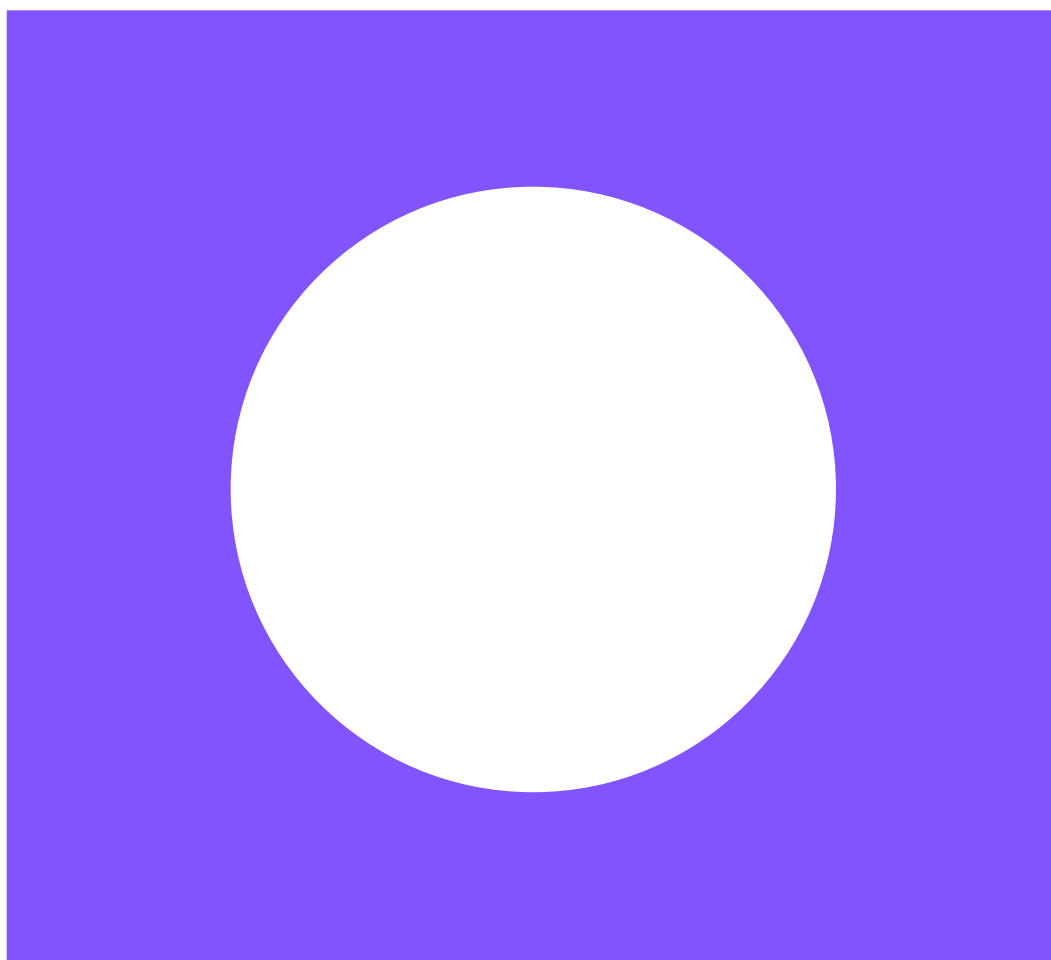




Midlands Regional Hospital Portlaoise

New Ward Block
Technical Specification for Ground Investigation

October 2026

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Midlands Regional Hospital Portlaoise

New Ward Block
Technical Specification for Ground Investigation

October 2026

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Introduction

Mott MacDonald has been commissioned by the Irish Health Service Executive (HSE - herein referred to as the Client/Employer) to produce a Technical Specification for Ground Investigation (GI) for the proposed works at Midland Regional Hospital, Portlaoise (herein referred to as the 'site') located in Portlaoise, County Laoise, Ireland.

This GI relates to a proposed new 48-bed Ward Block and carpark extension within the grounds of the existing Midland Regional Hospital Portlaoise. Further details on the location and description of the site are presented in Section S1.3 of this specification. Details of the current development proposals are presented in S1.4.1.

The Technical Specification shall be the '*Specification and Related Documents for Ground Investigation in Ireland*', Second Edition (2016) published by Engineers Ireland (EI), with information, amendments and additions as described in the accompanying Schedules below.

- Schedule 1 Information and Site-Specific Requirements
- Schedule 2 Exploratory Holes
- Schedule 3 Investigation Supervisor's Facilities
- Schedule 4 Specification Amendments
- Schedule 5 Specification Additions

In the event any of the numbered Schedules (1 to 5) conflict, or are inconsistent with the original EI Specification clauses, then the substitutions, amendments or additions in the numbered Schedules shall always prevail.

Any Clause in the EI Specification, which relates to the work or materials not required for the Investigation shall be deemed not to apply.

Where Manufacturers' or Suppliers' names are stated or particular reference to brand names are given, the words 'or equivalent approved' shall be deemed to be written immediately following such names. In this context, the word 'approved' means approved in writing by the Investigation Supervisor.

The Investigation is to be undertaken in accordance with '*Eurocode 7: Part 2 – Ground Properties*' and its associated complementary standards.

Schedule 1: Information and site-specific requirements

S1.1 Name of Contract

The name of the Contract is 'Midlands Regional Hospital, Portlaoise – New Ward Block'.

S1.2 Investigation Supervisor

Taking cognisance of Safety Health and Welfare at Work (Construction) Regulations 2013, the following definitions and descriptions apply:

- **Client and Employer** – Irish Health Service Executive (HSE)
- **Investigation Supervisor** – TBC
- **Project Supervisor Design Process (PSDP)** – AtkinsRéalis for Preliminary Health and Safety Plan
- **Project Supervisor Construction Stage (PSCS)** – The Ground Investigation Contractor (TBC)
- **Contractor** – Ground Investigation Contractor appointed to manage and deliver the GI works (TBC)
- **Ground Investigation Designer** – Mott MacDonald Ltd.

The Contractor must advise the Client/Employer and Investigation Supervisor should they intend to sub-contract any of the GI Contract including fieldworks.

Details of powers delegated to the Investigation Supervisor and their site-based representative(s) will be provided separately prior to commencement of the ground investigation (GI).

The appointed Contractor will be responsible for the implementation, management, and supervision of the GI and in doing so must satisfy the rules, regulations, and safe working procedures applicable to the Site.

Fieldwork shall be undertaken by the Contractor in accordance with the Specification requirements and the system of work / permitting procedures established by the Employer and site operator.

The Contractor is required to undertake the investigation works acting in the role of PSCS and GI Contractor. As PSCS for the works the Contractor shall satisfy all requirements for the work and be responsible for the health, safety and security of the site operations in accordance with the Safety Health & Welfare at Work (Construction) Regulations of 2013 (S.I. No. 291 of 2013).

As PSCS, the Contractor is responsible for undertaking the GI Contract in accordance with any protocols and procedures applicable to the works, private lands access agreements, and any stakeholder / statutory body permits and licenses.

The Contractor shall refer to the document '*Preliminary Safety & Health Plan – Site Investigations*' (*Doc Ref. TBC*) for further details regarding his role and responsibilities as PSCS for the Ground Investigation Contract.

S1.3 Description of site

After a feasibility study involving five different proposed layout options within the extents of the existing hospital, HSE have selected Option 5B to proceed with, herein referred to as 'the Site'.

In order to facilitate the proposed 48-bed ward block, an existing retaining wall and car park are expected to be demolished with a newly constructed retaining wall located further to the east to support the external building and road. The existing access road that runs around the east of the site will be required to be diverted further east outside the extents of the proposed building. An existing carparking area within the southwest of the site will also be extended to accommodate the increase in hospital facilities.

A general description of the site and a summary of the pertinent site information is provided in Table 1.1 below. A site location plan is presented in Figure 1.1.

Table 1.1: Site Details

Aspect	Comment
Site Name	Midlands Regional Hospital Portlaoise (Irish: Ospidéal Réigiúnach Lár Tíre, Port Laoise)
Local Authority	Laoise County Council
Grid Reference (ITM)	The site is located ITM 648562, 698819
Ground Cover and Land Use	The Site is located within the existing Midlands Regional Hospital, Portlaoise. The site comprises existing carpark areas with associated hospital buildings and access roads, with an additional overflow carpark within an area of largely undeveloped fields within the southwestern extent of the site.
Site Access	Access to the site is primarily gained from the north via Dublin Road (R445) followed by internal hospital roads. Secondary access from the west of the site is gained via the Block Road which allows access to the existing hospital to the east as well as the ambulance station to the west.
Topography	A topographic survey has been undertaken for the existing hospital in the east of the site which ranges from approximately 104m to 112m (Malin Head). The survey was undertaken in Irish Transverse Mercator (ITM) coordinates. No topographic survey was conducted for the proposed car park area in the southwest of the site.
Existing infrastructure	Operational hospital buildings, retaining wall, car parking spaces and internal hospital access roads. The field to the southwest of the site proposed for a new car park extension is currently occupied by an existing 100 space carpark.
Existing Tanks	Backup generator tanks are known to be located within the northwestern corner of the site.
Asbestos	An asbestos survey was undertaken for the existing hospital buildings by Asbestos Consultancy Services Limited in April 2011, which identified the presence of white asbestos within 5 out of the 11 samples taken for laboratory testing.
Surrounding area	The land uses surrounding the site comprises: ● North – R445 (Dublin Road) beyond which lies residential and commercial properties and a petrol station within 30m of the site. ● East – residential properties ● South – residential properties and the Laoise Education Support Centre ● West – undeveloped fields and the Saint Fintan's Hospital Complex
Environmental Designations	No sensitive land uses or special designations are known to be within 1km of any of the site areas
Archaeology	There are no known archaeological features recorded within the site or the immediate surroundings.

Figure 1.1: Sites Location Plan



Source: Mott MacDonald, 2026

S1.4 Main Works Proposed and Purpose of this Contract

S1.4.1 Development Proposals

Current development proposals are as follows:

- Construction of a new 4-storey purpose-built hospital building / facility housing an additional 48 patient beds, nursing stations and in-patient wards. At the time of writing, the design of the buildings is yet to be finalised.
- Demolition of an existing retaining wall (which currently rests within the footprint of the proposed 4-storey building), with construction of a new retaining structure along the eastern boundary of the site.
- Diversion of the existing access road further east around the proposed 4-storey building.
- Extension of an existing carparking area to replace existing car parks within the proposed building footprint.

S1.4.2 Purpose of this Contract

The proposed ground investigation has been designed to provide information relating to subsurface ground conditions to inform follow-on design and construction phases of the project.

The purpose of this GI is to gather representative information on the ground and groundwater conditions beneath the sites to facilitate geotechnical and geo-environmental assessments for the project, and to allow representative factual information to be provided for project use.

S1.5 Scope of investigation

The scope of proposed GI for the development described in Section S1.4 will comprise:

1. Intrusive and non-intrusive siteworks
2. Geotechnical and geo-environmental laboratory testing
3. Post-site monitoring and sampling
4. Factual Reporting
5. Interpretative reporting to include GIR (Geotechnical Interpretative Report) and Generic Qualitative Risk Assessment Report.

The objective of the investigation is to:

- Characterise the underlying ground and groundwater conditions, including rockhead profile and any weathered/karst zones if present.
- Determine engineering properties of the soils and underlying rock mass to inform the design of new structures.
- Allow identification of any key ground risks which may impact on design and construction of the proposed development.
- Obtain geo-environmental data to inform contaminated land risk assessments.

A summary of the proposed investigation works is provided below with the full scope of ground investigation works, sampling, and monitoring provided in **Schedule 2** (Schedule of Exploratory Holes).

The GI works shall comprise the following:

Package 1

- Combined soils and rock boreholes advanced using wireline GeoBoreS drilling (or other approved method) with in-situ testing (SPTs) and retrieval of soil (disturbed and Class 1 undisturbed samples in accordance with Eurocode 7), rock cores and groundwater samples for laboratory testing (geotechnical, geochemical and geo-environmental).
- Hand Excavated Foundation Inspection Pits to investigate the nature and geometry of the existing building foundations.
- Hand Excavated Slit Trenches of approximately 3m length x 1m wide x 1.2m depth to allow for identification of buried services.
- Installation of combined groundwater and ground gas monitoring installations (50mm diameter HDPE)
- Post-fieldwork monitoring visits for ground gas monitoring, with groundwater sampling on select visits.

Package 2

- Geophysical survey lines for Electrical Resistivity Tomography and Seismic Refraction to profile the ground and to identify potential karst features.

Package 3

- Machine excavated trial pits (using tracked excavator / JCB to achieve scheduled depth) with retrieval of soil and groundwater samples for laboratory testing (geotechnical and geo-environmental). In-situ testing (hand-vanes to be undertaken as detailed in Schedule 2).
- Dynamic Cone Penetrometer tests (TRL type) to gain CBR values to inform pavement design.
- Hand Excavated Pits to allow for collection of geotechnical and geoenvironmental soil samples.
- Infiltration testing to inform drainage design of the proposed car park.

- Installation of combined groundwater and ground gas monitoring installations (50mm diameter HDPE)

All boreholes undertaken are required to prove a minimum of 6m competent rock. Competent rock is classified as medium strong (or better) with an RQD of greater than 50% and TCR of 100%, and without sign of karst dissolution features. Termination depth of a borehole must be agreed with the Investigation Supervisor.

The number, location and extent of exploratory holes and in-situ testing may be revised by the Investigation Supervisor in response to the ground conditions encountered, amendments to the proposed scheme development, or for any other reason as advised.

Other Works

- Geotechnical laboratory testing on samples.
- Geo-environmental laboratory testing on selected samples.
- Management of the GI works by site-based Site Agent and full time Site Engineer (refer to Schedule S1.8.2)
- Survey of exploratory hole and test locations, with elevations recorded to Malin Head Vertical Datum (MHVD).
- Pre-condition and post-condition survey
- Factual reporting of data (PDFs and Excel) with provision of AGS data (in AGS4 format or newer).
- Interpretative reporting including Ground Investigation Report, including Generic Qualitative Risk assessment.

S1.6 Geology and Ground Conditions

S1.6.1 Published Geology

A general assessment of the geology and ground conditions (including hydrology and hydrogeology) has been inferred from available online sources (Geological Survey of Ireland online viewer) and is provided in Table 1.2. No assurance is given to its accuracy.

Table 1.2: Published Geology

Strata	Details
Made Ground/Topsoil	Geological Survey of Ireland (GSI) indicates that 'Urban' deposits are mapped across the entire site with exception of the undeveloped field to the west. Made Ground deposits of unknown thickness and composition are expected to be present associated with current and historical structures on site. Grass with underlying topsoil is expected across the undeveloped field to the west of the site.
Superficial Geology	Superficial deposits surrounding the hospital comprise Glacial Till. It is anticipated that these deposits underlie any Urban deposits discussed above. Offsite approximately 300m to the northwest, Lacustrine sediments are mapped, with localised Alluvium mapped approximately 500m to the east associated with an unnamed watercourse.
Bedrock Geology	The Allenwood Formation is recorded to underlie the entire site area. This formation is expected to comprise thickly bedded limestone, locally peloidal. Rock exposures are recorded as near as 320m to the northwest of the site, indicating possible shallow rock.
Structural Geology	No structural measurements are recorded within the site area; however a dip measurement of 30° northwest was recorded approximately 0.8km east of the site within the Allenwood Formation. Karst landforms have been recorded within the Allenwood Formation, with springs and swallow holes recorded within 2.0km south of the site and 2.4km east of the site respectively.

	There is potential for dissolution features to be present beneath the site associated with the Allenwood Formation.
Hydrology	There are no rivers or water bodies present on site. The nearest watercourse is an unnamed tributary of the River Triogue located approximately 500m east of the site running southeast to northwest.
Hydrogeology	No superficial aquifers are present beneath the site. The bedrock beneath the site is recorded to comprise a regionally important aquifer (karstified) with moderate – high groundwater vulnerability within the site area. The bedrock groundwater body is recorded as the 'Bagenalstown Upper' groundwater body which is of good overall quality.
Mining & Quarrying	No mining or quarrying is recorded within 2.0km of the site.
Flooding	Flood Info flood maps indicate that there is no known flood risk to the site.
Radon	The Environmental Protection Agency (EPA) Radon Maps indicated that 1 in 5 homes are likely to have high radon levels within area.
Historical Ground Investigations	There are no Previous Ground investigations within 1km of the site.

S1.7 Schedule of drawing(s) and documents

The following project specific ground investigation drawings are included in Appendix A.

- Midlands Regional Hospital Portlaoise New Ward Block Ground Investigation Exploratory Hole Location Plan, Package 1, Drawing Ref. 229101894-MMD-XX-XX-DR-G-00001
- Midlands Regional Hospital Portlaoise New Ward Block Ground Investigation Exploratory Hole Location Plan, Package 2, Drawing Ref. 229101894-MMD-XX-XX-DR-G-00002
- Midlands Regional Hospital Portlaoise New Ward Block Ground Investigation Exploratory Hole Location Plan, Package 3, Drawing Ref. 229101894-MMD-XX-XX-DR-G-00003

In addition to the above drawings, the Preliminary Health and Safety Plan shall be provided to the Contractor prior to the commencement of the works.

S1.8 General requirements (Specification Section 3) Particular restrictions / relaxations

The required timescales for completion of the investigation are outlined below. Key dates and timescales are summarised in Table 1.3.

A detailed programme is required to be submitted to the Investigation Supervisor and Client/Employer 10 working days after appointment/ contract award.

Table 1.3: Indicative Ground Investigation Programme

Item	Key Dates and Reporting Timescales
Appointment/Award of Contract	To be confirmed
Submission of Detailed RAMS and Construction Phase Health & Safety Plan (CPH&SP)	Draft to be submitted to the Client/Employer and PSDP for review no later than 10 working days after appointment / contract award. Final to be submitted to the Client/Employer and PSDP for review and acceptance a minimum of 5 working days prior to mobilisation to site. No site works shall be commenced until RAMS and pertinent health and safety plans have been approved by the Client/Employer and PSDP.
Pre-siteworks Condition Survey	To be completed and reported 5 working days prior the start of GI fieldworks.
Duration of Site Operations excluding post-site monitoring and laboratory testing and reporting	To be confirmed following award of a GI Contractor

Item	Key Dates and Reporting Timescales
Daily reporting such as drilling, sampling, backfilling, installation, groundwater measurements, in-situ field test records, testing records, daily progress reports (DPRs) etc.	Submission next working day.
Post-siteworks Condition Survey	To be completed and reported within 5 working days of siteworks completion (excluding post-site monitoring). Reinstatement and final condition of working areas and access routes to be to the satisfaction of the Investigation Supervisor and Client/Employer.
Records of identification, preliminary logs and description of soil and rock including in-situ test results and blank laboratory schedules	Completed driller's journals/draft trial pit logs, Chain of Custody documents and drafted geo-environmental test schedules to be provided to the Investigation Supervisor within 24hrs of the works they relate to. Draft typed engineering logs and accompanying drafted lab test schedules for to be provided to the Investigation Supervisor within 5 working days of completion of the works they refer to.
Issue of draft GI information	A complete set of ' checked and approved ' typed preliminary engineering logs and field test information to be provided 5 working days after completion of the fieldworks (excluding post-site monitoring)
Preliminary AGS data	Preliminary AGS data (to be submitted in the most recent data format available, and no older than AGS4) to be provided 5 working days after completion of the fieldworks (excluding post-site monitoring)
Laboratory Testing (geo-environmental results)	Provide within a maximum of 10 working days of the completed schedule being submitted to the Contractor
Laboratory Testing (geotechnical results)	Provide within a maximum of 15 working days of the completed schedule being submitted to the Contractor.
Post fieldwork monitoring	6 rounds of ground gas monitoring to be commenced on completion of the siteworks over 3 months. Groundwater sampling to be undertaken during the first three monitoring rounds, or as instructed by the Investigation Supervisor.
Draft GI Factual Report	To be provided to the Investigation Supervisor 5 working days after the completion of all geotechnical testing and no later than 20 working days after completion of the siteworks. Complete AGS file (to be submitted in the most recent file format available, and no older than AGS4) to be provided with draft factual report.
Final GI Factual Report	To be provided to the Investigation Supervisor within a maximum of 5 working days after comments on the draft GI factual report have been received from the Investigation Supervisor. Complete AGS file (to be submitted in the most recent file format available, and no older than AGS4) to be provided with final factual report.
Draft GIR including GQRA	To be provided to the Investigation Supervisor no later than 10 working days after completion of the Final GI Factual Report
Final GIR including GQRA	To be provided to the Investigation Supervisor within a maximum of 5 working days after comments on the draft report have been received from the Investigation Supervisor.

