accidental releases of hydrocarbons have the potential to occur from construction traffic operating on site.
- Dewatering is anticipated to be required for construction as excavation into underlying subsoil (water bearing strata) will be required for the basement.

5.5.2 Operational Activities

- Surface Water - There will be no direct discharges to ground required for operation of the facility.
- Water supply - Water supply will be supplied from public mains – it is not proposed to extract water from groundwater resources
- Foul Drainage – Foul drainage shall discharge to the public sewer.

5.6 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

5.6.1 Interactions considered

The lands soil and geology impacts are considered to interact with the following EIAR chapters:

- Chapter 6 – Water and Hydrology
- Chapter 12 – Waste

5.6.2 Construction Phase

Potential impacts considered during construction are as follows:

Excavation and Infilling

Excavated and stripped soil can be disturbed and eroded by site vehicles during the construction. Rainfall and wind can also impact on non-vegetated/uncovered areas within the excavation or where soil is stockpiled.

Excavation and infilling of soil and subsoil will be required for levelling of the site to render it suitable for building the building platform. The volume of material to be excavated has been estimated by the project engineers to be approximately 25,000m3 of material. It is proposed to stockpile suitable excavated material for reuse as fill where possible. Any materials which are not reused as fill shall be removed off-site for appropriate reuse, recovery and / or disposal.
These estimates will be refined prior to commencement of construction. If the material that requires removal from site is deemed to be a waste, removal and reuse/recycling/recovery/disposal of the material will be carried out in accordance with the 'Waste Management Act 1996' (as amended), the 'Waste Management (Collection Permit) Regulations 2007' as amended, and the 'Waste Management (Facility Permit & Registration) Regulations 2007' as amended.

It is likely that excavated material will be taken off site. When this material is removed off-site it could be reused as a by-product (and not as a waste). In order to reuse material as a byproduct it must be classified in accordance with Article 27 of the European Communities (Waste Directive) Regulations 2011.

Waste material will need to be classified as hazardous or non-hazardous in accordance with the EPA publication 'Waste Classification - List of Waste and Determining If Waste is Hazardous or Non-Hazardous'. It is likely that the surplus of material will be suitable for acceptance at either inert or non-hazardous soil recovery facilities/landfills in Ireland or, in the unlikely event of hazardous material being encountered, be transported for treatment/recovery or exported abroad for disposal in suitable facilities. However, more soil sampling will be required as part of the construction program to know the extent of the asbestos material.

The asbestos material will be appropriately segregated and disposed of to a licenced hazardous landfill by a licenced contractor.

Basement Construction

The DCC Development Plan 2022-2028 (Appendix 9 – Basement Development Guidelines) presents a methodology where the impact of basement on the surrounding ground and groundwater is assessed on a site-specific basis. This policy sets out the requirements to complete this risk-based impact assessment with regard to hydrology, hydrogeology and land stability.

An impact assessment (refer to section 5.7.1 below) was undertaken to assess the likely impact on the existing water regime during and post construction of a basement within the proposed development. The objective is to ensure that the basement development:

- Protects and enhances where possible the groundwater quality, quantity and classification.
- Provides evidence that the construction of the basement shall not place groundwater at undue risk.
- Provides evidence that the structural stability of adjoining or neighbouring buildings and land areas are not put at risk.
- Provides a management plan for any demolition works and for the construction of the basement.
- Does not have an adverse effect on existing patterns of surface water drainage.
- Shall not significantly impact on groundwater or surface water flows to the extent that this is likely to increase the risk of flooding.
- Ensures appropriate handling and dealing with waste removal.
- Conserves and where possible enhances the biodiversity value of the site.

A full site investigation was carried out by SIL in 2020 and then by GII in 2022. A specialist ground works contractor (piling contractor) will be appointed to carry out the excavation. There will be local rock breaking required due to the level of the tanks located below the basement. For the rest of the site, due to the depth of the bedrock being approx. 10 metres below ground level, it is not envisaged the rock breaking is required and foundations can be supported on

the rock layer. The appointed specialist contractor will carry out a full risk assessment prior to the commencement of work.

A ground works operation will be carried out in order to ensure that material removed from the ground is taken away at regular intervals in order to reduce the amount of material that will be stored on site.

The site level will be graded to a uniform level following demolition and removal of the building foundations and redundant services. It shall be ensured that no water runoff from the development site exits to the public street.

The main construction works following demolition shall be installation of an embedded pile retaining wall to facilitate the excavation and construction of the proposed basement. The following is a high-level sequence of the main construction works which shall take place following demolition of the existing buildings on site:

- A suitable piling platform shall be designed and installed to support the piling rig.
- The embedded pile retaining wall will be constructed around the site boundary, to facilitate deep excavation. This will involve the installation of augered or bored piles. The augering of the piles will generate spoil that must be disposed at an appropriate licensed facility off-site. The spoil shall be stockpiled on site ahead of disposal. WAC testing will be carried out an all-excavated material including pile arisings to determine requirements for reuse/disposal.
- The concrete operations associated with the pile wall construction will require concrete and steel reinforcement deliveries to site which will be managed in accordance with the Contractors Construction Management Plan. Pile reinforcement cages can be stored on site and concrete deliveries managed within the site footprint.
- Following installation of the pile wall, excavation of the basement will commence. This excavation phase shall be informed by a detailed phase of site investigation and chemical testing of the soils to develop a phased dig plan for the site. Any contamination identified during the investigation phase and subsequently the excavation phase will be segregated, removed and disposed in an appropriate registered facility. Any Made Ground excavated on site should be stockpiled separately to natural soils to avoid any potential cross contamination of the soils prior to removal from site.