The RAMS / Health and Safety Plan shall suitably address all tasks associated with the Ground Investigation work scope. All fully developed RAMS and CPH&SP shall address comments from the Pre-start Planning Meeting and Pre-works Planning Meetings, and recognised Health, Safety and Welfare risks and requirements as set out within the Designers Risk Assessments presented within the '*Preliminary Health and Safety Plan*' (**Doc Ref. TBC**).

A Pre-start Planning Meeting shall be arranged and attended via teleconference with the Client/Employer, PSDP and Investigation Supervisor prior to commencement of the mobilisation period to establish any particular constraints or considerations to the works, including but not limited to access/egress routes/arrangements, welfare/site compound arrangements, any site

restrictions or technical constraints associated with sequencing or delivering the works, enabling works requirements, etc. Further details of the meeting will be confirmed following Contract Award.

S1.8.1 Quality Management System (Clause 3.3)

Quality management to IS EN ISO 9001:2015, IS EN ISO 14001:2015 and ISO 45001 is required. Records to indicate compliance with quality management shall be made available to the Investigation Supervisor.

S1.8.2 Professional Attendance (Clause 3.5.2)

Full-time Professional Attendance is required on site for the duration of the Site Operations by a suitably qualified and experienced Geotechnical Engineer or Engineering Geologist nominated to act as Site Agent/Person in Control of the Workplace (PICW). The **Site Agent / PICW is required to have at least 5 years'** relevant practical experience of ground investigations of a similar nature, magnitude and scope, and shall be present full-time onsite for the duration of the siteworks.

The management (including sequencing and progress of the works) and technical direction of all aspects of the site operations shall be the responsibility of the Site Agent / PICW including the drilling, sampling, in-situ testing, and accurate logging of exploratory holes in accordance with Eurocode requirements. The Site Agent / PICW is required to maintain close liaison with the Investigation Supervisor with particular regard to ensuring that the technical objectives of the Investigation are being fully achieved.

Details and CV of the Site Agent shall be provided within the Draft CPH&SP. Suitability and competency of the Site Agent / PICW to manage the GI Contract shall be subject to approval by the Client/Employer and PSDP prior to the investigation commencement date.

In addition, full-time site attendance is required by **an experienced engineering geologist with at least 3 years'** relevant practical experience of logging limestone rock cores including identification of karstic features, for the duration of the works. Part of this role shall be to enable on-site real-time assessment of extracted rock cores and determination of their quality against the 'competent rock' criteria stated within Section 1.5 and Schedule 2.

Additional supervision to meet the technical requirements of the Scope of Works, including supervision of a single activity where constant supervision is required (e.g. trial pitting and in-situ testing) shall be provided. **All proposed technical supervisory staff shall have at least 3 years' practical experience** of works of a similar nature, unless otherwise agreed with the Investigation Supervisor.

All supervisory staff shall be acceptable to the Investigation Supervisor. The Investigation Supervisor may reject a nominated person after arriving at site, if he/she considers that the person does not have the necessary skill, knowledge or experience to carry out the required work. The chemical sampling and testing, and geotechnical personnel may be one and the same person if suitable qualifications and experience can be demonstrated.

No replacement or substitute the approved Site Agent / PICW or supervisory staff is permitted without permission of the Investigation Supervisor.

Further particular requirements for this contract are set out below:

- All site operatives shall have undertaken SAFEPASS / CSCS training (or other EU equivalent) and certification before working on the site.

- All drilling/boring personnel shall hold a valid BDA audited certificate, or other EU equivalent. (Where there is no national equivalent, the Contractor shall provide a demonstration of experience and competence through CV and/or field demonstration).
- In addition, at least one member of the Contractor's site personnel team must be trained and competent in accordance with the '**Health and Safety Authority (HSA) Code of Practice for Avoiding Danger from Underground Services (2016)**' and '**Health and Safety Authority (HSA) Code of Practice for Avoiding Danger From Overhead Electricity Lines (2019)**'.

CVs of all supervisory staff and copies of all current training certificates/records for operatives undertaking the works shall be submitted to the Investigation Supervisor and Client/Employer for approval 10 working days prior to commencement of the site works, and be contained within the draft CPH&SP. A GI delivery team organogram detailing supervisory personnel, roles and responsibilities shall be included in the draft CPH&SP.

The Contractor shall disseminate information and give instructions to their site staff on all aspects of this Specification. Any changes to scope or variance from this specification will be provided by the Investigation Supervisor and confirmed in writing.

Close liaison with the Investigation Supervisor is expected to ensure that the highest quality of sampling and testing is achieved.

S1.8.3 Provision of ground practitioners and other personnel (Clauses 3.6.1 and 3.6.2)

Any sub-Contractor to be used in association with the GI works shall require approval from the Client/Employer and Investigation Supervisor prior to mobilisation. The Contractor shall be responsible for the services to be provided by the sub-Contractor and shall be liable for defects and omissions from them.

S1.8.4 Hazardous ground and land affected by contamination and notifiable and invasive weeds (Clauses 3.7.1 and 3.22)

A high-level review of historical and current land uses has been undertaken for the site and an indicative **YELLOW** BDA site classification has been given.

The Contractor shall take cognisance that asbestos has been identified within the buildings onsite and should ensure that all site operatives are trained on the identification and best practice methods should asbestos be encountered within the soils on site. Appropriate PPE and regular hand-washing should be adopted by all site operatives for the duration of the works.

Should substances be encountered that warrant an increase in this classification then works shall stop and advice sought from the Investigation Supervisor.

Should visual or olfactory evidence of contamination be encountered during the investigation then the Investigation Supervisor must be notified immediately.

No invasive species are known to be present within the site areas.

Reference shall be made to the Designers Risk Assessment presented within '*Preliminary Health and Safety Plan*' (**Doc Ref TBC**) for recognised Health, Safety and Welfare risks and requirements associated with the works.

S1.8.5 Additional information on services not shown on the Contract Drawings (Clause 3.7.2)

Reference shall be made to the information and responsibilities relating the services and utilities as detailed within the document '*Preliminary Health and Safety Plan*' (**Doc Ref TBC**)

Current Utility or Local Authority records of significant site services shall be obtained prior to any ground disturbance.

All proposed works for the site and operatives working on the site must follow the requirements of the HSA Guidance Notes '**Health and Safety Authority (HSA) Code of Practice for Avoiding Danger from Underground Services (2016)**' and '**Health and Safety Authority (HSA) Code of Practice for Avoiding Danger From Overhead Electricity Lines (2019)**'.

S1.8.6 Known/Suspected mine workings, mineral extractions, etc. (Clause 3.7.3)

None known within site areas.

S1.8.7 Protected Species (Clause 3.7.4)

None known within site areas. Should any protected species be identified during the works, they shall be left undisturbed and the Client/Employer and Investigation Supervisor notified immediately.

S1.8.8 Archaeological Remains (Clause 3.7.5)

No known archaeological remains are understood to be located within the site. Should any archaeological remains be identified during the works, they shall be left undisturbed and the Client/Employer and Investigation Supervisor notified immediately.

S1.8.9 Security of the Site (Clause 3.11)

Given the accessible nature of the site, the ground investigation works are deemed to be within the public domain and shall be properly protected and/or secured. This is to include as a minimum, appropriate fencing/barriers, appropriate signage, and appropriate security measures if equipment is to be left on site outside of normal working hours, and/or as instructed by the Investigation Supervisor.

Given that the site is within and active hospital and works will be undertaken within the vicinity of the accident & emergency building, the Contractor shall give consideration to the use of visual and/or acoustic barriers to minimise disturbance to patients.

The indicative site boundary for the GI works is shown on the exploratory layout plans, contained in Appendix A. Any specific security provisions for the work site shall be established and agreed with the Client/Employer, PSDP and the Investigation Supervisor prior to commencement of the Site Operations. All fieldwork activities shall be within the agreed designated site boundary.

Working areas should be agreed with the Client/Employer, PSDP, and the Investigation Supervisor prior to commencement, and arrangements made to protect the site users, members of the public, and site vehicles during the works.

All exploratory hole locations shall be properly protected and secured during the fieldwork period, as per Health and Safety requirements, and any other site-specific requirements of the Client/Employer and/or PSDP. This is to include as a minimum, appropriate fencing/barriers and appropriate signage.

All barriers and fences breached or otherwise disturbed during the execution of the site operations shall be repaired or replaced to the same standard. Any permanent barriers and fences should not be breached unless clearly instructed by the Investigation Supervisor with full assurance that agreement has been given by the Client/Employer.

No excavations to be left open overnight.

S1.8.10 Traffic Management Measures (Clause 3.12)

The site areas are located within an active hospital, and as such it is considered that traffic management will be required to undertake the works in a safe and controlled manner.

The introduction of traffic calming measures shall be considered at the site access / egress points to alert road users of turning vehicles, access to works compounds, etc.

Exploratory holes are located in close proximity to the Accident & Emergency building entrance, and as such this area must be kept clear for any incoming ambulances.

S1.8.11 Restricted working hours (Clause 3.13)

Unless otherwise specified, the working hours shall be Monday to Friday between 08:00 and 18:00 (daylight permitting).

Prior permission from the Client/Employer will be required for night-time working, weekend working or work during Public Holidays, with a minimum of 5 working days' notice in advance of the proposed works. Any non-standard working hours shall also be agreed with the Investigation Supervisor, the cost of which shall be deemed to be covered within the rates submitted with the Bills of Quantities.

S1.8.12 Trainee Site Operatives (Clause 3.14.1)

Trainee site operative shall only be permitted if safety competence can be demonstrated.

S1.8.13 Contamination avoidance and/or aquifer protection methods required (Clause 3.15.2 and 3.15.3)

Avoidance of Further Contamination (Clause 3.15.2)

Works shall be completed in compliance with an Environmental Management System in accordance with BS EN ISO 14001, which requires that all environmental factors are considered at project planning and site operation stages. Details of environmental management systems (including control and mitigation measures) are to be detailed within RAMS for approval by the Client/Employer and Investigation Supervisor.

The Investigation Supervisor shall be notified immediately if visual and/or olfactory evidence of contamination is encountered during the siteworks. Borehole casing shall be used when drilling through contaminated ground, if identified, to prevent the spread of contaminants and to protect against cross-contamination of samples. If drilling is likely to penetrate an aquifer, then a double casing arrangement may be necessary.

Arisings shall be placed upon polythene sheeting, and in wet, or windy weather shall also be covered, to prevent the spread of contaminated material. Where necessary, provision shall be made for collection and disposal of contaminated wash water and groundwater to a licensed waste disposal or treatment facility.

Excess spoil shall be removed from the site. This includes any waste, whether it be solid, liquid or gaseous, arising during the works, or after the works. All working areas are to be returned their previous condition or equivalent agreed condition.

Contaminated materials and arisings (including geotechnical and geo-environmental samples) shall where necessary be disposed of at an appropriate waste disposal or treatment facility and in accordance with current waste management duty of care procedures. Copies of waste management licenses, waste transfer notes and consignment notes shall be submitted to the Investigation Supervisor for quality assurance purposes.

Noise, dust and odour must be kept to a minimum at all times. All drilling spoil, slurry and extracted borehole fluids / groundwater is to be contained.

Decontamination

Where contaminated land is encountered, all equipment to be reused at different sampling locations shall be decontaminated. Sampling equipment shall also be decontaminated in between collection of samples to prevent cross contamination.

Decontamination shall comprise, as a minimum, the washing of collection vessels and instrument probes with de-ionised water; however, the used of decontamination fluids is preferable such as phosphate-free detergent solution (e.g. Decon 90, Camtex or similar). For larger equipment and plant, a portable power washer or stream cleaner may be used. Washing shall be undertaken at locations to be agreed with the Investigation Supervisor.

Equipment should be rinsed with control water (uncontaminated water from a known source). Where required by the Investigation Supervisor, a sample of control water shall be collected by analysis.

Where necessary, provision shall be made for collection and disposal of contaminated wash water and groundwater to an approved disposal site.

Oil Storage and Refuelling

Leaking or empty oil drums must be removed from the site immediately.

Refuelling, oiling and greasing shall be strictly controlled, and together with any oil storage tanks, should be confined to a location remote from any watercourse or drain, above drip trays, or within a surfaced area providing protection to underground strata and watercourses. Only construction equipment and vehicles free of all oil/fuel leaks will be permitted on site.

Notwithstanding these precautions, a contingency plan shall be put in place and suitable materials to deal with any incident, including spillages of hazardous substances either on the land or into local watercourses, and ensure that employees know what to do in the event of a spillage. Preventative measures to avoid any such spillages should be reviewed to avoid any recurrences.

Groundwater Aquifer Protection Measures (Clause 3.15.3)

It should be noted that the solid geology at the site has been classified by the GSI as a locally important aquifer of moderate to high groundwater vulnerability. Further details are provided within S1.6.

If drilling is likely to penetrate an aquifer, then a double casing arrangement may be necessary.

Measures would also be required to be put in place to avoid potential for cross-contamination of an aquifer by drilling through an upper contaminated groundwater zone (if encountered) into the underlying clean, water supply aquifer.

Aquifer protection will usually be required when exploratory holes penetrate through an aquiclude into an underlying aquifer to prevent upward/downward groundwater migration. Aquifer protection is particularly important where the ground overlying the aquiclude is contaminated. Multiple aquifers (including perched water systems) will need the protection

measures repeated for each aquiclude/aquifer system. The protection measures may be formed by:

- Step 1. Boring or drilling (both with temporary casing) a suitable depth into but not penetrating through the aquiclude.
- Step 2. Forming a cement plug in the base of the hole then pulling back the temporary casing to just below the top of the seal.
- Step 3. Installing a secondary smaller diameter temporary casing through the seal to the depth required.

When only a single aquiclude/aquifer boundary is penetrated, the depth to which the secondary temporary casing extends will be governed by the need to prevent collapse of the exploratory hole wall. Where the hole is to penetrate through more than one aquiclude/aquifer boundary the secondary temporary casing must be extended into the lower aquiclude, then steps '2' and '3' above repeated with a tertiary casing.

Protection of Controlled Waters

In executing any works, precautions must be taken to secure the complete protection of reservoirs, rivers, streams, ditches, other watercourses and water in underground strata against silting, erosion, or pollution. If notwithstanding these precautions, such silting, erosion, or pollution does take place, the Irish Environmental Protection Agency (EPA) should be advised immediately, and immediate action should be taken to minimise the effect on the watercourse.

No material intended for, or arising from the Works, and no equipment or other items for use in executing the Works, shall be stored or disposed of in the watercourse or in a position where it may fall or be washed into the watercourse or water body. Any such material or equipment that gets into a water body shall be removed immediately.

Wash waters from mobile pressure washers shall not be discharged to surface water drains, watercourses, or soakaways. Detergents, including those described as bio-degradable shall not be discharged to surface water drains. Where possible washing activities shall be carried out in a designated area draining to the foul sewer or contained within a sealed drainage system or catch pit for offsite disposal by a licensed waste contractor. Any authorisation to discharge to the foul sewer shall be obtained.

Approval for all temporary discharges to and abstractions from watercourses from the appropriate regulators shall be obtained and shall comply in all respects with their requirements. Bio-degradable hydraulic oils shall be used in equipment working over or adjacent to water, and within aquifers.

S1.8.14 Maximum period for boring, pitting or trenching through hard material, hard stratum or obstruction (Clause 2.8, 4.3 and 6.4)

As specified in Clause 2.8, 4.3 and 6.4.

The Investigation Supervisor shall be immediately notified of any of the following:

- Chiselling exceeding 1 hour (total time in one borehole)
- Hardstanding breakout exceeding 0.5 hour.
- Refusal of drilling

S1.8.15 Reinstatement requirements (Clause 3.16)

The Investigation Supervisor shall be consulted prior to backfilling of any exploratory excavation, or demobilisation of plant from any exploratory location. On completion of drilling or

excavation works, all locations, access ways and fences shall be reinstated to the satisfaction of the Investigation Supervisor.

Boreholes with installations are to be reinstated with raised / flush protective covers as instructed by the Investigation Supervisor in agreement.

Where installations are not required material consistent with the ground surface prior to drilling is to be used.

Where boreholes, or pitting or trenching is carried out, the ground shall be reinstated as close as possible to the existing condition prior to the start of the Works, including topsoiling and reseeded in grassed areas.

All hand and machine excavated pits (inspection pits and trial pits) shall be neatly backfilled, in the reverse order that material was extracted, compacted in layers and reinstated to their original surface condition.

On completion, reinstatement of the site and access routes and remove all plant, equipment, surplus material, spoil etc. are required to the satisfaction of the Investigation Supervisor. Damage assessed as unavoidable and agreed by the Investigation Supervisor shall also be reinstated but will be reimbursed accordingly.

The site shall be reinstated to, or as close to, the original condition. All reinstatement must be undertaken to the satisfaction of the Investigation Supervisor.

S1.8.16 Hygiene facilities required (Clause 2.21 and 3.16.1)

As a minimum, hygiene facilities are required as per Clause 2.21 and shall be in accordance with Safety, Health and Welfare at Work Act (2005).

Refer to the document '*Preliminary Health and Safety Plan*' (*Doc Ref TBC*).

S1.8.17 Unavoidable damage to be reinstated by Contractor (Clause 3.16.1)

Damage and disturbance to the site due to GI works shall be minimised. Details of working practices (including backfilling of exploratory holes) and mitigation measures are to be included with detailed site-specific RAMS and construction phase Health and Safety Plan for approval by the Client/Employer, PSDP and Investigation Supervisor.

S1.8.18 Accuracy of exploratory hole locations (Clauses 3.19 and 3.20)

All exploratory hole locations to be surveyed using Irish Transverse Mercator (ITM) co-ordinates and reduced levels recorded relative to Malin Head Vertical Datum (MHVD), referred hereafter as Mean Sea Level (MSL), to within +/- 0.5m in plan and +/- 0.1m in elevation. An as-built drawing showing the location and elevation of all exploratory holes is required to be presented within the GI Factual Report.

S1.8.19 Photography requirements (Clause 3.25)

Photographic records are to be included in the GI Factual Report and as a minimum shall comprise photographs of each trial pit, rock core, pre and post condition survey at each site, damaged / repaired services.

Colour photographs are required at each trial pit location (i.e. base (short wall), sidewall view (long wall) and spoil), while a single colour photograph will be required of each core sample taken from rotary core holes.

For the site condition surveys, as a minimum, photographs shall be taken by the Contractor of the condition of the ground:

1. Before excavation.
2. On opening the exploratory hole; and
3. Once reinstatement has been completed.

S1.8.20 Further particular Contract restrictions/relaxations

S1.8.20.1 Standing Time

Any standing time will be notified to the Investigation Supervisor immediately once Standing Time starts to be incurred. A claim for Standing Time incurred on site will not be considered valid unless the Investigation Supervisor has been notified at the commencement of the said event incurring Standing Time.

S1.8.20.2 Descriptions

The geological stratum name shall be assessed for all strata at the time of logging and included at the end of each stratum description on engineering logs where applicable.

S1.8.20.3 Pre and Post Condition Survey

A pre-condition survey of areas expected to be affected by the proposed fieldwork operations is required. The survey shall be undertaken prior to the implementation of siteworks. A post-condition survey, shall be undertaken after completion of the works, following reinstatement back to the initial ground conditions. This should be completed for Package 1 and Package 3.

The survey is required to record the condition of the general site area, including external surfaces and finished of any roads/pavements, vegetation, boundary fences, walls, access tracks, and exploratory hole locations areas which may be affected by the proposed exploratory fieldworks. A detailed photographic record of pre- and post- conditions must be undertaken and reported by the Contractor in the form of a survey report, to be included in the GI Factual Report.

The survey report shall include a description of the external conditions based on visual observations by an experienced engineer, supplemented by a photographic record, highlighting any evidence of damage and/or distress to site features. The reporting format is to be agreed in advance with the Investigation Supervisor and Client/Employer. The report shall be in two parts, namely Part 1 – Pre-Condition, and Part 2 – Post-Condition. Part 1 shall be produced and issued to the Client/Employer no later than 1 week after the commencement of the fieldworks. Part 2 shall be produced and issued to the Client/Employer no later than 1 week following completion of the site operations.

S1.9 Percussion boring (Specification Section 4) Restrictions/relaxations

S1.9.1 Permitted Methods and Restrictions (Clauses 4.1 to 4.4)

Not required.

S1.9.2 Backfilling (Clause 4.5)

Not required.

S1.9.3 Dynamic Sampling (Clause 4.6)

Not required.

S1.10 Rotary drilling (Specification Section 5) Particular restrictions/relaxations

Prior to the commencement of each exploratory position, services clearance must be completed as per S1.11.1.

S1.10.1 Augering requirements and restrictions (Clauses 5.1)

Not required.

S1.10.2 Particular rotary drilling techniques (Clause 5.2)

It is expected that a combined soil and rock coring system (GeoBoreS wireline drilling or similar approved method) shall be used to achieve a continuous borehole and the technical requirements of the ground investigation without requiring movement of the system between soil and rock coring.

Rotary core drilling (or other approved method) shall be undertaken using plant and equipment (i.e. core barrels, bit types) considered suitable to the anticipated ground conditions; and capable of achieving the scheduled exploratory hole depths, in-situ Standard Penetration Testing (SPT) if/where required and sampling requirements (i.e. soil sampling in GeoBoreS boreholes).

Attention should be drawn to the rotary drilling core recovery and drill run requirements detailed within Schedule 4.

The stability of the boreholes must be ensured by installing temporary casing as necessary whilst remaining mindful of the in-situ requirements specified within Schedule 2.

S1.10.3 Drilling fluid type and collection (Clause 5.3)

Due consideration shall be given to appropriate flush method to maximise core recovery based the anticipated ground conditions at each drilling location.

Proposed drilling flush medium and their proposed containment shall be included within the RAMS and CPH&SP, to be agreed with the PSDP and Investigation Supervisor prior to commencement of drilling operations.

S1.10.4 Rotary core drilling equipment and core diameter (Clauses 5.4.1 & 5.4.2)

The most appropriate equipment for achieving the core recovery requirements and scheduled drillhole depths should be utilised.

Initial drillhole diameters shall allow for casing through highly fractured or weathered zones and allow for reducing equipment diameters to ensure scheduled depths are achieved.

Minimum hole diameter for rotary drilling should be 100mm to produce cores of minimum diameter of 76mm for conventional double barrel drilling, unless otherwise approved by the Investigation Supervisor. To maximise core recovery, core liners are to be used, unless otherwise agreed with the Investigation Supervisor.

Diameters shall be sufficient to enable the boreholes to achieve scheduled depth as a continuous borehole with retrieval of undisturbed Class 1 core samples to facilitate UT100 / U100 sub-sampling for geotechnical testing in superficial deposits.

The Investigation Supervisor may specify in situ testing between drill runs.

Care shall be taken to maintain recovered core in a condition as near as possible to its natural state.

A combination of methods, equipment and flush mediums shall be available to enable the coring technique to be varied to obtain maximum core recovery and minimise environmental impact. A method statement for drilling techniques and the range of equipment, flush medium is to be maintained on site.

Core recovery less than 95% in any drill run will not normally be acceptable unless the Investigation Supervisor is satisfied that more than 95% recovery is impracticable under the prevailing conditions. Potential karst/dissolution features identified during drilling operations shall be recorded and reported to the Investigation Supervisor immediately. If in the opinion of the Investigation Supervisor more than 95% recovery can be achieved and/or core quality could be improved, measures shall take measures to obtain improved satisfactory core recovery. Such measures may include experimentation with different drill bits, flush types, core barrels, liners or drilling techniques etc.

S1.10.5 Core logging (Clause 5.4.6)

Soil and rock logging shall be carried out by an experienced Geotechnical Engineer or Engineering Geologist in accordance with IS EN ISO 14688-1:2018, IS EN ISO 14688-2:2018, IS EN ISO 14689:2018 and BS 5930:2015+A1:2020. The geological stratum name shall be assessed for all strata at the time of logging and included at the end of each stratum description. In addition, the following logging procedures shall be followed:

- For over consolidated clays and weak rock, the descriptive procedure and weathering classification give in Spink, T W and Norbury, DR 'The Engineering Geological Description of Weak Rock and Over-consolidated Soils', Proc. 26th Regional Meeting of Engineering Ground of Geological Society, Leeds (1993).

Groundwater strikes shall be recorded wherever encountered.

In addition to the other requirements of the specification, the Contractor shall make detailed field observations in respect of the geo-environmental and gas monitoring investigations including:

- Visually/olfactory identified contaminants and hazardous materials e.g. free oil product, colour, odour and any other pertinent factors.
- Sample container type.
- Presence of potential pathways for contaminant migration, other than soil/rock, for example man-made features such as abandoned services, pipework, etc.
- Method of groundwater purging/volume of water removed.
- During gas monitoring, local weather conditions including ambient temperature, barometric pressure on the day of the observation and on the previous day should be recorded.

These shall be included in the Contractor's Factual Report.

Preliminary results of on site or in-situ tests on soil, groundwater and gas - together with cross reference to the appropriate calibration certificates - should be presented to the Investigation Supervisor within 48 hours of the tests being carried out. The condition of the monitoring points, damage, leakage from surface spills etc. must also be recorded.

All core should be logged and subsampled (where required) within 1 hour of the core liner being split to maintain sample integrity. Cores should be split, logged and subsampled within 4 hours of retrieval, otherwise the core should be wax sealed to prevent moisture loss.

Cores should be stored upright following retrieval, where practicable. As such, core liners should be clearly marked with 'Top' and 'Bottom' when retrieved from the ground to avoid cores being stored upside down. Consideration should be given to shorter core runs, e.g. 1.0m or 1.5m length, to allow for cores to be stored upright.

S1.10.6 Core sub-samples for laboratory testing (Clause 5.4.7)

As instructed by the Investigation Supervisor on site.

S1.10.7 Address for delivery of selected cores (Clauses 5.4.8 and 5.4.9)

As instructed by the Investigation Supervisor.

S1.10.8 Rotary core open hole drilling general requirements (Clause 5.5.1)

Not anticipated to be required. Prior approval from the Investigation Supervisor is required when rotary open-hole drilling is considered necessary to advance drilling.

S1.10.9 Rotary open-hole drilling for locating mineral seams, mine workings (Clause 5.2.2)

Not required.

S1.10.10 Open-hole resonance (sonic) drilling (Clause 5.6.1)

Not required.

S1.10.11 Resonance (sonic) drilling with sampling or continuous coring (Clause 5.6.2)

Not required.

S1.10.12 Backfilling (Clause 5.7)

Approval shall be sought from the Investigation Supervisor prior to the termination and backfilling of each hole.

Boreholes without installations shall be backfilled with bentonite pellets or cement-bentonite grout (as agreed with the Investigation Supervisor), up to 1.0m bgl followed thereafter by 'clean' arisings or granular materials and reinstated as agreed with the Investigation Supervisor.

Backfilling methodologies / proposals shall be agreed with the Investigation Supervisor if / where significant karstification (i.e. underground voids, cavities, hydrogeological / drainage pathways) is encountered within boreholes.

S1.10.13 Core photographic requirements (Clause 5.8)

As specified in Clause 5.8.

S1.11 Pitting and trenching (Specification Section 6) Particular restrictions/relaxations

S1.11.1 Indirect detection of buried services and inspection pits (Clauses 3.8.3 and 6.1)

A comprehensive utilities / services search is required prior to mobilisation to site, which shall provide full spatial coverage of the proposed GI works. A full set of existing utilities records shall

be held onsite and used to assist indirect detection of buried services in the vicinity of each exploratory hole position. Service plans and records shall be less than 3 months old from the date of the GI fieldworks commencing onsite.

All excavation works shall be undertaken in accordance with safe practices set out within **'Health and Safety Authority (HSA) Code of Practice for Avoiding Danger from Underground Services (2016)'**. CAT scanning shall also be undertaken periodically during the excavation works and upon reaching 1.2m depth.

S1.11.2 Restrictions on plant or pitting/trenching methods (Clauses 6.2 and 6.3)

Trial pit depths and particular requirements are provided in Schedule 2.

Where present, turf/hardstanding should be lifted from the pit location in such a way that it can be set aside and reinstated at the top of the pit upon completion. As each pit is advanced, the spoil should be segregated in such a way that it can be used to backfill the pit in the same order that it was removed (i.e. topsoil should be excavated and stockpiled separately from other soil layers). The Contractor shall consider the use of protective sheeting to avoid cross contamination / mixing of spoil with the existing ground surface.

If / where underground services are detected or located within the pit, the location and depth shall be recorded. The pit shall be backfilled and reinstated, and the pit may be re-located in consultation with the Investigation Supervisor. Relocated pits shall not be commenced until the new location has been approved by the Investigation Supervisor.

The reason for the premature termination of excavations in soil strata above the maximum scheduled depths shall be clearly shown on the exploratory hole logs and shall be subject to the agreement of the Investigation Supervisor. Exposed services, obstructions, groundwater conditions and excavation stability shall be recorded and included in the exploratory hole records.

Should any evidence of contamination be encountered during ground investigation works, the Investigation Supervisor must be notified immediately.

Machine Excavated Trial Pits

All trial pitting shall be extended mechanically in a controlled manner to a maximum of 4.5m depth or rockhead, whichever is shallower. Open pits must not be left unattended at any time.

Trial pits shall be logged on site. The following details of the rock encountered shall be recorded and included on the trial pit logs if encountered; depth, rock type, estimated strength, rock mass characteristics (GSI or similar approved) colour, and degree of weathering.

Hand Excavated Pits

Hand excavated trial pits shall be excavated to a depth of 1.2m bgl to inspect and record the ground conditions within spoil heaps and to facilitate the collection of geotechnical and geo-environmental soil samples.

Slit Trenching

Slit trench dimensions and any particular requirements are provided in Schedule 2.

Slit trenching works shall be extended by hand to a maximum of 1.2m depth to locate the targeted services.

Slit trenching shall be logged in the same manner as trial pitting. A continuous long section of the ground conditions encountered within the trench shall be included with the engineering log.

If / where underground services are detected or located within the trial trench, the location, type, depth and condition shall be recorded.

Foundation Inspection Pits

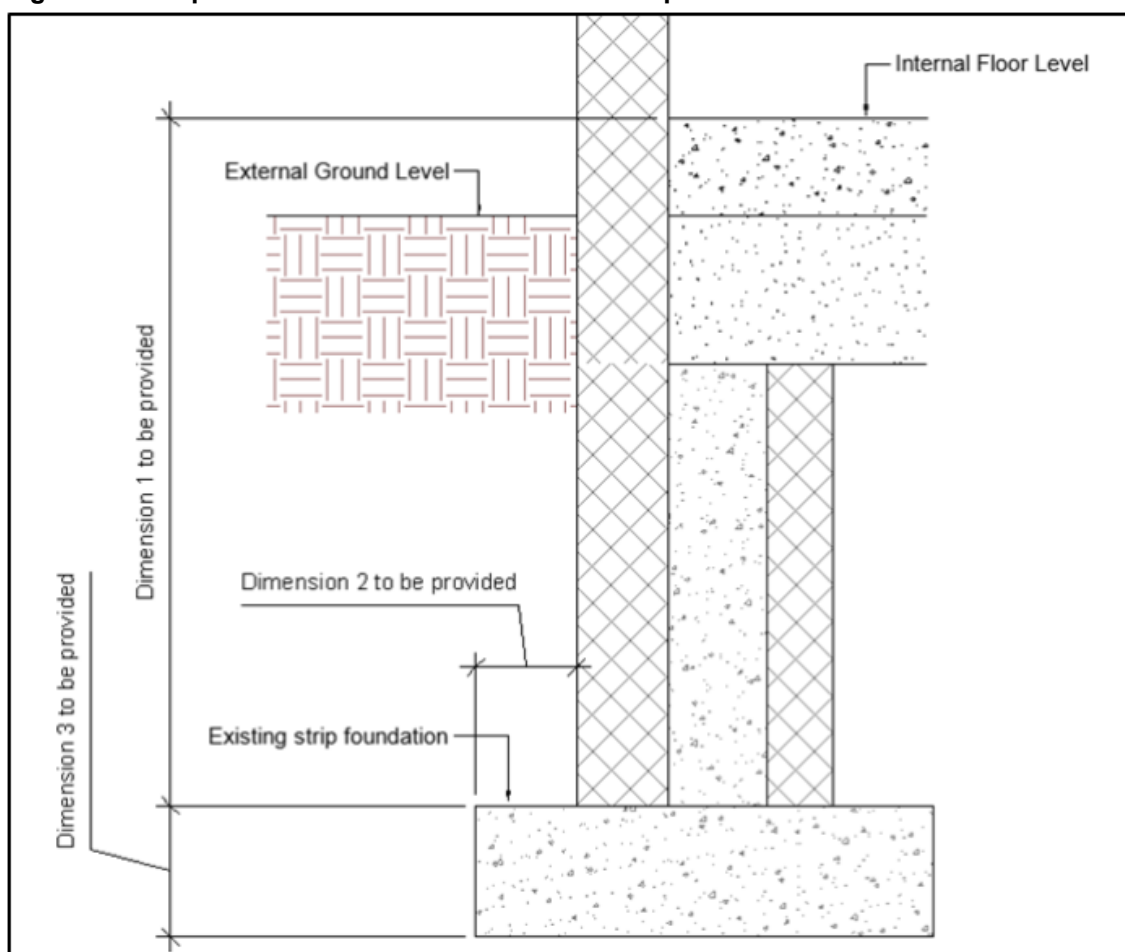
Hand excavated foundation inspection pits are required to identify the extents of the existing hospital buildings and retaining wall substructures (as detailed in Schedule 2). A minimum of two excavations shall be carried out for each building/retaining wall.

Foundation inspection pits shall be excavated to a depth of 1.2m bgl to inspect and record existing foundations and facilitate the collection of geotechnical and geo-environmental soil samples.

Each foundation inspection pit shall record the following:

- Geometry of the foundation with respect to ground level and the edge of the existing building/retaining wall, to be reported as detailed sketches with annotations and dimensions, including plan and cross sections. The dimensions required are detailed in Figure 1.2;
- Conditions of the foundation where clearly visible, including notes of any visible cracks or deterioration in the concrete;
- Survey coordinates and level of the foundation(s).

Figure 1.2: Required Dimensions for Foundation Inspection Pits



Source: Mott MacDonald

The obtained geometric information, sketches and photographs shall be included within the factual report.

Photographs of the exposed foundations shall be taken as per S1.14.7.

S1.11.3 Entry of personnel (Clause 6.5)

Not permitted for unsupported excavations greater than 1.2m depth.

S1.11.4 Alternative pit and trench dimensions (Clause 6.7)

Inspection pits / Hand dug pits shall have a minimum base area of 0.5m by 0.5m or sufficiently wide to allow the ground below the base of the pit to be CAT scanned prior to the commencement of boring / drilling works.

Foundation inspection pits shall have a minimum base area of 0.5m by 0.5m to allow for clear images and sketches of any foundations encountered. Foundation inspection pits may be extended to accurately delineate the nature of the foundations where instructed by the Investigation Supervisor.

Trial pits shall have a minimum base area of 2.0m by 1.0m, or as otherwise stated in Schedule 2. It is the responsibility of the Contractor to ensure the trial pits are sufficiently dimensioned and supported to allow safe excavation.

Slit trenching shall have minimum base dimensions of 3.0m by 1.0m, or as otherwise stated in Schedule 2.

S1.11.5 Abstracted groundwater from land affected by contamination (Clause 6.9.2)

Abstraction of groundwater is not required.

S1.11.6 Backfilling (Clause 6.10)

All excavations should be backfilled as soon as practicable upon completion and should not be left open unless supervised.

Excavations shall be backfilled with the arisings (unless specified otherwise by the Investigation Supervisor) in the reverse order to which they were excavated (i.e. last out, first in) corresponding to their excavation location. Backfill shall be nominally compacted in layers not greater than 200mm thick. Excess arisings must be removed and not spread around the pit location. Where possible, turf (where originally present) shall be carefully replaced on top.

Where exploratory pits occur in areas of hardstanding, road pavements or similar, reinstatement to previous condition will be required and backfilling should be carried out using excavated material and compacted in layers to approximately 95% relative compaction (subject to the approval of the Investigation Supervisor) to minimise future settlement.

S1.11.7 Photographic requirements (Clause 6.12)

Trial Pit and Foundation Inspection Pit photographs shall be taken using digital cameras. The photographs shall be taken using a minimum camera resolution of 10 megapixels. A minimum number of three photographs shall be taken per each pit. The photographs shall document all underground obstructions, short face, long face and excavated spoil.

S1.11.8 Artificial lighting (Clause 6.12.2)

Not required.

S1.11.9 Provision of pitting equipment & crew for Investigation Supervisor use (Clause 6.13)

Not required.

S1.12 Sampling and monitoring during intrusive investigation (Specification Section 7) Particular restrictions/relaxations

S1.12.1 Address for delivery of selected geotechnical samples (Clause 7.6.1)

Not required.

S1.12.2 Retention and disposal of geotechnical samples (Clause 7.6.2)

All samples (including rock cores) shall be retained for a minimum of 28 days after issue of the Final Factual Report. Thereafter, instruction shall be sought from the Investigation Supervisor regarding arrangements to continue with the storage requirements, or for sample disposal.

S1.12.3 Frequency of sampling for geotechnical purposes (Clauses 7.6.3 – 7.6.11)

Geotechnical sampling in soils and rock is to be carried out in accordance with the general requirements set out below.

The Investigation Supervisor may vary sampling and testing requirements on site to suit the ground conditions encountered.

Table 1.4: Geotechnical Soil and Rock Sampling Requirements

Investigation Technique	Sample Type	Sampling Frequency
Trial Pits, Slit Trenches, Inspection Pits, Hand Dug Pits and Foundation Inspection Pits	Small disturbed (1kg) soil samples	At 0.5m, 1.0m and 1.0m intervals thereafter and at every change in strata / soil consistency.
	Bulk disturbed (25kg) soil samples	At 0.5m, 1.0m and 1.0m intervals thereafter and at every change in strata / soil consistency.
Boreholes (Wireline GeoboreS drilling or similar) in soils	Small disturbed (1kg) samples	At 0.5m, 1.0m and 1.0m intervals thereafter and at every change in strata / soil consistency.
	Bulk disturbed (25kg) samples	At 0.5m, 1.0m and 1.0m intervals thereafter and at every change in strata / soil consistency.
	SPTs with recovered small disturbed samples and UT100 / U100 undisturbed samples	<u>Granular strata</u> – SPTs at 1m intervals to 10m depth, thereafter relaxed to 1.5m intervals. First SPT test at 1.2m depth at base of inspection pit. <u>Cohesive strata</u> – SPTs shall be alternated with collection of Class 1 undisturbed samples (in accordance with Eurocode 7) at 1m intervals to 10m depth, thereafter relaxed to 1.5m intervals.
Rotary Drilling (coring through rock)	Rock Core	Rock core shall be extruded from the barrel in semi-rigid plastic core liner sealed to prevent moisture loss.
	SPTs with recovered small disturbed samples	At 1.5m intervals within weathered / soft rock horizons as instructed by the Investigation Supervisor

Note: Where soil and rock samples are taken at a depth corresponding to a boundary between two different materials, the Contractor shall clearly state which material the sample is associated with.

All appropriate sampling methods shall be undertaken in accordance with Eurocode 7 Part 2 and IS EN ISO 22475-1:2006.

Attention is drawn to the sample storage and handling requirements of the “Concrete in Aggressive Ground, BRE Special Digest No. 1 (2005)” and the “Sulphate specification for structural backfills, TRL Report 447 (2005)” in respect of sulphate and pH testing. Suitable storage facilities appropriate to the proposed time of on-site storage shall be provided.

S1.12.4 Open-tube and piston sample diameters (Clause 7.6.5)

Undisturbed samples of minimum 100mm diameter shall be taken within cohesive deposits to achieve Class 1 quality samples in accordance with Eurocode 7 i.e. thin-walled open-tube samples (UT100) or alternative approved method. Should the undisturbed sample fail, the Contractor shall immediately carry out repeat sampling/testing after consultation with the Investigation Supervisor.

Thick-walled open-tube samples (U100) do not currently form part of the anticipated sampling strategy, however, dependant on the ground conditions at the site the Contractor may request approval from the Investigation Supervisor to use U100s (as a substitute for thin-walled open-tube samples (UT100)) if good reason exists.

S1.12.5 Retention of cutting shoe samples (Clause 7.6.5)

As specified.

S1.12.6 Thin walled sampling (Clause 7.6.12)

Thin walled Class 1 sampling to comply with Eurocode 7 and IS EN ISO 22475-1:2006.