The basement excavation shall be dewatered through settlement tanks and discharged after appropriate treatment into the local drainage network infrastructure. Outfall manholes will be regularly emptied of sediment during periods of heavy rainfall. These measures will prevent run-off from the site and total suspended solid levels in all discharge shall be in compliance with the Quality of Salmonid Water Regulations (SI 293:1988).

On completion of the excavation works to the formation level of the basement slab, this will be blinded to the final design levels. Any below ground services will be installed and tested within the basement slab. Prior to construction of the foundations and suspended slab at the lower basement level, a proprietary basement tanking system and water bar will be installed at all construction joints. A typical basement slab
construction is as follows:

- Trim & grade to slab formation with appropriate material.
- Cast mass concrete blinding
- Apply waterproof membrane and tanking.
- Apply continuous waterproof tanking material and seal all laps (and along perimeter of secant wall/slab junction).
- Install slab reinforcement to slab area (including any columns and wall starters) Formwork to perimeter and any box-outs necessary (e.g. around raking props).
- Pour concrete following inspection.

When a sufficient area of basement slab is constructed and sufficient concrete curing time has been allowed, the vertical elements can be constructed.

Once piling is installed, there will be limited groundwater to dewater due to the enclosing of potential water bearing strata.

The potential impacts of the basement construction include:

- A local impact may occur during the initial excavation stages until the piling wall is fully installed. Once the wall is embedded into the rock, horizontal water flow from the water-bearing gravel layer (or other strata) will be blocked. Dewatering may be required for other inflows such as rainwater. The regional water table within bedrock will not be affected by the planned basement construction. The effect on the shallow water table will at most be temporary. The basement is estimated to be completed within approximately 16-20 weeks.
- The proposed development will not increase the hardstanding area, ensuring that groundwater recharge and the groundwater regime remain unaffected.
- The proposed basement construction, which would involve c. 9.5-13.5-metre-deep excavations has the potential to cause minor ground movements inside the excavated area as a result of changes in vertical load on the ground. The construction sequence was developed to control any potential movement to within acceptable limits. Due to the presence of the piling wall surrounding the excavation there is no potential ground movements outside the excavation area.
- There is no source-pathway-receptor hydrogeological connection between the subject site and Dublin Bay through the Dublin aquifer as vertical migration to the underlying limestone bedrock is minimised due to the thickness of overburden ('Low' vulnerability) present at the site providing a high level of aquifer protection from any potential source. Therefore, no likely impact on the status of the aquifer is expected due to natural attenuation within overburden and reducing potential for off-site migration.

Accidental Spills and Leaks

Accidental spills and leaks of oils or fuels represent a risk of pollution if mitigation measures are not put into place on site. Spillage may occur due to refuelling of machinery, spillage of fuels stored on site or leakage of fuels from construction machinery.

5.6.3 Operational Phase

There will be no direct discharges to the water or soil environment during the operational phase.

Any accidental emissions during storage, transfer, or delivery or leakage in the car parks could cause localised contamination if the emissions enter the soil and groundwater environment. without adequate mitigation. However, it is noted that any accidental discharge will more likely impact stormwater drainage due to the hardstand and drainage infrastructure proposed.

The site is currently consisting of hardstanding area. The use of SUDs techniques will have a minor positive effect on local recharge to ground. It is proposed that the surface water drainage will be upgraded to facilitate the proposed development, refer to Chapter 8 Hydrology for further
information on the drainage system.

5.7 REMEDIAL AND MITIGATION MEASURES

Mitigation Measures have been included within the design and the CEMP to take account of the potential impacts of the development on the receiving land, soils, geology, and hydrogeology environment. These measures shall minimise potential effects through the implementation of best practice construction methods and adherence to all relevant legislation.

Due to the inter-relationship between land, soils, geology and hydrogeology and water (hydrology) the following mitigation measures discussed will be considered applicable to both.

5.7.1 Construction Phase

A project-specific Outline Construction and Environmental Management Plan (CEMP) has been prepared by CS Consulting (A Construction Management Plan prepared by PJ Hegarty is appended to the CEMP) and is submitted as part of this planning application. Prior to commencement of construction this CEMP will be updated and will be maintained by the contractors during the construction and operational phases. The CEMP will cover all potentially polluting activities and include an emergency response procedure. All personnel working on the site will be trained in the implementation of the procedures.

Soil handling, Removal and Compaction

Three soil samples were collected from the site, and the soil was classified as hazardous due to elevated levels of lead and zinc. Additional soil sampling and testing (including WAC testing) will be necessary if any soil is to be removed from the site for reuse or disposal. Any soil designated for removal will be handled and disposed of by a licensed contractor at a licenced facility

Temporary storage of soil will be carefully managed in such a way as to prevent any potential negative impact on the receiving environment and the material will be stored away from any surface water drains. Made ground shall be stockpiled separately to natural soils and stones in order to prevent cross-contamination of excavated materials on site. Movement of material will be minimised in order to reduce dust and degradation of soil structure.

Basement Assessment

The following mitigation measures will be included in the design to protect water quality:

Any minor ingress of groundwater and collected rainfall in the excavation will be pumped out during construction. It is proposed that the water be discharged via the existing stormwater sewer network. The use of silt traps, settlement tanks and an oil interceptor (if required) will be adopted if monitoring indicates the requirements for the same with no silt or contaminated water permitted to discharge to the sewer.

Where feasible all ready-mixed concrete will be brought to site by truck. A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline wastewaters or contaminated storm water to the underlying subsoil. Wash down and washout of concrete transporting vehicles will take place at an appropriate facility offsite.

An Outline Construction and Environmental Management Plan (CEMP) has been prepared by CS Consulting Engineers as part of the planning application. Prior to commencement of construction the appropriate contractor will produce a detailed CEMP which will include management of any collected water.

Appropriate instrumentation will be installed to monitor wall and ground movements during construction. The predictions of ground movement based on the ground movement analysis should be checked by monitoring the basement wall. The monitoring will include the installation of inclinometers in the basement wall elements so the pattern of wall behaviour can be reviewed with predicted values and due to the presence of residential dwellings and protected structures close to the site boundary. Contingency measures will be implemented if movements of the adjacent structures exceed predefined trigger levels.

In cases where vibration from construction methods could potentially damage sensitive neighbouring buildings and structures vibration monitors are to be installed. Contingency measures will be implemented if monitored vibrations exceed predefined trigger levels.

It is considered that there is a low risk of inflow during construction works due to the installation of piles into bedrock prior to excavation works on the basement.

The proposed basement will have no long-term impact on water levels in the overburden or underlying aquifer and no impact on the current water body status. The bedrock water table will not be affected by the excavation works. Temporary dewatering of the perched water table within the clayey deposits to facilitate excavation works is expected to be minor and it will have a temporary local impact only.

The basement will need to be fully waterproofed to ensure no groundwater enters the finished basement.

Management of any collected rainwater and any groundwater seepage during basement excavations will be pumped to existing sewers (following appropriate treatment) in agreement with the regulatory authority.

Fuel and Chemical Handling

All oils, solvents and paints used during construction will be stored within temporary bunded areas; these areas shall be bunded to a volume of 110% of the capacity of the largest tank/container.

To minimise any impact on the underlying subsurface strata from material spillages, all oils, solvents, and paints used during construction will be stored within temporary bunded areas. Oil and fuel storage tanks shall be stored in designated areas. Oil storage tanks should have secondary containment provided by means of an above ground bund to capture any oil leakage irrespective of whether it rises from leakage of the tank itself or from associated equipment such as filling and off-take points, sighting gauges etc., all of which should be located within the bund. Bund specification should conform to the current best practice for oil storage (Enterprise Ireland BPGC5005).

Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, will take place in a designated area (or where possible off the site) which will be away from surface water gulleys or drains. In the event of a machine requiring refuelling outside of this area, fuel will be transported in a mobile double skinned tank. An adequate supply of spill kits and hydrocarbon adsorbent packs will be stored in this area. All relevant personnel will be fully trained in the use of this equipment. Guidelines such as "Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors" (CIRIA 532, 2001) will be complied with.

All ready-mixed concrete will be brought to site by truck. A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline wastewaters or contaminated storm water to the underlying subsoil. The pouring of concrete will take place within a designated area using a geosynthetic material to prevent concrete runoff into the soil/groundwater media. Wash down and washout of concrete transporting vehicles will take place at an appropriate facility offsite.

Pouring of concrete should be carried out in the dry and allowed to cure. Mixer washings and excess concrete should not be discharged to surface water. Implementation of comprehensive and strict site housekeeping measures to isolate concrete from local surface waters is essential.

In the case of drummed fuel or other chemical which may be used during construction containers will be stored in a dedicated internally bunded chemical storage cabinet and labelled clearly to allow appropriate remedial action in the event of a spillage.

5.7.2 Operational Phase

During operation measures there is no requirement for bulk fuels. There is also no requirement for discharge to ground and no requirement for abstraction of groundwater. An environmental management plan will apply to the development during the operational phase incorporating mitigation measures and emergency response measures.

5.7.2.1 Management of Surface Water during Operation

The proposed development will provide full attenuation system, green blue roofs, and blue roofs, for the hardstand areas in compliance with the requirements of the Greater Dublin Strategic Drainage Study and Dublin City Council Development Plan. The proposed surface water drainage service to the development comprises various drainage components including positive stormwater networks, attenuation systems and several Sustainable Drainage Systems (SuDS) elements. The proposed surface water drainage was designed in accordance with the SuDS Manual 2015. This is further detailed in Chapter 6 Hydrology of this EIA Report.