S1.12.7 Groundwater level measurements during exploratory hole construction (Clause 7.7)

Monitoring of groundwater levels shall be undertaken at the start and end of each shift on a daily basis during the fieldwork period. All water strikes shall be monitored until levels have stabilised with appropriate readings / results clearly stated on the field records.

S1.12.8 Special geotechnical sampling (Clause 7.8)

To be advised by the Investigation Supervisor.

S1.12.9 Address for delivery of selected samples (Clause 7.9.2)

The integrity of the samples during transit from the investigation site to the chosen geo-environmental/geochemical testing laboratory shall be insured.

If contaminated land is encountered, the samples from the contaminated soils are likely to be of a hazardous nature. The transport of ‘dangerous’ samples is controlled by statutory regulations. Awareness of such restrictions is required and accommodation for this shall be included within the investigation plan at the outset of the project. These restrictions may include, for example, the requirement to use approved carriers only and to ensure that the sample transport vehicle displays appropriate hazard warning diamonds. The outside of the shipping container shall be labelled in such a way as to comply with current legislation. As a minimum requirement, the outside label shall contain the following information:

- Name and identification number of the shipment.
- Name and address of sender and receiver.
- Appropriate hazard class label.

The responsibility for disposal or surplus samples not delivered lies with the Contractor.

Each sample box will contain a Chain of Custody for signed by the Contractor and the courier. The form will list all the samples in the box, the exploratory hole location number, the depth and type (i.e. D, B, LB) of each samples, the unique sample reference, a note of any special sample handling, preservation and storage requirements, the date and time (where recorded) of the sampling, and the date and time of delivery by the courier. A copy of the Chain of Custody document shall be available for inspection by the Investigation Supervisor on request.

S1.12.10 Retention and disposal of contamination/WAC samples (Clause 7.9.3)

As specified.

S1.12.11 Frequency of sampling (Clause 7.9.4)

The standard geo-environmental sampling sequence summarised in Table 1.5 below shall be adopted. Sampling shall comprise containers appropriate to complete the testing suites provided in Appendix C. The Investigation Supervisor shall confirm where additional samples should be taken for BRE testing.

Table 1.5: Geo-environmental Soils Sampling Requirements

Investigation Technique	Sampling Frequency
Trial Pits, Slit Trenches, Inspection Pits, Hand Dug Pits and Foundation Inspection Pits	Samples shall be collected at 0.3m, 0.5m, 1.0m and at every 1.0m thereafter in made ground, to a maximum depth of 5.0m bgl, and 1.0m below the base of made ground. Additional samples to be taken at each change of strata or as instructed by the Investigation Supervisor. Samples to be taken where visual and/ or olfactory evidence of contamination is encountered
Boreholes	Samples shall be collected at 0.3m, 0.5m, 1.0m and at every 1.0m thereafter in made ground, to a maximum depth of 5.0m bgl, and 1.0m below the base of made ground. Additional samples to be taken at each change of strata or as instructed by the Investigation Supervisor. Samples to be taken where visual and/ or olfactory evidence of contamination is encountered

Contamination sampling shall also be taken upon visual/olfactory evidence of contamination and within the natural material as directed by the Investigation Supervisor. Should visual and/or olfactory evidence of contamination be encountered during the site operations then the Contractor should notify the Investigation Supervisor immediately.

S1.12.12 Sampling method (Clause 7.9.5)

Samples taken from boreholes and pits shall use the procedures identified in BS 10175 (2011) to avoid cross-contamination between samples, spreading of existing contamination and the introduction of external contamination.

A shovel, spade, trowel, rock pick or coring device may be used to collect samples. Clean stainless steel or PTFE coated tools shall be used. All equipment should be decontaminated in between the collection of samples to prevent cross contamination. Washing of sampling equipment shall be carried out after each sample taken. Clean disposable gloves should be worn when collecting the environmental samples. Wearing driller's gloves when sampling is not acceptable.

The sample containers shall be provided on-site by the laboratory, with the appropriate preservatives already added, as recommended by the analytical laboratory. The sample

containers shall be sealable, watertight and robust to avoid damage during handling and transport. All samples shall be clearly labelled and suitably protected during transport to comply with the relevant regulations. The sample labels shall also specify project name and number, unique sample ID, borehole ID, depth, plus the date and time of sampling. All containers shall indicate that the material is potentially contaminated. If a hazardous contaminant has been visually identified this should be noted on the label.

Sample containers and filling requirements for geo-environmental sampling must be confirmed with the Contractors' testing laboratory prior to works commencing ensuring that sufficient sample volume is collected, and appropriate containers used to complete the testing detailed in this specification. An indicative list of sample containers required for each sampling point is presented below:

Table 1.6: Indicative Required Sample Containers

Sample Type	Sample Containers
Geo-environmental Soil Sample	• 1 no. 1kg plastic tub • 1 no. 1kg glass jar • 2 no. 60g soil vials
Geo-environmental Groundwater Sample	• 1 No. 1L plastic bottle • 1 No. 1L glass bottle • 2 No. 40ml glass vials
BRE Soil Samples	• 2 No. 1kg plastic tub
WAC Soil Samples ¹	• 1 no. 1kg plastic tub • 1 no. 1kg glass jar • 2 no. 60g soil vials

¹The Contractor shall confirm with testing laboratory which sample containers are suitable for WAC testing

All samples shall be clearly labelled and suitably protected during transport to comply with the relevant regulations. The sample labels shall also specify project name and number, unique sample ID, borehole ID, depth, plus the date and time of sampling. All containers shall indicate that the material is potentially contaminated. If a hazardous contaminant has been visually identified this should be noted on the label.

All geo-environmental samples shall be collected, transported and stored in accordance with the guidance presented in BS 10175:2011+A2:2017 and BS 10176:2020, including being stored at a temperature not exceeding 4°C and shall also dispatched to the GI Contractor's geo-environmental testing laboratory within 24 hours of sampling.

Chain of custody documents along with drillers logs shall be made available to the Investigation Supervisor within 24 hours of the works to which they refer to negate the risk of deviating samples to ensure the validity of test reports.

The contractor shall provide details of their sample dispatch procedures and ensure that measures are in place to avoid deviating samples.

S1.12.13 Headspace Testing

Not required.

S1.13 Probing and cone penetration testing (Specification Section 8) Particular restrictions / relaxations

S1.13.1 Types(s) and Reporting of Dynamic Probing (Clause 8.1.1 and 8.1.2)

Dynamic Cone Penetrometers (DCP) TRL

In-situ Dynamic Cone Penetrometers (DCP) using TRL method shall be undertaken at locations specified in Schedule 2.

The purpose of the DCP TRL tests is to determine a continuous profile of in-situ CBR values with depth within the near surface deposits along the route of the proposed access road as well as the proposed car park west of the site. The test shall commence from ground level to 3m depth (or refusal).

Correlated CBR values shall be recorded with depth below ground level.

S1.13.2 Capacity and equipment requirements for Cone Penetration Testing (Clause 8.2.1)

Not required.

S1.13.3 Reporting of Cone Penetration Testing Parameters (Clause 8.2.4)

Not required.

S1.13.4 Seismic Cone Equipment Requirements (Clause 8.3.1)

Not required.

S1.13.5 Interpretation of Seismic Cones (Clause 8.3.4)

Not required.

S1.13.6 Other Cones or Specialist Probes (Clause 8.4)

Not required.

S1.14 Geophysical Surveying (Specification Section 9) Particular restrictions / relaxations

The geophysical surveys shall be carried out to British Standard or other national equivalent standards and best practice guidance.

Detailed method statements, risk assessments, quality manuals and equipment (or tool) specifications shall be supplied by the Contractor within the CPH&SP, and no later than a minimum of 10 working days prior to commencement of the fieldworks for approval by the Client and Investigation Supervisor.

S1.14.1 Geophysical survey objectives

The objectives of the geophysical surveys are as follows:

- To characterise the ground conditions / detailed two-dimensional profile across the site to minimum of 20m penetration depth.
- Profile rockhead level beneath the site and identify any potential karstic features within the limestone bedrock, if present within the specified depth range.

- To determine resistivity (including Pressure Wave & Shear Wave velocities) and stiffness characteristics of soil and rock strata within the specified depth range.

S1.14.2 Requirement for competent geophysicist

The Contractor shall engage a competent and experienced geophysical specialist for the works, as specified in Clause 9.1.1.

S1.14.3 Trial geophysical methods

As specified in Clause 9.1.1.

S1.14.4 Types of geophysical methods required

The following land based geophysical surveys are proposed to achieve the objectives stated in S1.14.1:

- Electrical Resistivity Tomography Ground Profiling - to characterise ground profile and properties, including rockhead level, changes in rock weathering/fracturing, and identify karst/sinkhole features.
- Seismic Refraction Ground Profiling - to characterise ground profile and properties, including rockhead level, changes in rock weathering/fracturing, identify karst/sinkhole features, and to determine strength and stiffness characteristics of soils and rock.

The details of the proposed surveys, including positions and required minimum depths are outlined in Schedule 2, and as shown within the Exploratory Hole Layout Plan included in Appendix A.

The geophysical specialist shall confirm the actual length of survey lines required to meet the penetration depths of the proposed ground profiling surveys.

The Contractor shall review the proposed methods against the existing ground conditions, site constraints and local knowledge and propose alternative methods if deemed more suitable to achieve the objectives of the investigation (i.e. MASW methods). The Contractor's proposed alternative survey methods shall be submitted for consideration and approval by the Investigation Supervisor a minimum of 10 working days in advance of commencement of the works.

S1.14.5 Information provided

A topographical survey shall be provided to the Contractor to assist with any Geophysical surveys.

S1.14.6 Horizontal data density

To be agreed on site with the Investigation Supervisor prior to the commencement of the works to provide best results. Due attention is to be made to the potential for karst features beneath the site that may be of variable size (<0.5m to few meters diameter); the Contractor shall determine the horizontal data density to meet the minimum penetration depth without compromise on data quality.

S1.14.7 Level datum

As specified in S1.8.18.

S1.14.8 Geophysical survey report

The factual and interpretative geophysical surveys data shall be reported within interpretative reports, and included as an appendix to the Contractor's draft Ground Investigation Factual Report. Further re-interpretation shall be provided following completion of the completed intrusive GI works.

The Contractor shall produce a summary report on the results of the geophysical surveys, including the following:

- Text outlining objectives of the survey, a description of the method and instruments used and any limitations affecting the results obtained, the measurement stations/line spacing used, data processing methodology, an interpretation of the findings and the likely causes of any anomalies identified in the data
- All calibration certificates and serial numbers of the instrument used
- The results of any on site instrument calibrations or checks of equipment performance.

One electronic copy of the draft Geophysical Interpretative Report (including interpreted electrical resistivity data and ground profiles) in PDF format shall be provided to the Employer and Investigation Supervisor with the Draft Factual Report.

One electronic copy of the final Geophysical Interpretative Report in PDF format and survey data in digital format (format as agreed with the Investigation Supervisor) shall be provided within 1 week after receiving comments from the Investigation Supervisor on the draft report.

S1.15 In situ testing (Specification Section 10) Particular restrictions/relaxations

All in-situ testing is to be carried out by personnel who have been trained and are experienced in the use of the equipment, the test methods and the recording of results, and will generally be performed by Engineers or Technical Assistants.

S1.15.1 Tests in accordance with Irish, UK or European Standards (Clause 10.3)

S1.15.1.1 Standard Penetration Tests (SPTs) (IS EN ISO 22476-3:2005)

Relevant calibration certificates, including SPT hammer efficiency certificates, shall be submitted to the Investigation Supervisor prior to any testing being undertaken. In-situ SPT testing shall be undertaken and reported in accordance with the requirements of Geotechnical Investigation and Testing – Field Testing. Standard Penetration Test (IS EN ISO 22476-3:2005).

Care should be taken to use the cone attachment in granular soils as opposed to a split spoon sampler.

A small, disturbed sample shall be taken of the material from the split spoon sampler. A solid cone shall not be used instead of a split spoon sampler unless otherwise agreed with the Investigation Supervisor. Where a solid cone has been used in a coarse granular soil bulk disturbed samples shall be taken representative of the depth over which the test was carried out.

If groundwater is encountered, the water levels in the borehole shall be topped up so that the level is above the local groundwater table level during the execution of every SPT.

Testing sequences may be altered during the investigation by the Investigation Supervisor to suit the actual ground conditions encountered.

S1.15.1.2 Dynamic Probing (IS EN ISO 22476-2:2005)

Dynamic Cone Penetrometer (TRL Type) to determine ground stiffness and CBR values shall be advanced to a scheduled depth of 3.0m or refusal at designated trial pit locations.

Refer to Schedule S1.13 for further details.

S1.15.1.3 Soakaway Testing

Soakaway (infiltration testing) testing shall be undertaken in accordance with BRE Digest 365 (2007) at designated test pit locations as specified in Schedule 2 unless otherwise instructed by the Investigation Supervisor.

The tests depths shall be confirmed by the Investigation Supervisor onsite based on the ground conditions encountered but shall be no greater than 3m depth.

All soakaway pits shall be logged, photographed and sampled to the same requirements as for trial pits.

S1.15.1.4 Variable Head Test in Boreholes and Piezometers (BS 5930)

Variable (rising or falling) head tests shall be undertaken as directed by the Investigation Supervisor. Where requested by the Investigation Supervisor, a constant head test shall be performed for the duration of at least 30 minutes.

Permeability testing should be undertaken in accordance with the requirements of BS 5930. Details of the proposed methodology is to be provided to the Investigation Supervisor before mobilising to site.

Sufficient water supply is required to raise the head in the borehole, and clean coarse material (nominal diameter 20mm) to use as a filter pack where required.

If undertaken in a standpipe, prior to testing the well shall be developed until the discharge water is clear of drilling mud and cuttings that may be clogging the aquifer. Water produced by the development shall be discharged in a controlled manner and disposed of so as to cause minimal disturbance to the site. Water shall not be discharged directly onto the ground.

S1.15.2 Hand penetrometer and hand vane for shear strength (Clause 10.4.1)

Hand shear vane tests shall be carried out in accordance with EN ISO 22476-9, within cohesive soil in trial pits to provide an estimate of the undrained shear strength of the soil.

Hand shear vane testing shall be undertaken within all trial pits at depths of 0.5m and 1.0m, typically undertaken as a set of three results per test with the average result reports, in suitable cohesive strata encountered on the sides of the excavations, where deemed safe to enter up to 1.2m depth.

S1.15.3 Self boring pressuremeter and high-pressure dilatometer and reporting (Clause 10.5.1)

Not required.

S1.15.4 Driven or push-in pressuremeter testing and reporting requirements (Clause 10.5.2)

Not required.

S1.15.5 Menard pressuremeter tests (Clause 10.5.3)

Not required.

S1.15.6 Soil infiltration test (Clause 10.6)

As specified in S1.15.1.3

S1.15.7 Special in situ testing and reporting requirements (Clause 10.7)

Not required.

S1.15.8 Interface probes (Clause 10.8)

Not required.

S1.15.9 Contamination screening tests (Clause 10.9)

Not required.

S1.15.10 Metal detection (Clause 10.10)

Not required.

S1.16 Instrumentation (Specification Section 11) Particular restrictions / relaxations

S1.16.1 Protective cover for installations (Clause 11.2)

The type of protective cover for monitoring installations may vary between locations and is to be confirmed with the Investigation Supervisor prior to the commencement of the Works.

S1.16.2 Protective fencing (Clause 11.3)

Not required.

S1.16.3 Standpipe and standpipe piezometer installations (Clause 11.4.1 and 11.4.2)

The installation of 50mm HDPE combined groundwater and ground gas, if required, monitoring standpipes shall be in accordance with the Technical Specification and Schedule 2. The Investigation Supervisor may instruct installation of 19mm standpipe piezometers should the ground conditions dictate this requirement.

The Investigation Supervisor may instruct dual standpipe installations if deemed of benefit to the understanding of the prevailing groundwater regime at the site.

On attaining the full depth of each hole where an instrument is to be installed, the Investigation Supervisor shall be informed of the sequence of materials encountered and water strike/standing water levels. Installation construction details (including diameter, depth, seals and other details) shall be instructed by the Investigation Supervisor.

The requirement for ground gas monitoring shall be confirmed on site by the Investigation Supervisor based on the encountered ground conditions.

S1.16.4 Other piezometer installations (Clause 11.4.3)

Casagrande Piezometers may be installed within borehole locations intended to inform retaining wall design, as determined by the ground conditions and as specified by the Investigation Supervisor.

S1.16.5 Development of standpipe and standpipe piezometers (Clause 11.4.5)

Standpipes shall be developed in accordance with IS ISO 14686:2003 to:

- Ensure good hydraulic continuity between the installation and the groundwater.
- 'Settle down' the filter pack.
- Break down any skin of remoulded soil on the borehole surface wall formed during its sinking.

The RAMS for well development as a minimum must specify:

- The proposed method of well development and justification for the specific method.
- Details on the proposed storage and disposal of well development water.

Following installation, the workability of all the installations in accordance with the manufacturer's specifications shall be demonstrated within 5 working days of completing an installation.

S1.16.6 Ground gas standpipes (Clause 11.5)

As specified in Clause S1.5 and Schedule S1.16.3.

S1.16.7 Inclinometer installations (Clause 11.6)

Not required.

S1.16.8 Slip indicators (Clause 11.7)

Not required.

S1.16.9 Extensometer and settlement gauges (Clause 11.8)

Not required.

S1.16.10 Settlement monuments (Clause 11.9)

Not required.

S1.16.11 Removal of installations (Clause 11.10)

Not required.

S1.16.12 Other instrumentation

Not required.

S1.17 Installation monitoring and sampling (Specification Section 12) Particular restrictions / relaxations)

Calibration records for all monitoring instrumentation shall be submitted to the Investigation Supervisor 5 working days prior to commencing in-situ monitoring. The frequency of in-situ calibration of all instrumentation shall be agreed with the Investigation Supervisor.

Sampling and groundwater measurements shall be carried out in accordance with BS ISO 5667-11:2009 and IS EN ISO 22475-1:2006 respectively.

S1.17.1 Groundwater level readings in installations (Clause 12.2)

Following completion of the fieldwork the contractor will undertake the scheduled number of rounds of groundwater and ground gas, if required, monitoring as stated within S1.5, unless otherwise instructed by the Investigation Supervisor.

Each monitoring visit shall include recording of:

- the depth of water (m bgl & m MHVD)
- depth to base of installation (m bgl & m MHVD).
- Visual and/or olfactory evidence of contamination, colour of sample, depth and thickness of free phase product (if any).

Continuous (24h) groundwater monitoring using submersible groundwater level monitoring pressure transducers (or data-loggers) does not form part of this scope of investigation.

S1.17.2 Groundwater sampling from installations (Clause 12.3.1)

Groundwater samples shall be retrieved from installations specified in Schedule 2 during the first three rounds of groundwater monitoring, unless otherwise instructed by the Investigation Supervisor.

Sampling shall be completed in accordance with BS ISO 5667-11:2009. RAMS for groundwater sampling shall be submitted for approval to the Investigation Supervisor in advance of the first round on sampling.

Sample volumes, the containers, preservatives and conditions required in transit should be agreed with the testing laboratory before sampling. Water sample containers should be kept in the dark, filled and refrigerated, without any contact with materials that could affect the water quality.

Samples must be dispatched to the testing laboratory in appropriate containers on the day of sampling where possible and, at the latest, within 24 hours of the sample being taken.

S1.17.3 Purging/micro purging (Clause 12.3.2)

Installations shall be purged as detailed in Clause 12.3.2.

RAMS for purging shall be submitted for approval to the Investigation Supervisor in advance of the first round on sampling. They must include the proposed method of well purging and justification for the specific method, and details on the proposed storage and disposal of purge water.

Installations shall be purged a minimum of 3 well volumes immediately prior to collection of groundwater samples, as a minimum.

S1.17.4 Ground gas monitoring (Clause 12.4)

If instructed, post fieldwork ground gas monitoring shall be undertaken from installations as specified in Schedule 2.

At least one monitoring visit shall be undertaken during low and falling pressure (i.e. beneath 1000mb).

Gas measurements shall be recorded prior to measuring the groundwater depth.

Parameters to be recorded during the gas monitoring period are:

- Atmospheric pressure (including information on whether it is falling/rising/stable during the monitoring visit),
- Gas flow rate (peak and steady state),
- Differential pressure,
- Peak and steady state concentrations of methane, hydrogen sulphide, carbon dioxide, carbon monoxide, oxygen, nitrogen, Lower Explosive Limit (LEL).