5.8 RESIDUAL IMPACT OF THE PROPOSED DEVELOPMENT

There are no likely significant impacts on the land, geological or hydrogeological environment associated with the proposed operational development of the site following implementation of the proposed mitigation measures.

The appropriate mitigation measures set out in see Section 5.6 reduce the potential for any impact of accidental discharges to ground during the construction phase. Overall, the construction phase is considered to have a short term, imperceptible significance, with a neutral impact on quality.

The predicted impact during operations is considered to be long term, neutral in terms of quality and of an imperceptible significance as a result of this proposed development on the surrounding land, soils, geology, and hydrological environment.

5.9 MONITORING OR REINSTATEMENT

5.9.1 Construction Phase

Regular inspection of surface water run-off and sediments controls e.g. silt traps and settlement tanks will be employed during the construction phase. Soil sampling to confirm disposal options for excavated soils. Regular inspection of construction/mitigation measures will be undertaken e.g. concrete pouring, refuelling etc.

5.9.2 Operational Phase

There is no monitoring required during the operational phase.

5.10 CUMULATIVE IMPACT OF THE PROPOSED DEVELOPMENT

The cumulative impact of the Proposed Development with any/all relevant other planned or permitted developments are discussed below. Related and permitted, concurrent, and future developments are listed in Chapter 2 (Description of the Proposed Development).

5.10.1 Construction Stage

In relation to the potential cumulative impact on the geological or hydrogeological environment during the construction phases, those key engineering works which would have additional impacts are:

- Run-off with high silt content could damage surface water systems and result in a negative impact on receiving watercourses. To mitigate this, run-off from the development and other permitted projects will need to be managed using methods outlined within section 5.7.1 above.
- There is also a risk of soil and groundwater contamination beneath the site due to accidental spills or leaks from construction traffic and materials. To address this, project-specific Construction Environmental Management Plans (CEMPs) will be developed and implemented for the Proposed Development and any future developments in line with the measures outlined in section 5.7.1 above.

The proposed development does require dewatering and with standard mitigation in place (as outlined in Section 5.6) for management of construction water, accidental discharges, the effect due to construction in this area is considered to be neutral on groundwater and soil quality and an imperceptible significance.

Contractors for the proposed development will be contractually required to operate in compliance with a CEMP which will include the mitigation measures outlined in this EIA report. Other developments will also have to incorporate measures to protect soil and water quality in compliance with legislative standards for receiving water quality. As a result, there will be no cumulative potential for change in soil quality or the natural groundwater regime. The cumulative impact is considered to be neutral and imperceptible.

5.10.2 Operational Phase

In relation to the potential cumulative impacts from the operational stages, the following would apply:

Overall, there will no change in recharge pattern as there is no increase in hardstand from the proposed development and surrounding planned or permitted developments. Therefore, there will be no overall change on the groundwater body status. There is no requirement for bulk fuel storage at the proposed development.

Localised accidental discharge of hydrocarbons could occur in car parking areas and along roads unless diverted to surface water drainage system with petrol interceptors. However, all developments are required to ensure they do not have an impact on the receiving water environment in accordance with the relevant legislation (primarily the European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S. I. No. 9 of 2010) as amended by S. I. No. 366/2016) such that they would be required to manage runoff and fuel leakages.

As such there will be no cumulative impact to groundwater quality. The cumulative impact is concluded to have a long-term, imperceptible significance with a neutral impact on soil and water quality.

The land is commercial, and the development is considered commercial therefore the cumulative impact on the land is considered to be long-term, imperceptible significance with a neutral impact.

5.11 DIFFICULTIES ENCOUNTERED IN COMPILING INFIRMATION

There were no difficulties encountered during the writing of this EIAR chapter.

5.12 REFERENCES

- **Department Housing, Local Government and Heritage, 2018.** *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment.* Environmental Protection Agency. The Department Housing, Local Government and Heritage.
- **Dublin City Council, 2022**. *Dublin City Development Plan 2022-2028 (Appendix 9: Basement Development Guidelines)*. Dublin City Council.
- **Environmental Protection Agency, 2022.** *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.* Environmental Protection Agency.
- **Environmental Protection Agency, 2015a**. *Revised Guidelines on the Information to be contained in Environmental Impact Statements*. Environmental Protection Agency.
- **Environmental Protection Agency, 2015b**. *Advice notes for Preparing Environmental Impact Statements*. Environmental Protection Agency.
- **Institute of Geologists of Ireland, 2013a**. *Guidelines for the Preparation of Soil, Geology and Hydrogeology (Chapters of Environment Impact Statements).*
- **Institute of Geologists of Ireland, September 2013b.** *Geology in Environmental Impact Assessments, A Guide*, University College Dublin.
- **Institute of Geologists of Ireland, 2002**. *Geology in Environmental Impact Assessments, a Guide,* University College Dublin.