S1.17.5 Sampling from ground gas installations (Clause 12.5)

Not required.

S1.17.6 Other monitoring (Clause 12.8)

Not required.

S1.17.7 Sampling and testing of surface water bodies (Clause 12.9)

Not required.

S1.18 Daily records (Specification Section 13) Particular restrictions and relaxations

S1.18.1 Information for daily records (Clause 13.1)

Daily reports and logs shall be submitted to the Investigation Supervisor on the morning of the next working day. Information to be included in the daily reports is to be in accordance with Clause 13.2, although the report should also include, but is not limited to:

- A summary of works carried out that day, reported within a Daily Progress Report (DPR)
- Copies of drillers daily records
- Preliminary in-situ field test data and results, where undertaken
- Any photographs for approval (if taken)
- A forecast of works to be carried out the following day.
- Any site issues (including Health & Safety)

The format of this report shall be agreed with the Investigation Supervisor before commencement of site operations.

S1.18.2 Special in situ tests and instrumentation records (Clause 13.4)

Calibration records for all testing equipment shall be made available to the Investigation Supervisor upon request.

S1.19 Geotechnical laboratory testing (Specification Section 14) Particular restrictions / relaxations

S1.19.1 Investigation Supervisor or Contractor to schedule testing (Clause 14.1.1)

The Contractor is to schedule testing.

The Investigation Supervisor shall be provided the schedule of laboratory testing for review prior to issue to the laboratory.

The Investigation Supervisor may specify additional testing following initial schedule return, if required.

S1.19.2 Tests required (Clause 14.1.2)

All soil and rock testing shall be carried out in accordance with Eurocode 7 and BS 1377:1990 or ISRM unless otherwise indicated in the Schedules.

The following geotechnical testing as a minimum is expected to be included within the testing to achieve the required data for the design of the proposed development.

- On soil samples, three classification tests per strata:
 - Water content tests
 - Liquid Limit, Plastic Limit and Plasticity Index (including sample moisture content)
 - Particle size distribution (mechanical sieving and sedimentation as applicable)
 - Bulk and Dry Density tests
 - Pyrite Suite (BoQ reference K9.2)
- On U100 cohesive samples - all suitable samples to be tested for
 - Unconsolidated Undrained Triaxial (Total Stress)
 - 1-D Consolidation Testing (Oedometer testing)
 - With at least 50% of suitable samples to be considered for Consolidated Undrained/Drained Triaxial (Effective Stress)
- On rock samples per rock type per borehole:
 - 1 Deformability in uniaxial compression (and then irregular lump Point Load Index tests on remnants), these tests are to be prioritised over all other rock tests.
 - 1 Uniaxial Compressive Strength (and then irregular Point Load Index tests on the remnants)
 - 2 Sets of 10 Point Load Index tests (5 axial and 5 diametral)
 - If rock recovered as gravel, irregular lump Point Load Index tests shall be completed
 - Pyrite Suite (BoQ reference K9.2)

S1.19.3 Specification for tests not covered by BS 1377 / options under BS 1377 (Clauses 14.2.1 and 14.4)

Not required. S1.19.4 INAB or UKAS accreditation to be adopted (Clause 14.3)

All laboratory testing shall be undertaken to UKAS accredited methods (or national equivalent). Details of accredited tests shall be submitted to the Investigation Supervisor. Where UKAS accreditation has not been achieved for a specific test, approval to undertake the test shall be sought from the Investigation Supervisor prior to the test being undertaken.

S1.19.5 Rock testing requirements (Clause 14.5)

As specified in Clause 14.5 and S1.19.2.

S1.19.6 Chemical testing for aggressive ground/groundwater for concrete (Clause 14.6)

Geo-chemical testing is required for soil, rock and groundwater samples. As a minimum this include three tests per strata/rock type, including the following:

- pH value (soil and crushed rock samples)

- Sulphate content (soil and crushed rock samples)
- Suite C/D – Brownfield Site (derived from BRE Special Digest SD1 – required suite is subject to the encountered ground conditions i.e. visible pyrite)

S1.19.7 Laboratory testing on site (Clause 14.7)

Not required.

S1.19.8 Special laboratory testing (Clause 14.8)

Not required.

S1.20 Geo-environmental laboratory testing (Specification Section 15) Particular restrictions/relaxations

S1.20.1 Investigation Supervisor or Contractor to schedule testing (Clause 15.1)

The Contractor is to schedule testing.

The Investigation Supervisor shall be provided with the schedule of laboratory testing for review prior to issue to the laboratory.

The Investigation Supervisor may specify additional testing following initial schedule return, if required.

S1.20.2 Accreditation required (Clause 15.2)

The geo-environmental testing laboratory shall be UKAS (or national equivalent) and MCERTS accredited for all relevant tests/suites carried out.

The proposed laboratory shall be confirmed in advance of site works and accreditation certificates and limits of detection provided to the Investigation Supervisor.

Limits of detection are as set out in Appendix C.

S1.20.3 Chemical testing for contamination (Clause 15.3)

Laboratory testing shall include determinants within the suites specified in Table 1.7 as a minimum. All laboratory testing shall be undertaken using UKAS and MCERTS accredited methods.

As a minimum the testing shall be distributed evenly across stratum types and at varying depths as follows:

- Package 1 – 30 soils and 15 leachates
- Package 3 – 10 soils and 5 leachates

Table 1.7: Geo-environmental Laboratory Testing Suites

Suite	Determinants and Limits of Detection (LoD)
Soil	Refer to Appendix C
Leachate (BS EN 12457-1:2002)	Refer to Appendix C
Groundwater	Refer to Appendix C
Waste Acceptance Criteria	Refer to Appendix C

In addition, the Investigation Supervisor may schedule semi-volatile organic compounds (SVOCs), volatile organic compounds (VOCs), poly-chlorinated biphenyls (PCBs) and speciated

total petroleum hydrocarbons (TPH) testing suites on selected samples if visual and/or olfactory evidence of contamination is encountered that is not covered by the above suite of contaminants.

The laboratory to be used for testing is required to meet the Limits of Detection (LODs) specified in Appendix C. The Geo-environmental laboratory that will be subcontracted to complete the specified testing shall be identified to the Investigation Supervisor in advance of the works and the LODs for each testing suite and sample holding times shall also be provided.

S1.20.4 Waste Characterisation (Clause 15.4)

Not required.

S1.20.5 Waste acceptance criteria testing (Clause 15.5)

Waste Acceptance Criteria (WAC) testing shall be carried out as a minimum on three tests per strata type. WAC testing suites are included in Appendix C.

S1.20.6 Laboratory testing on site (Clause 15.6)

Not required.

S1.20.7 Special laboratory testing (Clause 15.7)

Not required.

S1.21 Reporting (Specification Section 16) Particular restrictions/relaxations

S1.21.1 Form of exploratory hole logs (Clauses 16.1 and 16.2.1)

Preliminary logging and in-situ testing results shall be submitted within 5 working days of completion of the work to which they refer.

In addition to the other requirements of this specification, detailed field observations shall be recorded in respect of the geo-environmental and gas monitoring investigations including:

- Visually/olfactory identified contaminants and hazardous materials e.g. free oil product, colour, odour, and any other pertinent factors.
- Sample container type.
- Presence of potential pathways for contamination migration, other than soil/rock, for example man-made features such as abandoned services, pipework, etc.
- Method of groundwater purging/volume of water removed.
- During gas monitoring, local weather conditions including ambient temperature and barometric pressure on the day of the observation and the previous day should be recorded.

These shall be included in the draft and final factual report.

Preliminary results of in-situ tests, together with calibration certificated, should be presented to the Investigation Supervisor within 48 hours of the test being undertaken. The condition of the monitoring points, damage, leakage from surface spills etc. must also be recorded.

S1.21.2 Information on exploratory hole logs (Clause 16.2.2)

As specified in Clause 16.2.2.

S1.21.3 Variations to final digital data supply requirements (Clause 16.5.1)

Fieldwork, monitoring and laboratory data shall be provided in digital form in accordance with the current revision of the Association of Geotechnical and Geoenvironmental Specialists (AGS) publication 'Electronic Transfer of Geotechnical Data Edition 4.1.1 (AGS, March 2022).

S1.21.4 Preliminary digital data (Clause 16.5.3)

Preliminary AGS data shall be provided to accompany the complete set of preliminary logs and final logs and upon issue of each batch of geo-environmental test results and geotechnical test results.

A single complete AGS file will be issued with the Draft Factual Report and Final Factual Report.

The digital data shall comply with the requirements of 'Electronic Transfer of Geotechnical Data Edition 4.1.1 (AGS, March 2022). Prior to issue of electronic data, the files shall be checked for AGS compliance by AGS Validator V.3.2 and for viruses by a commercial anti-virus program that has been updated within the previous three months.

S1.21.5 Type(s) of report required (Clause 16.6)

A Draft and Final Factual Report and a Draft and Final GIR (Geotechnical Interpretative Report) including GQRA (Generic Qualitative Assessment Report) is required to be provided in accordance with the timescales set out in Table 1.3.

S1.21.6 Electronic report requirements (Clause 16.6.3)

Draft and final reports shall be submitted in digital PDF format as specified in Clause 16.6.3. The PDF files are to be created directly from the source documents rather than scanned and checked for completeness.

If any contributors to the files have copyrights for their material, permission must be obtained to reproduce the information in electronic format.

Extensive use of bookmarks should be used to enable easy navigation of the PDF file. As a minimum, links should exist within the document between the contents page and the component parts.

Photographs within the factual report must also be submitted as JPG format files, via electronic transfer.

As-built exploratory hole location plans shall be provided to the Investigation Supervisor as an AutoCAD DWG or DXF drawing file, as well as PDF copy within the Ground Investigation Factual Report.

S1.21.7 Format and contents of Desk Study Report (Clause 16.7)

Not required.

S1.21.8 Contents of Ground Investigation Report (or specified parts thereof) (Clause 16.8)

Factual Report

The Contractor shall produce a Ground Investigation Factual Report (draft and final) in accordance with EC7. The Factual Report shall contain, but not limited to, the following information:

- A statement referring to the purpose and rationale of the investigation
- A description of the work carried out, including reference to the specification and standards adopted (including site protocols) and any deviation from them
- Outline of geology of area and summary details of ground conditions
- Exploratory hole logs, including photographs and details of sampling and any instrumentation installed
- Monitoring data
- In-situ test records
- Laboratory test results
- Plan with locations of exploratory holes
- Site location plan, as described above
- Pre- and post-fieldwork survey records
- AGS data (digital version only)

Ground Investigation Report

- The Contractor shall produce a Ground Investigation Report (draft and final) in accordance with EC7 (i.e. Geotechnical Interpretative Report). Separate Ground Investigation Reports shall be produced for the North Site, South Site and FAS site. Each report shall contain the GI Factual Report as an appendix.
 - The Ground Investigation Report shall present the findings of the GI including but not limited to:
 - An interpreted ground model specific to the development site
 - A factual account of all ground Investigation activities carried out
 - A presentation of all appropriate geotechnical information, including geological and hydrogeological features
 - Derived ground parameters for the strata encountered
 - Material parameter and testing graphical plots
 - Interpretation of the GI relative to the proposed works associated with:
 - Proposed building foundations and basements
 - Car parks, roads and drainage
 - Proposed earthworks
 - CBR
 - Geo-chemical / ground aggressivity environment -concrete classification
 - Any known limitations of the investigation results should be included in the GIR, as required by BS EN 1997-2:2007.
 - Geotechnical Ground Risk Register
-
- The Contractor shall provide a content list for the report to the Investigation Supervisor, prior to commencement of the reporting, to agree the format of reporting and content.

Generic Quantitative Contaminated Land Risk Assessment (GQRA)

- In addition to the GIR, the Contractor shall produce a Generic Quantitative Contaminated Land Risk Assessment (GQRA) report for the development which shall be suitable for submission to planning authorities. Separate GQRAs shall be produced for the North Site, South Site and FAS site. The reports shall be undertaken in accordance with current best practice guidance, including but not limited to:

- EPA “Management of Contaminated Land & Groundwater at EPA Licenced Sites”, 2013
- BS 10175:2011+A2:2017, Investigation of potentially contaminated sites. Code of Practice
- Land Contamination Risk Management (LCRM) Land contamination risk management (LCRM) - GOV.UK
- The GQRA report shall include but not be limited to:
 - Summary of existing desk study information and conceptual site model
 - A factual account of all relevant ground investigation activities carried out
 - A presentation of all appropriate geo-environmental information, including geological and hydrogeological features
 - Identification of pertinent sources pathways and receptors relating to each development site
 - Human Health Risk Assessment – using appropriate assessment criteria for a hospital end use
 - Groundwater and surface water risk assessment
 - Ground gas risk assessment and recommendations for ground gas and/or radon protection
 - Conceptual Site Model identifying pollutant linkages and risk assessment
 - Recommendations for further investigation, remediation, risk mitigation and risk management during construction
 - Waste Classification Assessment using HazWaste Online and discussion of material management, re-use and disposal options.
- The Contractor shall provide a report content list to the Investigation Supervisor prior to commencement of the reporting, to agree the format of reporting and content.

S1.21.9 Contents of Geotechnical Design Report (or specified part thereof) (Clause 16.9)

A Geotechnical Design Report is not required.

S1.21.10 Times for supply of electronic information (Clause 16.10.1)

All Ground Investigation data shall also be provided in AGS data format (Version 4.1.1) at completion of the fieldwork, and at draft and final report submission in accordance with the timescales of the Contract.

S1.21.11 Electronic information transmission media (Clause 16.10.2)

Information may be transmitted by email to the Investigation Supervisor and project site email address (where applicable – to be confirmed by the Investigation Supervisor). Final information is to be provided by electronic transfer.

All reporting shall be issued via a task-specific File Transfer Protocol (FTP) site managed by Mott MacDonald. Prior to issuing/uploading any documents, the GI Contractor should contact the Investigation Supervisor to request the log-in details for the relevant FTP. The GI Contractor shall upload the required documentation within three working days of receiving the log-in details.

File sharing sites such as Dropbox or WeTransfer shall not be used to issue deliverables.

S1.21.12 Report approval (Clause 16.11)

The draft reports shall be submitted to the Investigation Supervisor as an electronic copy within five weeks of completing the siteworks. The Investigation Supervisor shall approve the draft reports (or instruct any required revisions or amendments) within two weeks following its receipt.

One electronic copy of the final report shall be submitted to the Investigation Supervisor within one week after draft copy approval or receipt of instructed revisions / amendments.

The draft and final reports shall not be accepted as complete without submission of complete and error free AGS data files.

Schedule 2 – Exploratory Holes

The schedule of exploratory hole locations is presented below. Reference should be made to the Exploratory Hole Location Plan presented in Appendix A.

Table 2.1: Schedule of Exploratory Holes (Package 1)

Hole ID	Type	Scheduled Depth (m bgl)	Location	Install (Y/N)	Remarks
BH101	Borehole (Soils and Rock, Wireline GeoboreS or similar)	25.00 (estimated 5m soils and 20m rock)	See Plan	Y	- To inform building foundation design - Combined Soil and Rock Borehole completed using wireline GeoBoreS or similar to achieve continuous sample recovery through soils and rock. - All locations are to be commenced with a hand excavated inspection pit to 1.2m bgl to clear the location of buried services. - Borehole to be advanced to scheduled depth unless otherwise instructed by the Investigation Supervisor. - Borehole meterage for soils and rock are estimates and may vary to those encountered during the works. - Boreholes are required to prove a minimum of 6m competent rock (i.e. medium strong or better, with RQD >50% and TCR of 100%) unless otherwise instructed by the Investigation Supervisor. - Standard Penetration Tests (SPTs) and geotechnical sampling (disturbed & undisturbed) is required in all boreholes, commencing from 1.2m depth. Test frequency detailed in S1.12.3. - Collection of geotechnical soil samples as detailed in S1.12.3 and geo-environmental soil samples as detailed in S1.12.11. 50mm HDPE groundwater and ground gas standpipe installations in select boreholes, as instructed by the Investigation Supervisor, for post-site groundwater level monitoring (6no. provisional visits). Collection of groundwater samples during the first 3 monitoring rounds or as specified by the Investigation Supervisor. Ground Gas monitoring may also be instructed based on ground conditions encountered. - Variable head permeability testing to be undertaken in select borehole locations are instructed by the Investigation Supervisor.
BH102	Borehole (Soils and Rock, Wireline GeoboreS or similar)	25.00 (estimated 5m soils and 20m rock)	See Plan	Y	
BH103	Borehole (Soils and Rock, Wireline GeoboreS or similar)	15.00 (estimated 5m soils and 10m rock)	See Plan	Y	
BH104	Borehole (Soils and Rock, Wireline GeoboreS or similar)	15.00 (estimated 5m soils and 10m rock)	See Plan	Y	
BH105	Borehole (Soils and Rock, Wireline GeoboreS or similar)	25.00 (estimated 5m soils and 20m rock)	See Plan	Y	
BH106	Borehole (Soils and Rock, Wireline GeoboreS or similar)	10.00 (estimated 5m soils and 5m rock)	See Plan	Y	- To inform retaining wall design. - Combined Soil and Rock Borehole completed using wireline GeoBoreS or similar to achieve continuous sample recovery through soils and rock. - All locations are to be commenced with a hand excavated inspection pit to 1.2m bgl to clear the location of buried services. - Borehole to be advanced to scheduled depth unless otherwise instructed by the Investigation Supervisor. - Borehole meterage for soils and rock are estimates and may vary to those encountered during the works. - Boreholes are required to prove a minimum of 6m competent rock (i.e. medium strong or better, with RQD >50% and TCR of 100%) unless otherwise instructed by the Investigation Supervisor. - Standard Penetration Tests (SPTs) and geotechnical sampling (disturbed & undisturbed) is required in all boreholes, commencing from 1.2m depth. Test frequency detailed in S1.12.3. - Collection of geotechnical soil samples as detailed in S1.12.3 and geo-environmental soil samples as detailed in S1.12.11. 50mm HDPE groundwater and ground gas standpipe installations in select boreholes, as instructed by the Investigation Supervisor, for post-site groundwater level monitoring (6no. provisional visits). Collection of groundwater samples during the first 3 monitoring rounds or as specified by the Investigation Supervisor. Ground Gas monitoring may also be instructed based on ground conditions encountered. - Variable head permeability testing to be undertaken in select borehole locations are instructed by the Investigation Supervisor.
BH107	Borehole (Soils and Rock, Wireline GeoboreS or similar)	10.00 (estimated 5m soils and 5m rock)	See Plan	Y	
BH108	Borehole (Soils and Rock, Wireline GeoboreS or similar)	10.00 (estimated 5m soils and 5m rock)	See Plan	Y	
FIP101	Foundation Inspection Pit	1.20 (Maximum)	See Plan	N/A	- To inform building foundation and retaining wall designs. - Hand dug foundation observation pits 1.2m depth, or refusal, to investigate the nature of the existing foundations of existing buildings and the retaining wall, for general site characterisation and to allow for the collection of geotechnical, geochemical and geo-environmental laboratory testing. - Hand dug pits to have a minimum dimension of 0.5m (L) x 0.5m (W) x 1.2m (D). - Exploratory hole logs to include a foundation sketch indicating the nature and geometry of the existing foundations (e.g. depth, width, foundation type). - Prior to the termination of the foundation inspection pits, the Contractor is required to provide photographic records of the pit and exposed foundations to the Investigation Supervisor for review to determine if the pits are required to be extended.
FIP102	Foundation Observation Pit	1.20 (Maximum)	See Plan	N/A	
FIP103	Foundation Observation Pit	1.20 (Maximum)	See Plan	N/A	
FIP104	Foundation Observation Pit	1.20 (Maximum)	See Plan	N/A	
FIP105	Foundation Observation Pit	1.20 (Maximum)	See Plan	N/A	
FIP106	Foundation Observation Pit	1.20 (Maximum)	See Plan	N/A	
ST101	Slit Trench	1.20 (Maximum)	See Plan	N/A	- Hand Excavated slit trench to investigate presence of existing services. - Trench dimensions: 3m (L) x 1m (W) x 1.2m (D). - Collection of geotechnical soil samples as detailed in S1.12.3 and geo-environmental soil samples as detailed in S1.12.11.

Table 2.2: Schedule of Geophysical Surveys (Package 2)

Survey ID	Type	Location	Remarks
GS01 to GS13	Ground Profiling Geophysics (Electrical Resistivity Tomography & Seismic Refraction)	See Plan	- Non-intrusive surveys using Seismic Refraction (SR) and Electrical Resistivity Tomography (ERT) (or other approved methods) to investigate rockhead profile, characterise ground conditions (including ground stiffness properties) and identify any potential karstic features. - Surveys to achieve a minimum survey penetration depth of 20m below ground level.

Table 2.3: Schedule of Exploratory Holes (Package 3)

Hole ID	Type	Scheduled Depth (m bgl)	Location	Remarks
TP101	Machine Excavated Trial Pit	4.50 (Maximum)	See Plan	- Machine excavated trial pits to inform shallow ground conditions of soils at the proposed access road and allow for collection of disturbed soil samples (small disturbed and bulks) for geotechnical, geochemical and geo-environmental laboratory testing. - Clearance of services to be undertaken at each location using Cat & Genny scanning progressively to a depth of 1.2m bgl. - Minimum dimensions of 1m (W) x 2m (L) x maximum of 4.5m (D), or rockhead if shallower. - In-situ hand vane tests to be undertaken within suitable cohesive soils at 0.5m and 1.0m depth within all trial pits. - Collection of geotechnical soil samples as detailed in S1.12.3 and geo-environmental soil samples as detailed in S1.12.11.
TP102	Machine Excavated Trial Pit	4.50 (Maximum)	See Plan	Machine excavated trial pits to inform shallow ground conditions of soils at the proposed car park and allow for collection of disturbed soil samples (small disturbed and bulks) for geotechnical, geochemical and geo-environmental laboratory testing.
TP103	Machine Excavated Trial Pit	4.50 (Maximum)	See Plan	- Clearance of services to be undertaken at each location using Cat & Genny scanning progressively to a depth of 1.2m bgl. - Minimum dimensions of 1m (W) x 2m (L) x maximum of 4.5m (D), or rockhead if shallower.
TP104	Machine Excavated Trial Pit	4.50 (Maximum)	See Plan	- In-situ hand vane tests to be undertaken within suitable cohesive soils at 0.5m and 1.0m depth within all trial pits. - Collection of geotechnical soil samples as detailed in S1.12.3 and geo-environmental soil samples as detailed in S1.12.11.
TP105	Machine Excavated Trial Pit	4.50 (Maximum)	See Plan	
HP101	Hand Dug Pit	1.20m	See Plan	Hand excavated pit to be undertaken to facilitate the collection of geotechnical and geo-environmental samples within spoil heap adjacent to existing car park.
DCP101 to DCP105	Dynamic Cone Penetrometer (TRL Type)	3.00m	See Plan	Dynamic Cone Penetrometer Probes (TRL Type) to be undertaken to a maximum of 3mbgl, or refusal if shallower, to gain measurement of in-situ CBR values with depth to inform pavement design of access road.
DCP106 to DCP109	Dynamic Cone Penetrometer (TRL Type)	3.00m	See Plan	Dynamic Cone Penetrometer Probes (TRL Type) to be undertaken to a maximum of 3mbgl, or refusal if shallower, to gain measurement of in-situ CBR values with depth to inform pavement design of carpark.
SW101	Infiltration Test	1.00m	See Plan	Infiltration test to inform drainage design of car park, undertaken in accordance with BRE365 and to be completed at a depth no greater than 1.0m bgl.

Schedule 3 - Investigation Supervisor's Facilities

The Contractor is required to provide the Investigation Supervisor and their site-based representatives with the use of their site welfare facilities (including internet access) for the duration of the Site Operations.

Schedule 4 - Specification Amendments

1.1 Eurocode 7

Clauses within the Specification and Related Documents for Ground Investigation in Ireland, Second Edition (2016) referring to BS EN 1997-1:2004 and BS EN 1997-2:2007 should be superseded by the relevant updated Eurocode 7 documents:

- BS EN 1997-1:2024 “Eurocode 7 - Geotechnical design – Part 1: General rules”
- BS EN 1997-2:2024 “Eurocode 7 - Geotechnical design – Part 2: Ground properties”
- BS EN 1997-3:2025 “Eurocode 7 - Geotechnical design – Part 3: Geotechnical structures”

1.2 PAS 128 Utility Detection Survey

The following Clauses within the Specification and Related Documents for Ground Investigation in Ireland, Second Edition (2016) referring to PAS 128:2014 should be superseded by the updated PAS 128:2022 ‘Underground utility detection, verification and location – Specification’ published by the British Standard Institution (BSI):

- Clause 3.8.3

Schedule 5: Specification Additions

S5.1 General Requirements

S5.1.1 Particular Safety Health and Welfare Requirements

The Contractor shall comply with the Safety, Health and Welfare at Work Act 2005, and the Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. No. 291 of 2013) and any amendment thereof.

The Contractor shall be required to act as Project Supervisor for the Construction Stage (PSCS) for the ground investigation. The Health and Welfare at Work (Construction) Regulations 2013 clearly define the role and responsibilities of the PSCS.

The cost of acting as PSCS, including the preparation of any necessary documentation and implementation of the Health, Safety and Welfare at Work (Construction) Regulations 2013 requirements is included in the Bill of Quantities.

If work on site is planned to last longer than 30 working days or exceed 500 person-days, the project shall be notifiable to the Health and Safety Authority (HSA). Under the Safety, Health and Welfare at Work (Construction) Regulations 2013, it is the duty of the PSCS to give notice to HSA on an approved form before the commencement of siteworks.

A Preliminary Health and Safety Plan has been prepared and is provided with this contract documentation. The Contractor shall produce a construction Safety and Health Plan in accordance with his duties as PSCS under the Safety, Health and Welfare at Work.

The Contractor shall ensure that when using percussive or pneumatic equipment that the health and safety plans highlight the risk of vibration white finger.

S5.2 Utility Survey

Available utility plans shall be provided in the preconstruction information. The position of any utilities at or near the proposed exploratory hole locations shall be located and positively identified as accurately as possible in accordance with HSG47 by means of locating devices, the principal types being a cable avoidance tool with a signal generator (CAT and genny) and ground-penetrating radar (GPR) operated by a suitably trained and qualified person.

Type B utilities clearance shall be undertaken (including a desktop utilities search (Level D)) in accordance with PAS128:2022 to clear each exploratory hole location for buried service.

With inspection pits, the utility plans shall be consulted, and additional CAT and genny scanning shall be carried out after the PAS 128:2014 utility survey immediately prior to breaking ground, at every 300 mm of excavation and on completion of the pit.

For trial pit and trench locations, the utility plans shall be consulted, and additional CAT and genny scanning shall be carried out after the PAS 128:2014 utility survey and immediately prior to breaking ground.

The Contractor shall provide a proposal for service clearance for acceptance. The contractor shall also comply with any site rules related to utility clearance and excavations.

S5.3 Specific Environment / Ecological Requirements

S5.3.1 Protection of Water Quality

In accordance with standard CIRIA Good Practice On-Site Guidelines (C741), no refuelling will take place within 20m of any watercourse or drain.

No abstraction from any watercourses will be permitted to facilitate the works. If lubricants are required, these shall be vegetable-based.

The Contractor will take measures to avoid potential for cross-contamination of an aquifer by drilling through an upper contaminated groundwater zone into the underlying clean, water supply aquifer.

The Contractor shall notify the Investigation Supervisor immediately if visual and/or olfactory evidence of contamination is encountered during the siteworks. Borehole casing shall be used when drilling through contaminated ground to prevent the spread of contaminants and to protect against cross contamination of samples.

All trial pits will be back-filled immediately on completion.

Consumables or waste will be removed from all sampling locations and returned to the site compound for disposal.

There will be no storage of machinery (including drill rigs) fuel, samples, or chemicals (e.g. bentonite, drilling fluid) in areas prone to flooding or within 20m of any drain or watercourse.

Storage tanks shall have secondary containment provided by means of an above ground bund to capture any oil leakage irrespective of whether it arises 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, BPGCS005).

Oil booms and oil soakage pads should be maintained on-site to enable a rapid and effective response to any accidental spillage or discharge.

Waste oils and hydraulic fluids shall be collected in suitable leak-proof containers and transported from the Site and Off-Site Areas for disposal or recycling;

Machinery used on Site shall be regularly inspected to ensure there is no leakage from them and to ensure the machinery shall not cause contamination of watercourses;

Protection measures shall be put in place by the Contractor to ensure that all hydrocarbons used during the GI works are appropriately handled, stored and disposed of in accordance with recognised standards as detailed by the Environmental Protection Agency;

Guidelines for minimising impacts on water quality and fisheries in relation to Construction shall be implemented including, but not limited to, CIRIA "C532 "Control of water pollution from construction –activities - Guidance for consultants and contractors", Inland Fisheries Ireland guidelines and TII guidelines

S5.3.2 Standard Measures for Control of Sediments

Ensure no machinery enters or cross watercourse (including drainage channels).

Standard runoff containment measures will be installed before starting borehole and trial pit sampling. Sediment controls will be monitored and maintained throughout the proposed GI works to protect sensitive aquatic species.

There will be no direct or indirect discharge of surface or ground water generated during GI works to any surface water feature (drain, stream, river, lake, estuarine or coastal waterbody).

In accordance with standard CIRIA Good Practice On-Site Guidelines (C741), run-off from GI works areas (either surface water or ground water generated during dewatering or drilling) will be intercepted and managed in order to avoid indirect sedimentation impacts on any nearby surface waters. These standard measures may include suitably designed settlement pond/filter channels along with other pollution control measures such as silt fences and silt mats. Pumping and transport of water off-site in tankers may be required if volumes prevent effective control by other means. The contractor will be obliged to maintain any water management system in satisfactory working order throughout the period of construction activities.

All working areas will be dewatered at the end of each working day, to prevent over-topping of silt control measures.

S5.3.3 Reinstatement

A photographic condition survey will be undertaken by the Contractor prior to entry and on departure from all GI works areas (including the access route to the works area).

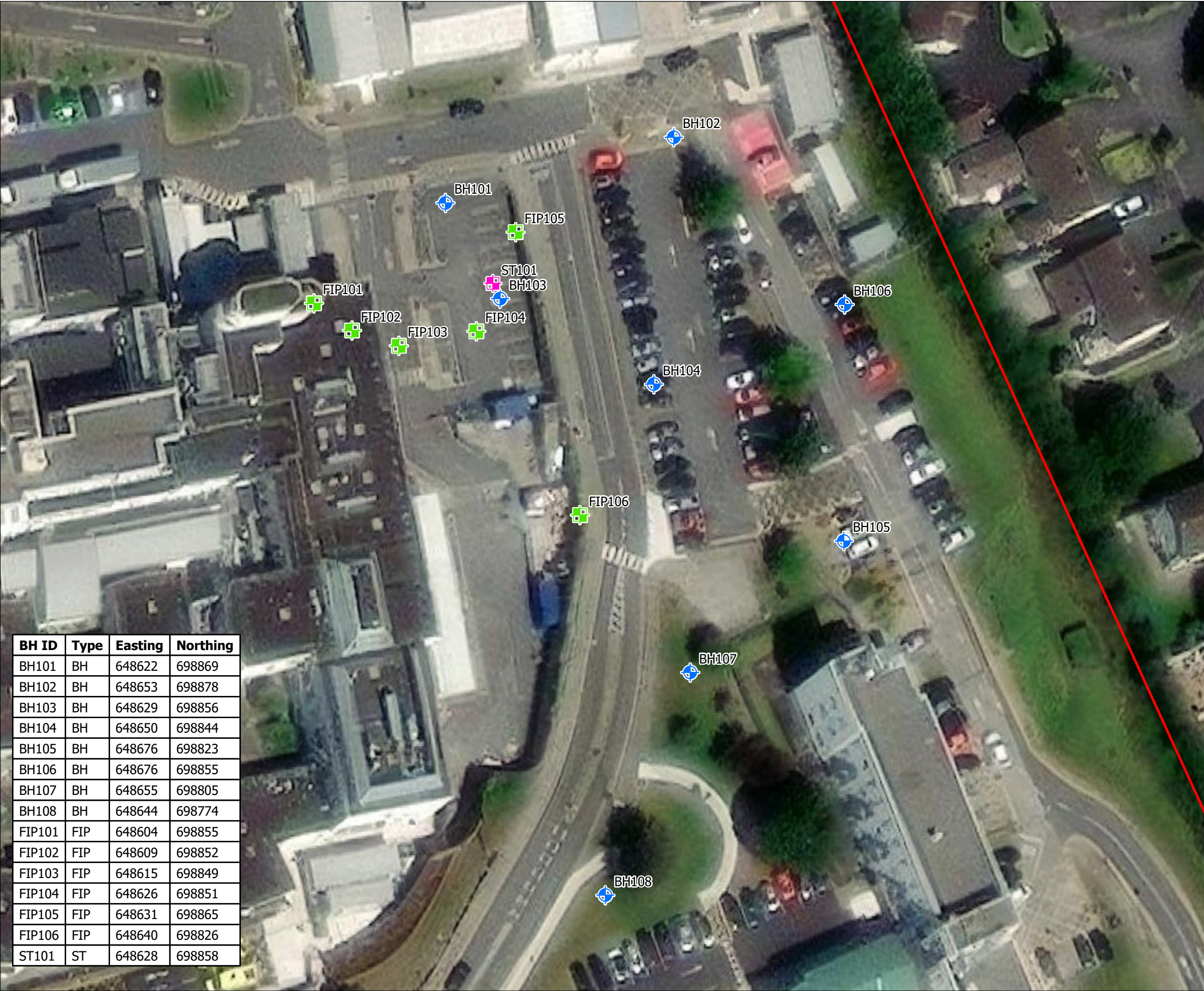
Where boreholes or trenching is carried out, the ground shall be reinstated as close as possible to the existing condition prior to the start of the Works, including topsoiling and reseedling in grassed areas.

Turves shall be kept within an enclosed temporary fenced area that will prevent them from being damaged, stored on bog-mats and kept moist if they are being stored for more than a few hours or if the weather is hot.

Topsoil and subsoil shall be stored separately. Turves shall be watered in when they have been replaced.

Appendices

A. Exploratory Hole Location Plans



BH ID	Type	Easting	Northing
BH101	BH	648622	698869
BH102	BH	648653	698878
BH103	BH	648629	698856
BH104	BH	648650	698844
BH105	BH	648676	698823
BH106	BH	648676	698855
BH107	BH	648655	698805
BH108	BH	648644	698774
FIP101	FIP	648604	698855
FIP102	FIP	648609	698852
FIP103	FIP	648615	698849
FIP104	FIP	648626	698851
FIP105	FIP	648631	698865
FIP106	FIP	648640	698826
ST101	ST	648628	698858



Legend

Site Boundary

Exploratory Holes

Soil and Rock Borehole

Foundation Inspection Pit

Slit Trench

Notes

1. This drawing should be read in conjunction with Midlands Regional Hospital Portlaoise 48 Bed Ward Block Ground Investigation Technical Specification (ref. 229101894-MMD-XX-XX-SP-G-00001), dated September 2026.

2. This drawing is for information only.

3. Location of proposed exploratory holes are indicative and should be revised for presence of underground services, or other physical constraints, prior to commencement of site works.

4. The Contractor shall be responsible for ensuring the exploratory holes are set out at the correct coordinates, subject to utility clearance.

5. All exploratory hole locations, including alternative positions, are to be agreed with the Investigation Supervisor. All exploratory holes are expected to be cleared of services by using a CAT scanner and genny.

7. All boreholes are to be commenced by a hand dug inspection pit to 1.2m below ground level.

8. The number, depth and method of exploratory holes may be changed in accordance with the ground conditions and site constraints encountered.

9. These notes are for guidance only and form a non-exhaustive list. It is expected that as a minimum, these notes are incorporated into the RAMS for the siteworks.

Coordinate system: IRENET95 Irish Transverse Mercator; Datum: IRENET95

Data sources:

Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Microsoft, Vantor

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Steeven's Lane,

Dublin 8,

D08 W2A8

Midlands Regional Hospital Portlaoise

New Ward Block

Ground Investigation

Exploratory Hole Location Plan

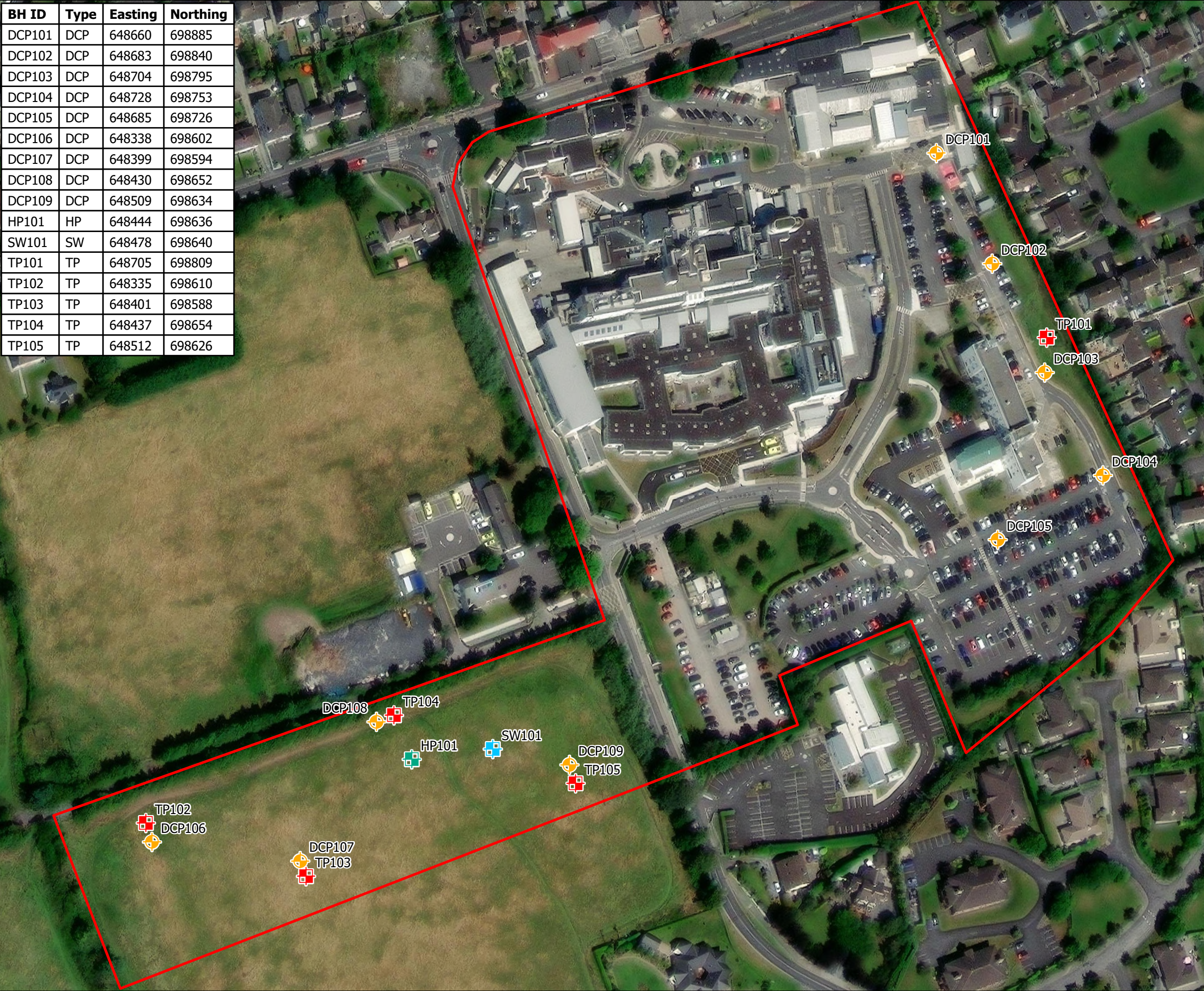
Package 1

Drawn J Carlyle	GIS Checked S Evers-Young	Checked K McCafferty	Approved E Dickson
Scale at A3 1:500	Status S2	Revision P01	Security STD

229101894-MMD-XX-XX-DR-G-00001



BH ID	Type	Easting	Northing
DCP101	DCP	648660	698885
DCP102	DCP	648683	698840
DCP103	DCP	648704	698795
DCP104	DCP	648728	698753
DCP105	DCP	648685	698726
DCP106	DCP	648338	698602
DCP107	DCP	648399	698594
DCP108	DCP	648430	698652
DCP109	DCP	648509	698634
HP101	HP	648444	698636
SW101	SW	648478	698640
TP101	TP	648705	698809
TP102	TP	648335	698610
TP103	TP	648401	698588
TP104	TP	648437	698654
TP105	TP	648512	698626



Legend	
Site Boundary	Hand Dug Pit
Dynamic Cone Penetrometer - TRL Type	Infiltration Test
Machine Excavated Trial Pit	

- Notes
1. This drawing should be read in conjunction with Midlands Regional Hospital Portlaoise 48 Bed Ward Block Ground Investigation Technical Specification (ref. 229101894-MMD-XX-XX-SP-G-00001), dated September 2026.
 2. This drawing is for information only.
 3. Location of proposed exploratory holes are indicative and should be revised for presence of underground services, or other physical constraints, prior to commencement of site works.
 4. The Contractor shall be responsible for ensuring the exploratory holes are set out at the correct coordinates, subject to utility clearance.
 5. All exploratory hole locations, including alternative positions, are to be agreed with the Investigation Supervisor. All exploratory holes are expected to be cleared of services by using a CAT scanner and genny.
 7. All boreholes are to be commenced by a hand dug inspection pit to 1.2m below ground level.
 8. The number, depth and method of exploratory holes may be changed in accordance with the ground conditions and site constraints encountered.
 9. These notes are for guidance only and form a non-exhaustive list. It is expected that as a minimum, these notes are incorporated into the RAMS for the siteworks.