APPENDIX 5.1

AVAILABLE BOREHOLE LOGS (SII, 2020 & GII, 2022)

Contract No: 5686	**Cable Percussion Borehole Log**				Borehole No: **BH01**
Contract:	City Quay	Easting:	716399.437	Date Started:	28/01/2020
Location:	City Quay, Dublin 2	Northing:	734389.391	Date Completed:	29/01/2020
Client:	City Arts and City Quay Partnership	Elevation:	2.97	Drilled By:	J. O'Toole
Engineer:	-	Borehole Diameter:	200mm	Status:	FINAL

Depth (m) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples and Insitu Tests Depth	Type	Result	Water Strike	Backfill
	0.20	MADE GROUND: concrete.			2.77					
0.5		MADE GROUND: brown grey slightly sandy slightly gravelly silty clay with much red brick and concrete content.		2.5		0.50	ES	JOT01		
1.0				2.0		1.00	B	JOT02		
						1.20	C	N=5 (0,1/1,1,1,2)		
1.5	1.50	MADE GROUND: grey silty sandy gravel with much red brick and concrete content.		1.5	1.47					
2.0				1.0		2.00	B	JOT03		
						2.00	C	N=7 (0,0/1,2,2,2)		
2.5				0.5						
	2.80	Medium dense silty very gravelly SAND with low cobble content.			0.17					
3.0				0.0		3.00	B	JOT04		
						3.00	C	N=10 (1,1/2,2,3,3)		
3.5				-0.5						
4.0				-1.0		4.00	B	JOT05		
						4.00	C	N=14 (2,2/3,3,4,4)		
4.5				-1.5						
5.0				-2.0		5.00	B	JOT06		
						5.00	C	N=19 (2,3/4,5,5,5)		
5.5	5.60	Firm grey sandy slightly gravelly clayey SILT.		-2.5	-2.63					
6.0				-3.0		6.00	B	JOT07		
						6.00	C	N=12 (2,2/3,3,3,3)		
6.5				-3.5						
7.0	7.00	Stiff grey slightly sandy slightly gravelly silty CLAY with low cobble content.		-4.0	-4.03	7.00	B	JOT08		
						7.00	C	N=24 (2,4/5,5,7,7)		
7.5				-4.5						
	7.80	Very stiff black slightly sandy slightly gravelly silty CLAY with low cobble content.			-4.83					
8.0				-5.0		8.00	B	JOT09		
						8.00	C	N=33 (4,5/6,7,9,11)		
8.5	8.50	Grey slightly sandy gravelly silty CLAY with high cobble content.		-5.5	-5.53					
	8.90				-5.93					
9.0	9.00	Obstruction - possible boulders.		-6.0	-6.03	9.00	C	50 (25 for 5mm/50 for 0mm)		
		End of Borehole at 9.00m								
9.5				-6.5						

Chiselling:

From:	To:	Time:
1.60	1.80	00:45
7.80	7.90	00:45
8.90	9.00	01:00

Water Strikes:

Strike:	Rose:	Depth Sealed
4.80	4.10	NS
8.00	4.70	NS

Water Details:

Date:	Hole Depth:	Water Depth:
28/01	5.00	4.80
29/01	5.00	4.60
29/01	9.00	3.00

Installation:

From:	To:	Pipe:

Backfill:

From:	To:	Type:
0.00	9.00	Arisings

Remarks:

Hand dug inspection pit to 1.20mbgl.
Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No: 5686	**Cable Percussion Borehole Log**				Borehole No: **BH02**
Contract:	City Quay	Easting:	716398.885	Date Started:	29/01/2020
Location:	City Quay, Dublin 2	Northing:	734359.594	Date Completed:	30/01/2020
Client:	City Arts and City Quay Partnership	Elevation:	3.04	Drilled By:	J. O'Toole
Engineer:	-	Borehole Diameter:	200mm	Status:	FINAL

Depth (m) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples and Insitu Tests Depth	Type	Result	Water Strike	Backfill
	0.20	MADE GROUND: concrete.			2.84					
0.5		MADE GROUND: brown grey slightly sandy slightly gravelly silty clay with much red brick and concrete content.		2.5		0.50	ES	JOT10		
1.0	1.10			2.0	1.94	1.00	B	JOT11		
		MADE GROUND: grey silty sandy gravel with much red brick and concrete content.				1.20	C	N=18 (2,4/5,6,3,4)		
1.5				1.5						
2.0				1.0		2.00	B	JOT12		
						2.00	C	N=15 (2,2/3,3,4,5)		
2.5				0.5						
	2.80				0.24					
3.0		Loose becoming medium dense slightly silty very sandy fine to coarse GRAVEL with low cobble content.		0.0		3.00	B	JOT13		
						3.00	C	N=7 (1,1/1,2,2,2)		
3.5				-0.5						
4.0				-1.0		4.00	B	JOT14		
						4.00	C	N=24 (2,4/5,5,7,7)		
4.5				-1.5						
	4.80				-1.76					
5.0		Firm grey slightly sandy slightly gravelly clayey SILT.		-2.0		5.00	B	JOT15		
						5.00	C	N=10 (1,2/2,2,3,3)		
5.5				-2.5						
	5.60				-2.56					
6.0		Dense brown silty very sandy GRAVEL with low cobble content.		-3.0		6.00	B	JOT16		
						6.00	C	N=34 (4,7/7,9,8,10)		
6.5				-3.5						
7.0				-4.0		7.00	B	JOT17		
						7.00	C	50 (8,17/50 for 100mm)		
7.5				-4.5						
8.0				-5.0		8.00	B	JOT18		
						8.00	C	50 (10,15/50 for 125mm)		
8.5				-5.5						
	8.80				-5.76					
9.0	8.90	Obstruction - possible boulders.		-6.0	-5.86	8.90	C	50 (25 for 5mm/50 for 0mm)		
		End of Borehole at 8.90m								
9.5				-6.5						

Chiselling:

From:	To:	Time:
2.70	2.80	00:45
7.30	7.40	00:45
8.80	8.90	01:00

Water Strikes:

Strike:	Rose:	Depth Sealed
5.60	5.10	NS
6.50	5.50	NS

Water Details:

Date:	Hole Depth:	Water Depth:
29/01	3.00	Dry
30/01	3.00	Dry
30/01	8.90	3.80

Installation:

From:	To:	Pipe:

Backfill:

From:	To:	Type:
0.00	8.90	Arisings

Remarks:

Hand dug inspection pit to 1.20mbgl.
Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No: 5686	**Cable Percussion Borehole Log**			Borehole No: **BH03**
Contract:	City Quay	Easting:	716419.553	Date Started: 31/01/2020
Location:	City Quay, Dublin 2	Northing:	734407.078	Date Completed: 31/01/2020
Client:	City Arts and City Quay Partnership	Elevation:	3.01	Drilled By: J. O'Toole
Engineer:	-	Borehole Diameter:	200mm	Status: FINAL

Depth (m) Scale	Depth	Stratum Description	Legend	Level (mOD) Scale	Depth	Samples and Insitu Tests Depth	Type	Result	Water Strike	Backfill
	0.20	MADE GROUND: concrete.			2.81					
0.5		MADE GROUND: brown grey slightly sandy slightly gravelly silty clay with much red brick and concrete content.		2.5		0.50	ES	JOT19		
1.0				2.0		1.00	B	JOT20		
						1.20	C	N=13 (2,3/3,4,3,3)		
1.5	1.60			1.5	1.41					
2.0		MADE GROUND: grey silty sandy gravel with much red brick and concrete content.		1.0		2.00	B	JOT21		
						2.00	C	N=20 (1,2/4,7,5,4)		
2.5				0.5						
3.0	2.90			0.0	0.11					
		Medium dense silty very gravelly SAND with low cobble content.				3.00	B	JOT22		
						3.00	C	N=11 (1,2/2,3,3,3)		
3.5				-0.5						
4.0				-1.0		4.00	B	JOT23		
						4.00	C	N=16 (1,3/4,3,4,5)		
4.5				-1.5						
5.0				-2.0		5.00	B	JOT24		
						5.00	C	N=12 (2,2/2,2,4,4)		
5.5	5.50			-2.5	-2.49					
		Stiff grey slightly sandy slightly gravelly silty CLAY with low cobble content.								
6.0				-3.0		6.00	B	JOT25		
						6.00	C	N=16 (2,2/3,4,5,4)		
6.5				-3.5						
7.0	7.10			-4.0	-4.09	7.00	B	JOT26		
		Very stiff black slightly sandy slightly gravelly silty CLAY with low cobble content.				7.00	C	N=39 (6,7/39 for 90mm)		
7.5				-4.5						
8.0				-5.0		8.00	B	JOT27		
						8.00	C	50 (10,15/50 for 105mm)		
8.5	8.50			-5.5	-5.49					
		Grey slightly sandy slightly gravelly silty CLAY with high cobble content.								
9.0	9.00			-6.0	-5.99	9.00	C	50 (25 for 10mm/50 for 5mm)		
	9.10	Obstruction - possible boulders. End of Borehole at 9.10m			-6.09					
9.5				-6.5						

Chiselling:

From:	To:	Time:
1.80	1.90	00:45
7.70	7.80	00:45
9.00	9.10	01:00

Water Strikes:

Strike:	Rose:	Depth Sealed
4.80	4.10	NS
6.40	4.50	NS

Water Details:

Date:	Hole Depth:	Water Depth:
31/01	9.10	3.00

Installation:

From:	To:	Pipe:

Backfill:

From:	To:	Type:
0.00	9.10	Arisings

Remarks:

Hand dug inspection pit to 1.20mbgl.
Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