Coordinate system: IRENET95 Irish Transverse Mercator; Datum: IRENET95

Data sources:

Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Microsoft, Vantor

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Midlands Regional Hospital Portlaoise
New Ward Block
Ground Investigation
Exploratory Hole Location Plan
Package 3

Drawn J Carlyle	GIS Checked S Evers-Young	Checked K McCafferty	Approved E Dickson
Scale at A3 1:1,500	Status S2	Revision P01	Security STD

229101894-MMD-XX-XX-DR-G-00003



B. Designers Hazard Elimination and Management Record

Project title	Midlands Regional Hospital, Portlaoise - New Ward Block				Project number	229101894		
Project Technical Lead	Aidan Hyland				Division/ unit	BLD		
Project Safety Advisor	Liam Burke				Form number/ revision	P01		

Scope of design

This form is also available in [Word format](#)

Ground investigation to provide information on ground conditions to facilitate the proposed development. Proposed development is to increase the hospital capacity by a minimum of 48-beds via construction of a new hospital building. Demolition of an existing retaining wall and carpark are expected to be undertaken prior to construction of the proposed building. A new diverted access road and car park is proposed to replace the existing areas planned for demolition.

Haz ref	Activity/ process/ material/ element – what is being undertaken?	Hazard ¹	Stage of work	Designer risk control measures: ² Design action taken, record of decision process including options considered, design constraints and justification for options/ actions not having been taken	Is there a 'significant' or 'particular' ³ residual risk to be passed on? ⁴	If the answer to the previous question is 'yes', information flow: D/ P/ F ⁵	Status within Mott MacDonald
Section header (move/ delete as required)							
1	Intrusive Ground Investigation	Unexpected buried services	Construction	The exploratory hole locations have been positioned to avoid buried services/utilities where possible; however the Contractor shall be responsible for reviewing the proposed locations against the available plans to satisfy themselves that the locations are clear of services before breaking ground.	Yes	GI Specification, PH&SP (D/P/F)	Closed
2	Intrusive Ground Investigation	Working in an active hospital	Construction	Works are within an active hospital, and should be carried out in a manner which does not impact on the daily operation of the hospital, with consideration given to the location of the works so that they do not block emergency access routes for ambulances/hospital vehicles. Exploratory hole positions may need to be moved to avoid interfering with access to and from the site.	Yes	GI Specification, PH&SP (D/P/F)	Closed
3	Intrusive Ground Investigation	Site security	Construction	The GI is to be undertaken within an active hospital, and as such there is potential for visitors or members of the general public to be within the site area during the ground investigation period. Appropriate security measures to be provided for the duration of the works. As a minimum, this should include appropriate fencing/barriers, appropriate signage and appropriate security measure if plant or equipment is to be left on site out with standard working hours. The Contractor shall remain vigilant and should stop work if approached by a member of the public	Yes	GI Specification, PH&SP (D/P/F)	Closed
4	Intrusive Ground Investigation	Work in karst and subsidence ground conditions - collapse of ground	Construction	No karst features identified within the site area, however, potential for dissolution features to be present associated with the underlying limestone bedrock of the Allenwood Formation. Karst features have been identified in this formation within 2km of the site. All staff shall remain vigilant for ground subsidence during works.	Yes	GI Specification, PH&SP (D/P/F)	Closed

Project title	Midlands Regional Hospital, Portlaoise - New Ward Block	Project number	229101894
Project Technical Lead	Aidan Hyland	Division/ unit	BLD
Project Safety Advisor	Liam Burke	Form number/ revision	P01

Scope of design

Ground investigation to provide information on ground conditions to facilitate the proposed development. Proposed development is to increase the hospital capacity by a minimum of 48-beds via construction of a new hospital building. Demolition of an existing retaining wall and carpark are expected to be undertaken prior to construction of the proposed building. A new diverted access road and car park is proposed to replace the existing areas planned for demolition.

This form is also available in Word format

Haz ref	Activity/ process/ material/ element – what is being undertaken?	Hazard ¹	Stage of work	Designer risk control measures: ² Design action taken, record of decision process including options considered, design constraints and justification for options/ actions not having been taken	Is there a 'significant' or 'particular' ³ residual risk to be passed on? ⁴	If the answer to the previous question is 'yes', information flow: D/ P/ F ⁵	Status within Mott MacDonald
5	Intrusive Ground Investigation	Unforeseen Contaminated Ground or Groundwater	Construction	The ground investigation is required in areas which may have elevated levels of contaminants of concern. The sites have been assessed to be 'YELLOW' BDA status. Staff on site to use appropriate PPE to manage the risk.	Yes	GI Specification, PH&SP (D/P/F)	Closed
6	Intrusive Ground Investigation	Contamination of aquifer	Construction	The limestone bedrock beneath the site is recorded to comprise a regionally important aquifer with a moderate - high groundwater vulnerability. The bedrock aquifer stores the Bagenalstown groundwater body. PSCS to detail measures mitigating risk of contamination of aquifer on site during ground investigation.	Yes	GI Specification, PH&SP (D/P/F)	Closed

1. A hazard is something with the potential to cause harm, such as: working near live traffic, working at height, falling object etc.

2. Designer risk control measures are to be based upon the principles of prevention: - eliminate, reduce, inform/ isolate, control.

3. 'Significant risk' is the UK terminology; 'particular risk' is the EU terminology.

4. Significant/ particular risks are not necessarily those that involve the greatest risks, but those, including health risks that are: (a) not likely to be obvious to a competent contractor or other designers; (b) unusual; or (c) likely to be difficult to manage effectively.

5. Please note that this information may also be relevant to specifications and/ or reports. D - Information detailed on drawings (add drawing numbers); P - Information to be communicated via pre-construction information; F - Information for the health and safety file

C. Geo-environmental Testing Suites and Laboratory Limits of Detection

Table C.1: Soil Suite and LODs

Parameter	Maximum Allowable Limits of Detection	Reporting Unit
Arsenic	<1	mg/kg
Barium	<1	mg/kg
Beryllium	<1	mg/kg
Boron	<1	mg/kg
Cadmium	<1	mg/kg
Chromium - III	<1	mg/kg
Chromium - Hexavalent	<1	mg/kg
Copper	<1	mg/kg
Iron	<1	mg/kg
Lead	<1	mg/kg
Magnesium	<1	mg/kg
Manganese	<1	mg/kg
Mercury	<1	mg/kg
Molybdenum	<1	mg/kg
Nickel	<1	mg/kg
Selenium	<1	mg/kg
Vanadium	<1	mg/kg
Zinc	<1	mg/kg
Asbestos Screen & ID	NAD	N/A
pH	0.1	pH Units
Total sulphur	<1	mg/kg
Sulphate	<1	mg/kg
Sulphide	<1	mg/kg
Total cyanide	<1.0	mg/kg
Free cyanide	<1.0	mg/kg
Thiocyanate	<1.0	mg/kg
TPH CWG (ali/ aro split C5-C44)	<0.01	mg/kg
PAH - Speciated (EPA 16)	<0.01	mg/kg
Phenols - Speciated	<0.01	mg/kg
Soil Organic Matter (SOM)	<0.01	%
Total Organic Carbon (TOC)	<0.01	%
Moisture content	<0.01	%

Table C.2: Leachate Suite and LODs

Parameter	Maximum Allowable Limits of Detection	Reporting Unit
Arsenic	<1	µg/l
Barium	<1	µg/l
Beryllium	<1	µg/l
Boron	<1	µg/l
Cadmium	<0.1	µg/l
Chromium - III	<1	µg/l
Chromium - Hexavalent	<1	µg/l
Copper	<1	µg/l
Iron	<1	µg/l
Lead	<1	µg/l
Magnesium	<1	µg/l
Manganese	<1	µg/l
Mercury	<0.01	µg/l
Molybdenum	<1	µg/l
Nickel	<1	µg/l
Selenium	<1	µg/l
Vanadium	<1	µg/l
Zinc	<1	µg/l
Total Hardness	<1	µg/l
pH	0.1	pH units
Sulphate (water soluble)	<1	µg/l
Sulphide	<1	µg/l
Cyanide - Free	<0.001	µg/l
Cyanide - Total	<0.05	µg/l
Ammoniacal Nitrogen	<1	µg/l
Chloride	<1	µg/l
Nitrate	<1	µg/l
Phenols	<0.01	µg/l
TPH CWG (ali/aro split C5-C44)	<0.1	µg/l
PAH - Speciated (EPA 16)	<0.01	µg/l

Table C.3: Groundwater Suite and LODS

Parameter	Maximum Allowable Limits of Detection	Reporting Unit
Arsenic	<1	µg/l
Barium	<1	µg/l
Beryllium	<1	µg/l
Boron	<1	µg/l
Cadmium	<0.1	µg/l
Chromium – III	<1	µg/l
Chromium - Hexavalent	<1	µg/l
Copper	<1	µg/l
Iron	<1	µg/l

Parameter	Maximum Allowable Limits of Detection	Reporting Unit
Lead	<1	µg/l
Magnesium	<1	µg/l
Manganese	<1	µg/l
Mercury	<0.01	µg/l
Molybdenum	<1	µg/l
Nickel	<1	µg/l
Selenium	<1	µg/l
Vanadium	<1	µg/l
Zinc	<1	µg/l
Total Hardness	<1	µg/l
pH	0.1	pH units
Sulphate (water soluble)	<1	µg/l
Sulphide	<1	µg/l
Cyanide – Free	<0.001	µg/l
Cyanide – Total	<0.05	µg/l
Ammoniacal Nitrogen	<1	µg/l
Chloride	<1	µg/l
Nitrate	<1	µg/l
Phenols	<0.01	µg/l
TPH CWG (ali/aro split C ₅ -C ₄₄)	<0.1	µg/l
PAH - Speciated (EPA 16)	<0.01	µg/l
Total Dissolved Solids (TDS)	<0.1	µg/l
Dissolved organic carbon (DOC)	1.0	mg/l

Table C.4: Speciated VOC Suite and LODs

Parameter	Maximum Allowable LOD	Reporting Unit	Groundwater Sample Maximum Allowable Limits of Detection	Reporting Unit
Chloromethane	<0.001	mg/kg	<0.01	µg/l
Chloroethane	<0.001	mg/kg	<0.01	µg/l
Bromomethane	<0.001	mg/kg	<0.01	µg/l
Vinyl chloride	<0.00064	mg/kg	<0.01	µg/l
Trichlorofluoromethane	<0.001	mg/kg	<0.01	µg/l
1,1-Dichloroethane	<0.001	mg/kg	<0.01	µg/l
1,1,2-Trichloro 1,2,2-Trifluoroethane	<0.001	mg/kg	<0.01	µg/l
cis-1,2-Dichloroethene	<0.001	mg/kg	<0.01	µg/l
MTBE (Methyl Tertiary Butyl Ether)	<0.001	mg/kg	<0.01	µg/l
1,1-Dichloroethane	<0.001	mg/kg	<0.01	µg/l
2,2-Dichloropropane	<0.001	mg/kg	<0.01	µg/l
Trichloromethane	<0.001	mg/kg	<0.01	µg/l
1,1,1-Trichloroethane	<0.001	mg/kg	0.1	µg/l
1,2-Dichloroethane	<0.001	mg/kg	0.1	µg/l
1,1-Dichloropropene	<0.001	mg/kg	<0.01	µg/l

Parameter	Maximum Allowable LOD	Reporting Unit	Groundwater Sample Maximum Allowable Limits of Detection	Reporting Unit
trans-1,2-Dichloroethene	<0.001	mg/kg	<0.01	µg/l
Benzene	<0.001	mg/kg	1	µg/l
Tetrachloromethane	<0.001	mg/kg	<0.01	µg/l
1,2-Dichloropropane	<0.001	mg/kg	<0.01	µg/l
Trichloroethene	<0.001	mg/kg	<0.01	µg/l
Dibromomethane	<0.001	mg/kg	<0.01	µg/l
Bromodichloromethane	<0.001	mg/kg	<0.01	µg/l
cis-1,3-Dichloropropene	<0.001	mg/kg	<0.01	µg/l
trans-1,3-Dichloropropene	<0.001	mg/kg	<0.01	µg/l
Toluene	<0.001	mg/kg	4	µg/l
1,1,2-Trichloroethane	<0.001	mg/kg	<0.01	µg/l
1,3-Dichloropropane	<0.001	mg/kg	<0.01	µg/l
Dibromochloromethane	<0.001	mg/kg	<0.01	µg/l
Tetrachloroethene	<0.001	mg/kg	<0.01	µg/l
1,2-Dibromoethane	<0.001	mg/kg	<0.01	µg/l
Chlorobenzene	<0.001	mg/kg	<0.01	µg/l
1,1,1,2-Tetrachloroethane	<0.001	mg/kg	<0.01	µg/l
Ethylbenzene	<0.001	mg/kg	<0.01	µg/l
p & m-xylene	<0.001	mg/kg	3	µg/l
Styrene	<0.001	mg/kg	<0.01	µg/l
Tribromomethane	<0.001	mg/kg	<0.01	µg/l
o-Xylene	<0.001	mg/kg	3	µg/l
Isopropylbenzene	<0.001	mg/kg	<0.01	µg/l
Bromobenzene	<0.001	mg/kg	<0.01	µg/l
n-Propylbenzene	<0.001	mg/kg	<0.01	µg/l
2-Chlorotoluene	<0.001	mg/kg	<0.01	µg/l
4-Chlorotoluene	<0.001	mg/kg	<0.01	µg/l
1,3,5-Trimethylbenzene	<0.001	mg/kg	<0.01	µg/l
tert-Butylbenzene	<0.001	mg/kg	<0.01	µg/l
1,2,4-Trimethylbenzene	<0.001	mg/kg	<0.01	µg/l
sec-Butylbenzene	<0.001	mg/kg	<0.01	µg/l
1,3-Dichlorobenzene	<0.001	mg/kg	<0.01	µg/l
p-Isopropyltoluene	<0.001	mg/kg	<0.01	µg/l
1,2-Dichlorobenzene	<0.001	mg/kg	<0.01	µg/l
1,4-Dichlorobenzene	<0.001	mg/kg	<0.01	µg/l
Butylbenzene	<0.001	mg/kg	<0.01	µg/l
1,2-Dibromo-3-chloropropane	<0.001	mg/kg	<0.01	µg/l
1,2,4-Trichlorobenzene	<0.001	mg/kg	<0.01	µg/l
Hexachlorobutadiene	<0.001	mg/kg	<0.01	µg/l
1,2,3-Trichlorobenzene	<0.001	mg/kg	<0.01	µg/l

Table C.5: Speciated SVOC Suite and LODs

Parameter	Maximum Allowable LOD	Reporting Unit	Groundwater Sample Maximum Allowable Limits of Detection	Reporting Unit
Phenol	<0.001	mg/kg	<0.01	µg/l
Bis(2-chloro)ether	<0.001	mg/kg	<0.01	µg/l
2-Chlorophenol	<0.001	mg/kg	0.1	µg/l
1,3-Dichlorobenzene	<0.001	mg/kg	<0.01	µg/l
1,4-Dichlorobenzene	<0.001	mg/kg	<0.01	µg/l
1,2-Dichlorobenzene	<0.001	mg/kg	<0.01	µg/l
Bis(2-chloroisopropyl)ether	<0.001	mg/kg	<0.01	µg/l
2-methyl	<0.001	mg/kg	<0.01	µg/l
3/4-Methylphenol	<0.001	mg/kg	<0.01	µg/l
Hexachloroethane	<0.001	mg/kg	<0.01	µg/l
Nitrobenzene	<0.001	mg/kg	<0.01	µg/l
Isophorone	<0.001	mg/kg	<0.01	µg/l
2,4-Dimethylphenol	<0.001	mg/kg	<0.01	µg/l
Bis(2-chloroethoxy)methane	<0.001	mg/kg	<0.01	µg/l
2,4-Dichlorophenol	<0.001	mg/kg	0.1	µg/l
1,2,4-Trichlorobenzene	<0.001	mg/kg	<0.01	µg/l
Naphthalene	<0.001	mg/kg	<0.01	µg/l
4-Chloroaniline	<0.001	mg/kg	<0.01	µg/l
Hexachlorobutadiene	<0.001	mg/kg	0.005	µg/l
4-Chloro-3-methylphenol	<0.001	mg/kg	0.1	µg/l
2-Methylnaphthalene	<0.001	mg/kg	<0.01	µg/l
Hexachlorocyclopentadiene	<0.001	mg/kg	<0.01	µg/l
2,4,6-Trichlorophenol	<0.001	mg/kg	<0.01	µg/l
2,4,5-Trichlorophenol	<0.001	mg/kg	<0.01	µg/l
2-Chloronaphthalene	<0.001	mg/kg	<0.01	µg/l
2-Nitroaniline	<0.001	mg/kg	<0.01	µg/l
Dimethyl phthalate	<0.001	mg/kg	<0.01	µg/l
2,6-Dinitrotoluene	<0.001	mg/kg	<0.01	µg/l
Acenaphthylene	<0.001	mg/kg	<0.01	µg/l
Acenaphthene	<0.001	mg/kg	<0.01	µg/l
3-Nitroaniline	<0.001	mg/kg	<0.01	µg/l
2,4-Dinitrophenol	<0.001	mg/kg	<0.01	µg/l
Dibenzofuran	<0.001	mg/kg	<0.01	µg/l
2,4-Dinitrotoluene	<0.001	mg/kg	<0.01	µg/l
2-Nitrophenol	<0.001	mg/kg	<0.01	µg/l
4-Nitrophenol	<0.001	mg/kg	<0.01	µg/l
Diethyl phthalate	<0.001	mg/kg	<0.01	µg/l
Fluorene	<0.001	mg/kg	<0.01	µg/l
4-Chlorophenyl phenylether	<0.001	mg/kg	<0.01	µg/l
4-Nitroaniline	<0.001	mg/kg	<0.01	µg/l
Azobenzene	<0.001	mg/kg	<0.01	µg/l
4-Bromophenyl phenylether	<0.001	mg/kg	<0.01	µg/l

Parameter	Maximum Allowable LOD	Reporting Unit	Groundwater Sample Maximum Allowable Limits of Detection	Reporting Unit
Hexachlorobenzene	<0.001	mg/kg	<0.01	µg/l
Pentachlorophenol	<0.001	mg/kg	<0.01	µg/l
Phenanthrene	<0.001	mg/kg	<0.01	µg/l
Anthracene	<0.001	mg/kg	<0.01	µg/l
Carbazole	<0.001	mg/kg	<0.01	µg/l
Di-n-butylphthalate	<0.001	mg/kg	<0.01	µg/l
Fluoranthene	<0.001	mg/kg	<0.01	µg/l
Pyrene	<0.001	mg/kg	<0.01	µg/l
Butyl benzylphthalate	<0.001	mg/kg	<0.01	µg/l
Benzo(a)Anthracene	<0.001	mg/kg	<0.01	µg/l
Chrysene	<0.001	mg/kg	<0.01	µg/l
Bis(2-ethylhexyl)phthalate	<0.001	mg/kg	<0.01	µg/l
Di-n-octylphthalate	<0.001	mg/kg	<0.01	µg/l
Benzo(b/k)Fluoranthene	<0.001	mg/kg	<0.01	µg/l
Benzo(a)Pyrene	<0.001	mg/kg	<0.01	µg/l
Indeno(123-cd)Pyrene	<0.001	mg/kg	<0.01	µg/l
Dibenzo(ah)Anthracene	<0.001	mg/kg	<0.01	µg/l
Benzo(ghi)Perylene	<0.001	mg/kg	<0.01	µg/l

Table C.6: Full WAC Suite

Full WAC Suite	Parameter	Maximum Acceptable Laboratory Detection Limit	Reporting Units
Leachate Suite	Arsenic	0.5	mg/kg
	Barium	20	mg/kg
	Cadmium	0.04	mg/kg
	Chromium	0.5	mg/kg
	Copper	2	mg/kg
	Mercury	0.01	mg/kg
	Molybdenum	0.5	mg/kg
	Nickel	0.4	mg/kg
	Lead	0.5	mg/kg
	Antimony	0.06	mg/kg
	Selenium	0.1	mg/kg
	Zinc	4	mg/kg
	Chloride	800	mg/kg
	Fluoride	10	mg/kg
	Sulphate as SO ₄	1000	mg/kg
	Total Dissolved Solids (TDS)	4000	mg/kg
	Phenol Index	1	mg/kg
	Dissolved Organic Carbon	500	mg/kg
Solid Waste Suite	Total Organic Carbon (TOC)	3	%
	Loss on ignition	10	%
	BTEX by GC-FID	6	mg/kg
	pH	0.1	pH Units
	Acid Neutralisation Capacity (ANC)		mol/kg

Full WAC Suite	Parameter	Maximum Acceptable Laboratory Detection Limit	Reporting Units
	PAHs (total)	100	mg/kg
	PCBs (7 congeners)	1	mg/kg
	Mineral Oil (C10-C40)	500	mg/kg

D. Bills of Quantities

D.1 Preamble to Bill of Quantities

The Bills of Quantities (BoQs) are based on the Bill of Quantities for Ground Investigation given as Annex 1 of the Specification and Related Documents for Ground Investigation in Ireland, Second Edition (2016). The Preamble given in the above-mentioned document shall apply, including the amendments and additions as set out below.