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Site 1-6 City Quay			**Borehole Number** BH01
Machine : Berretta T44 **Flush :** Polymer **Core Dia:** 102 mm **Method :** Rotary Cored	**Casing Diameter** 146mm cased to 12.80m	**Ground Level (mOD)** 2.89	**Client** Ventaway Ltd
	Location 716425.8 E 734418.5 N	**Dates** 27/04/2022-03/05/2022	**Engineer** Byrne Looby Partners
			Job Number 11789-04-22
			Sheet 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						2.84	0.05	Concrete			
	-	-					(1.15)	MADE GROUND: Brown/grey clayey gravelly Sand with frequent red brick and pieces of concrete			
1.20						1.69	1.20				
	73	-					(0.60)	MADE GROUND: Greyish brown sandy gravelly slightly silty Clay with silt lenses and red brick fragments			
						1.09	1.80	MADE GROUND: Greyish dark brown sandy gravelly slightly silty Clay			
2.30 2.30-2.75					3,2/4,4,4,4 SPT(C) N=16						
	67	-					(2.00)				
3.80 3.80-4.25					3,5/5,6,7,6 SPT(C) N=24	-0.91	3.80	Medium dense grey clayey sandy subrounded to rounded fine to coarse GRAVEL with sand and clay lenses			
	47	-									
							(2.75)				
5.30 5.30-5.75					2,3/4,4,3,4 SPT(C) N=15						
	37	-									
						-3.66	6.55	Firm brownish grey slightly sandy silty CLAY			
6.80 6.80-7.25					1,2/2,2,2,3 SPT(C) N=9						
	100	-									
							(3.25)				
8.30 8.30-8.75					2,2/1,2,3,3 SPT(C) N=9						
	97	-									
9.80 9.80-9.95					18,25/50 SPT(C) 50/0	-6.91	9.80	Medium strong to strong thinly laminated grey fine			

Remarks
Inspection pit dug to 1.20m BGL
No groundwater encountered
Slotted standpipe with flush cover installed for groundwater monitoring

Scale (approx)	Logged By
1:50	M.Sheehan

Figure No.
11789-04-22.BH01

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Site 1-6 City Quay			**Borehole Number** BH01
Machine : Berretta T44 **Flush :** Polymer **Core Dia :** 102 mm **Method :** Rotary Cored	**Casing Diameter** 146mm cased to 12.80m	**Ground Level (mOD)** 2.89	**Client** Ventaway Ltd
	Location 716425.8 E 734418.5 N	**Dates** 27/04/2022-03/05/2022	**Engineer** Byrne Looby Partners
			Job Number 11789-04-22
			Sheet 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
				NI				to medium grained LIMESTONE interbedded with weak to medium strong thinly laminated fine grained MUDSTONE. Partially weathered Non intact			
10.30	100	15		11			(1.10)				
10.70				NI		-8.01	10.90	1 fracture set. F1: Dipping 10-30 degrees very close spacing stepped rough with clay infill Non intact			
11.00								Strong thinly laminated grey fine to medium grained LIMESTONE interbedded with weak to medium strong thinly laminated fine grained MUDSTONE. Distinctly weathered			
11.30				6				1 fracture set. F1: Dipping 10-30 degrees very close to close spacing stepped smooth with clay smearing Non intact			
11.70				NI			(1.90)				
11.90	100	73	34	7				1 fracture set. F1: Dipping 10-30 degrees very close to close spacing stepped smooth with clay smearing			
12.80						-9.91	12.80	Complete at 12.80m			

Remarks

Scale (approx)	Logged By
1:50	M.Sheehan

Figure No. 11789-04-22.BH01

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Site 1-6 City Quay			**Borehole Number** BH02
Machine : Berretta T44 **Flush :** Polymer **Core Dia:** 102 mm **Method :** Rotary Cored	**Casing Diameter** 146mm cased to 11.30m	**Ground Level (mOD)** 3.10	**Client** Ventaway Ltd
	Location 716410.4 E 734386.8 N	**Dates** 26/04/2022-27/04/2022	**Engineer** Byrne Looby Partners
			Job Number 11789-04-22
			Sheet 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						2.95	(0.15) 0.15	Concrete			
								Grey/brown fine to coarse clayey gravelly Sand with occasional red brick and concrete			
							(1.05)				
1.20						1.90	1.20	MADE GROUND: Greyish dark brown sandy gravelly Clay with red brick and mortar fragments			
	59	-					(1.10)				
2.30 2.30-2.75					1,1/2,1,2,2 SPT(C) N=7	0.80	2.30	MADE GROUND: Greyish dark brown slightly sandy gravelly slightly silty Clay with organic matter			
	100	-					(1.50)				
3.80 3.80-4.25					5,6/8,7,8,7 SPT(C) N=30	-0.70	3.80	No recovery. Driller notes Sand (Dense)			
	0	-					(1.50)				
5.30 5.30-5.75					3,4/4,5,7,6 SPT(C) N=22	-2.20	5.30	Stiff grey sandy gravelly CLAY. Driller notes Sand onto Clay			
	50	-					(0.90)				
						-3.10	6.20	Residual Soil: Stiff grey slightly sandy gravelly CLAY			
6.80 6.80-7.25					2,2/3,2,3,4 SPT(C) N=12						
	51	-					(2.40)				
8.30 8.30-8.75					6,7/9,8,10,13 SPT(C) N=40						
8.60	100	73	0	19		-5.50	8.60	Weak to medium strong thinly laminated grey fine to medium grained LIMESTONE interbedded withweak to medium strong thinly laminated fine grained MUDSTONE. Distinctly weathered 1 fracture set. F1: Dipping 20-40 degrees very close to close spacing stepped rough with clay infill			
9.60 9.80						-6.70	(1.20) 9.80	Recovery consisting of strong thinly laminated			

Remarks
Inspection pit carried out to 1.20m BGL
No groundwater encountered
Slotted standpipe with flush cover installed for groundwater monitoring

Scale (approx)	Logged By
1:50	M.Sheehan

Figure No. 11789-04-22.BH02

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Site 1-6 City Quay			**Borehole Number** BH02
Machine : Berretta T44 **Flush :** Polymer **Core Dia:** 102 mm **Method :** Rotary Cored	**Casing Diameter** 146mm cased to 11.30m	**Ground Level (mOD)** 3.10	**Client** Ventaway Ltd
	Location 716410.4 E 734386.8 N	**Dates** 26/04/2022-27/04/2022	**Engineer** Byrne Looby Partners
			Job Number 11789-04-22
			Sheet 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
				14				grey fine to medium grained LIMESTONE interbedded with weak to medium strong thinly laminated fine grained MUDSTONE.Partially weathered			
10.60	100	51	11	12			(1.50)				
11.20				NI		-8.20	11.30	Non intact			
11.30								Complete at 11.30m			

Remarks

Scale (approx)	Logged By
1:50	M.Sheehan

Figure No. 11789-04-22.BH02

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Site 1-6 City Quay			**Borehole Number** BH03
Machine : Berretta T44 **Flush :** Polymer **Core Dia:** 103 mm **Method :** Rotary Cored	**Casing Diameter** 146mm cased to 11.30m	**Ground Level (mOD)** 3.15	**Client** Ventaway Ltd
	Location 716413.3 E 734361.3 N	**Dates** 25/04/2022-26/04/2022	**Engineer** Byrne Looby Partners
			Job Number 11789-04-22
			Sheet 1/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						3.05	0.10 (0.20)	Concrete			
						2.85	0.30 (0.50)	Grey fine to coarse angualr to subangular crushed rock FILL			
						2.35	0.80	MADE GROUND: Brown/grey clayey gravelly SAND with frequent red brick and concrete			
1.20	59	-					(1.70)	MADE GROUND: Greyish brown sandy gravelly Clay with red brick fragments			
2.30 2.30-2.75	98	-			1,12/2,1,2,23 SPT(C) N=28	0.65	2.50 (1.00)	MADE GROUND: Brownish dark grey slightly sandy slightly gravelly slightly silty slightly peaty Clay with organic matter and red brick fragments			
3.80 3.80-4.25	33	-			3,4/4,4,5,4 SPT(C) N=17	-0.35	3.50 (1.80)	POSSIBLE MADE GROUND: Greyish brown sandy gravelly Clay. Driller notes Sand. Driller notes Sand onto gravelly Clay			
5.30 5.30-5.75	70	-			2,2/4,4,5,4 SPT(C) N=17	-2.15	5.30 (0.70)	Medium dense grey slightly clayey slightly sandy subrounded to rounded fine to coarse GRAVEL			
						-2.85	6.00 (0.80)	Stiff grey slightly gravelly silty CLAY with shell fragments			
6.80 6.80-7.25	97	-			4,4/5,7,7,6 SPT(C) N=25	-3.65	6.80 (0.90)	Medium dense grey subrounded to rounded fine to coarse GRAVEL			
						-4.55	7.70 (0.60)	Stiff grey sandy gravelly CLAY			
8.30 8.30-8.45	97	33	0	NI	25,25/50 SPT(C) 50/0	-5.15	8.30 (1.00)	Recovery consisting of weak to medium strong thinly laminated grey fine to coarse grained LIMESTONE interbedded with MUDSTONE. Distinct weathering Non intact			
9.30 9.80				15		-6.15	9.30	Recovery consisting of medium strong to strong thinly laminated grey fine to medium grained LIMESTONE interbedded with MUDSTONE. Partial weathering 2 fracture sets. F1: Dipping 10-30 degrees			

Remarks
Inspection pit carried out to 1.20m BGL
No groundwater encountered
Slotted standpipe with flush cover installed for groundwater monitoring

Scale (approx)	Logged By
1:50	M.Sheehan

Figure No.
11789-04-22.BH03

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Site 1-6 City Quay			**Borehole Number** BH03
Machine : Berretta T44 **Flush :** Polymer **Core Dia:** 103 mm **Method :** Rotary Cored	**Casing Diameter** 146mm cased to 11.30m	**Ground Level (mOD)** 3.15	**Client** Ventaway Ltd
	Location 716413.3 E 734361.3 N	**Dates** 25/04/2022-26/04/2022	**Engineer** Byrne Looby Partners
			Job Number 11789-04-22
			Sheet 2/2

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
10.30	97		23	18			(2.00)	close spacing stepped rough with clay smearing. F2: Dipping 60-80 degrees medium to wide spacing stepped rough with clay smearing			
11.30						-8.15	11.30	Complete at 11.30m			

Remarks

Scale (approx)	Logged By
1:50	M.Sheehan

Figure No. 11789-04-22.BH03