Preamble Additions

- All items or groups of items, which are designated “provisional” only are at the direction and discretion of the Investigation Supervisor. No claim will be entertained in respect of overhead charges or of any other costs, which may allegedly result from the omission of all or part of the work, covered by such provisional items.
- The rates provided within the Bills of Quantities shall be applicable to the corresponding works. No claim or rate increase will be accepted for implementation of this, or parts of this works.
- The Client/Employer reserves the right to reduce the scope of works to meet commercial and programme requirements of the Contract. The rates provided shall be deemed to account for this possibility. No claim or rate increase shall be accepted where the client reduces the scope of works.
- The rates quoted in the Bill of Quantities shall be exclusive of Value Added Tax.
- Item A2 (including sub-items) Rates for establishment are deemed to include for all costs associated with mobilisation to site and demobilisation from site of all necessary plant, rigs, equipment, services and operational crews required to undertake the scope of works within the programmed timescales.
- Items A7, A30, Rates quoted for supervisory staff (or professional attendance) shall include for all transport, subsistence and accommodation costs associated with delivering the scope of works. Costs shall include for any necessary staff training to satisfy the requirements of the GI Contract. Site logging of samples is deemed to be included within the rates for boring, drilling, trial pitting and sampling. Logging outside of the site supervision requirements, such as at the Contractor's offices or testing laboratories shall not be deemed payable under the Contract. Weekend or night supervisory work will be agreed in advance with the Investigation Supervisor. No additional payments will be payable if the Contractor elects to accelerate his programme above a normal working week. The Contractor is required, within his tendered rates, to include for the costs of all site staff who are not explicitly stated in the Bill of Quantities.
- Items A8 & A8.1 Rates quoted for setting out and establishment of as-built exploratory holes shall be deemed to include boreholes and trial excavations (including test specific pits for plate testing and infiltration testing). Setting out and confirmation of as-built positions and elevations of dynamic probes shall be derived from the trial excavation they correspond to and not be chargeable under the contract.
- Item A9 Rates quoted for preparation of Health and Safety documentation shall include for all RAMs, construction health and safety plans, traffic management plans, and any other documentation, and subsequent iterations of documents, appropriate for the defined Scope of Works to satisfy PSCS responsibilities under the Safety Health and Welfare at Work (Construction) Regulations 2013, and approval requirements of the Client/Employer, Project Developer and Landowner Liaison Officer, and any other affected parties.

- Item A19 (including sub-items) One master copy of the Ground Investigation Report (Factual) per site to include for provision for a draft report (including necessary iterations) and a final report incorporating and addressing the Investigation Supervisor's comments (to his satisfaction) shall be provided. Rates are to include for provision of PDF electronic version of reports and drawings, in addition to, DWG AutoCAD version of all drawings. Rates also to include for digital data in AGS transfer format (most recent version of AGS in a single AGS file), with provisional data provided following completion of fieldwork, and checked and approved data with draft and final reports.
- Item A21 (including sub-items) One master copy of the Ground Investigation Report (Geotechnical Interpretative Report) per site to include for provision for a draft report (including necessary iterations) and a final report incorporating and addressing the Investigation Supervisor's comments (to his satisfaction) shall be provided. Rates are to include for provision of PDF electronic version of reports and drawings, in addition to, DWG AutoCAD version of all drawings.
- Item A30 Rates provided are deemed to include and account for all necessary costs associated with undertaking the Investigation in the role of Project Supervisor Construction Stage under the Safety Health and Welfare at Work (Construction) Regulations 2013.
- Move and set-up rates for exploratory holes shall only be paid where the distance between moves is sufficient to require the equipment and plant to be fully dismantled and reassembled. Short movements required to restart a location due to misalignment or obstructions etc. shall be paid for at the corresponding standing time rates taken to relocate position.
- Standing time shall be measured as the duration of time for which plant, equipment and personnel are standing on the instruction of the Investigation Supervisor or in accordance with the Contract. Standing time resulting from the undertaking of in-situ testing is not considered to be payable and should be accounted for within the individual in-situ testing rates.
- All rates for sampling (geotechnical and geo-environmental) shall include for the provision of specialist containers where applicable.
- Item K1.2 Rates of Liquid Limit, Plastic Limit and Plasticity Index testing shall include for moisture content determination for each sample tested.

D.2 Bills of Quantities

The following pages constitute the Bill of Quantities (provided in electronic Excel spreadsheet format).

Midlands Regional Hospital, Portlaoise
New Ward Block Technical Specification for Ground Investigations Package 1
Bill of Quantities

Summary Scope
Combined soils and rock boreholes advanced using wireline GeoBoreS drilling (or other approved method) to a maximum depth of 15m below ground level (bgl), (provisionally estimated to be 5m soils boring and 10m of rock coring), with in-situ testing (SPTs) and retrieval of soil (disturbed and Class 1 undisturbed samples in accordance with Eurocode 7), rock cores and groundwater samples for laboratory testing (geotechnical, geochemical and geo-environmental).
Hand Excavated Foundation Observation Pits to a maximum depth of 1.2m to investigate the nature and geometry of the existing building foundations.
Installation of combined groundwater and ground gas monitoring installations (50mm diameter HDPE) with geosock, endcap, gas tap and flush / raised lockable protective cover, at selected locations as directed by the Investigation Supervisor. Depths and response zones to be confirmed by the Investigation Supervisor upon completion of the exploratory hole.
Collection of geotechnical and geo-environmental samples for laboratory testing.
Post-fieldwork groundwater monitoring visits (Ground gas monitoring may be scheduled by the Investigation Supervisor depending on the results of the GI and early monitoring visits), with

Bill A General Items, provisional services and additional items					
Nr.	Item Description	Unit	Quantity	Rate	Amount
A	General Items and Provisional Services				
A1	Offices and stores for the Contractor	sum	1		
A2.1	Establish on site cable percussion ('shell/auger') boring plant and equipment for a Green Category site	sum			
A2.2	Establish on site rotary drilling plant and equipment for a Green Category site.	sum			
A2.3	Establish on site Geobor S rotary drilling plant and equipment for a Green Category site.	sum	1		
A2.4	Establish on site trial pitting and trenching plant and equipment for a Green Category site.	sum	1		
A2.5	Establish on site in situ test and sampling equipment for a Green Category site.	sum	1		
A2.6	Establish on site cone penetration testing (CPT) plant and equipment for a Green category site.	sum			
A2.7	Establish on site dynamic sampling and probing plant and equipment for a Green Category site.	sum			
A2.8	Establish on site geophysical survey equipment for a Green Category site.	sum			
A2.9	Establish instrumentation equipment on site as required for Green Category site.	sum	1		
A3.1	Extra over item A2.1 –A2.9 for yellow category site.	sum	1		
A3.2	As Item A3.1 but for Red Category Site.	sum			
A4.1	Maintain on site all site safety equipment for a Yellow Category site.	per week	3		
A4.2	As Item A4.1 but for Red Category site	per week			
A5	Decontamination of equipment during and at the end of fieldworks for a Yellow Category site.	sum	1		
A5.1	As item A5 but for Red Category site.	sum			
A6	Appropriate storage, transport and off-site disposal of excess contaminated arisings from borehole, trial pit or slit trench to EPA regulated landfill site (includes any PPE equipment but excludes laboratory testing on suspected contaminated materials). Note item to be re-measured with delivery dockets and records maintained by the Contractor.	provisional sum			
A6.1	Contractors uplift on item A6.	%			
A7	Professional attendance to meet the contract requirements detailed in Technical Specification S1.8.2. Costs to include for any specialist training to facilitate delivery of the works in accordance with the GI Contract.	sum	1		
A7.1	Provide Technician.	per day			
A7.2	Provide Engineer/Geologist (as per item 2.3 of Specification).	per day			
A7.3	Provide Chartered Engineer/Professional Geologist (as per item 2.3 of specification).	per day			
A7.4	Provide Chartered Engineer/Professional Geologist (+10 yr experience post charter).	per day			
A7.5	Provide Chartered Engineer/Professional Geologist (+20 yr experience post charter).	per day			
A8	Set out location at each exploratory hole or point.	nr	15		
A8.1	Establish the location and elevation (X, Y, Z) of ground at each 'as-built' exploratory hole or point.	nr	15		
A9	Preparation of Health and Safety documentation and Safety Risk Assessment.	sum	1		
A10	Facilities for the Investigation Supervisor .	per week	Rate Only		
A11	Vehicle(s) for the Investigation Supervisor.	vehicle week			
A11.1	Provision of fuel and tolls for A11 (to be reimbursed under the contract).	provisional sum			
A11.2	Contractors Uplift on item A11 and 11.1.	% Uplift			

A12	Provision of phone and internet for the Investigation Supervisor (to be reimbursed under the contract).	provisional sum			
A12.1	Contractors Uplift on item A12.	% Uplift			
A13	Deliver selected cores and samples to specified Client address.	provisional sum			
A14	Special additional testing and sampling required by Investigation Supervisor.	provisional sum			
A15	Traffic safety and management to include preparation of traffic management drawings for investigations on roads or pavement areas.	provisional sum	Rate Only		
A16	Provision of road opening licences and road damages bond.	provisional sum			
A17	Contractors Uplift on items A15 and A16.	% Uplift			
A18	One master copy of Desk Study Report.	sum			
A18.1	Additional hard copy of Desk Study Report.	nr			
A18.2	Electronic copy of Desk Study Report (PDF).	sum			
A19	One master copy of Ground Investigation Report (Factual).	sum	1		
A19.1	Additional copy of Ground Investigation Report (Factual).	nr			
A19.2	Electronic copy of Ground Investigation Report.	sum			
A20	One master copy of Geophysical Report.	sum			
A20.1	Additional hard copy of Geophysical Report.	nr			
A20.2	Electronic Copy of Geophysical Report (PDF).	sum			
A21	One master copy of Geotechnical Interpretative Report.	sum	1		
A21.1	Additional copy of Geotechnical Interpretative Report.	nr			
A21.2	Electronic copy of Geotechnical Interpretative Report.	sum			
A22	Digital field/engineering logs in AGS transfer format.	sum	1		
A23	Digital laboratory test data in AGS transfer files.	sum	1		
A24	Digital copy of trial pit slit trench or core photographs.	nr	1		
A25	Storage of samples (geotechnical or environmental) following completion of fieldworks.	wk	Rate Only		
A26	Storage of core boxes following completion of fieldworks.	wk	Rate Only		
A27	Provision of water supply for the fieldworks.	sum	1		
A28	Provision of Insurances.	sum			
A29	Provision of performance bond.	sum			
A30	Perform the role of PSCS.	sum	1		
A31	Contractor liaison with external bodies to obtain road opening licence, foreshore licence for marine investigations etc. (Specify).	sum			
Contract Specific additional bill items					
A32	Provision on appropriate security measures including safety fencing, dust screens, acoustic barriers etc.	sum	1		
A33	Pre- and Post-fieldwork condition survey of the site	sum	1		
A34	One Master copy of the Generic Quantitative Risk Assessment	sum	1		
A35	Procure necessary utilities/service information for the GI Contract	sum	1		
A36	PAS 128 Survey at Exploratory hole Locations	sum	1		
Subtotal Section A, carried to Summary					0

Bill C Rotary Boring					
Nr	Item Description	Unit	Quantity	Rate	Amount
C	Rotary Boring				
	<u>Hand Augering</u>				
C1	Bring hand auger equipment to the position of each exploratory hole.	nr			
C2	Bore with hand auger from existing ground level to 2m depth.	m			
C3	As item C2 but between 2 and 4m depth.	m			
C4	Standing time for hand auger equipment and crew.	h			
C5	Provision of hand augering equipment and crew for augering as directed by the Investigation Supervisor, maximum depth 4m.	day			
C6	Backfill hand auger hole with cement/bentonite grout or bentonite pellets.	m			
	<u>Continuous flight and hollow-stem flight augering</u>				
C7	Move mechanical augering plant and equipment to the site of each exploratory hole and set up.	nr			
C8	Extra over item C7 for setting up on a slope of gradient greater than 20%.	nr			
C9	Break out surface obstructions where present at auger hole.	h			
C10	Standing time for rotary auger equipment and crew.	h			
C11	Auger in materials other than hard strata at the specified diameter between existing ground level and 10m depth.	m			
C12	As item C11 but between 10 and 20m depth.	m			
C13	As item C11 but between 20 and 30m depth.	m			
C14	Backfill auger hole with cement/bentonite grout or bentonite pellets.				
	<u>Rotary drilling with and without core recovery</u>				
C15	Move rotary drilling plant and equipment to the site of each exploratory drillhole and set up on gradient less than 20%.	nr			
C16	Extra over item C15 for setting up drilling plant on gradient greater than 20%.	nr			
C17	Hand digging and CAT scan at rotary drillhole location to confirm absence of utility ducts (Maximum depth of 1.20m or lesser if ground is assessed as potentially unstable).	nr			
C18	Break out surface obstructions where present at exploratory drillhole.	h			
C19	Standing time for rotary drilling plant, equipment and crew.	h			
C20	Provide aquifer protection measures at a single aquiclude/aquifer boundary in a drillhole.	nr			
	<u>Drilling without cores.</u>				
C21	Rotary drill in materials other than hard strata at the specified diameter, from which cores are not required, between 0 and 10m depth openhole drilling.	m			
C22	As item C21 but between 10 and 20m depth.	m			
C23	As item C21 but between 20 and 30m depth.	m			
C24	As item C21 but between 30 and 40m depth.	m			
C25	As item C21 but between 40 and 50m depth.	m			
C26	Extra over items C21 and C25 for inclined rotary drillhole.	m			
C27	Rotary drill in hard strata at the specified diameter, from which cores are not required, between 0 and 10m depth.	m			
C28	As item C27 but between 10 and 20m depth.	m			
C29	As item C27 but between 20 and 30m depth.	m			
C30	As item C27 but between 30 and 40m depth.	m			
C31	As item C27 but between 40 and 50m depth.	m			
C32	Extra over items C27 to C31 for inclined drillhole.	m			
C33	Backfill rotary drillhole with cement/bentonite grout or bentonite pellets (where standpipe or piezometer is not installed).	m ³			
	<u>Drilling to obtain cores</u>				
C34	Rotary drill in materials other than hard strata to obtain cores of the specified diameter between 0 and 10m depth.	m			
C35	As item C34 but between 10 and 20m depth.	m			
C36	As item C34 but between 20 and 30m depth.	m			
C37	As item C34 but between 30 and 40m depth.	m			
C38	As item C34 but between 40 and 50m depth.	m			
C39	Extra over items C34 to C38 for use of semi-rigid core liner.	m			
C40	Extra over items C34 to C38 for coring inclined rotary drillhole.	m			
C41	Rotary drill in hard strata to obtain cores of the specified diameter between existing ground level and 10m depth.	m			
C42	As item C41 but between 10 and 20m depth.	m			
C43	As item C41 but between 20 and 30m depth.	m			
C44	As item C41 but between 30 and 40m depth.	m			
C45	As item C41 but between 40 and 50m depth.	m			
C46	Extra over items C41 to C45 for use of semi-rigid liner.	m			
C47	Extra over items C41 to C45 for covering inclined rotary drillhole.	m			
C48	Backfill rotary drillhole with cement/bentonite grout or bentonite pellets (where standpipe or piezometer is not required).	m ³			
C49	Core box to be retained by client.	nr			
	<u>Rotary percussive drilling (Odex/Symmetrix)</u>	nr			
C50	Move rotary percussive drilling plant and equipment to the site of each drill hole and set up.	nr			
C51	Extra over item C50 for setting up on a slope of gradient greater than 20%.	nr			
C52	Rotary percussive drill at the specified diameter in any material between 0 and 10m depth.	m			
C53	As item C52 but between 10 and 20m depth.	m			
C54	As item C52 but between 20 and 30m depth.	m			
C55	As item C52 but between 30 and 40m depth.	m			
C56	As item C52 but between 40 and 50m depth.	m			
C57	Standing time for rotary percussive drilling plant, equipment and crew.	h			
C58	Backfill rotary percussive drillhole with cement/bentonite grout or bentonite pellets (where standpipe or piezometer is not installed).	m			

	Geobor S Rotary Drilling.				
C59	Move drilling plant and equipment to the site of each exploratory location and set up equipment (including recirculation tanks).	nr	8		
C60	Hand digging and CAT scan at Geobor drillhole location to confirm absence of utility ducts (maximum depth of 1.20m or lesser if ground is assessed as potentially unstable).	nr	8		
C61	Provision of biodegradable polymer gel (drilling fluid) for Geobor S coring.	sum	1		
C62	Break out surface obstructions where present at exploratory drillhole.	h	8		
C63	Standing time for GEobor S drilling plant, equipment and crew.	h	8		
	Geobor S Rotary Coring (to produce 102mm diameter cores).				
C64	Rotary openhole drilling without core recovery to install casing prior to Geobor coring (nominally 1.5m).	m			
C65	Rotary drilling with Geobor S equipment to recover cores of overburden material using polymer gel/mud drilling fluid in depth range 0 to 10m.	m	40		
C66	As item C65 but between 10 and 20m depth.	m	Rate Only		
C67	As item C65 but between 20 and 30m depth.	m			
C68	As item C65 but between 30 and 40m depth.	m			
C69	As item C65 but between 40 and 50m depth.	m			
C70	Rotary drilling using Geobor S equipment to recover cores in bedrock formation(s) using polymer gel/mud drilling fluid in depth range 0 to 10m.	m	40		
C71	As item C70 but between 10 and 20m depth.	m	40		
C72	As item C70 but between 20 and 30m depth.	m	15		
C73	As item C70 but between 30 and 40m depth.	m			
C74	As item C70 but between 40 and 50m depth.	m			
C75	Extra over items C64 to C74 for inclined Geobor S drillhole (maximum of 20 degrees from the vertical).	m			
	Geobor S Rotary Drilling – Additional Items				
C76	Backfill Geobor S drillhole with cement/bentonite grout or bentonite pellets (where standpipe or piezometer is not installed).	m ³			
C77	Provision of semi rigid core liner for items C64 – C75.	m	135		
C78	Provision of core boxes (2m of Geobor S core per box).	nr	68		
C79	Disposal of Geobor S Drilling supernatant flush returns (contained in the recirculation tanks) where permitted on site. Note disposal areas/locations to be recorded and photographed by contractor.	m ³			
C80	Disposal of Geobor S drilling supernatant flush returns (contained in the recirculation tanks to landfill by tanker where on site disposal is not permitted. Note tanker delivery dockets to be retained by the Contractor.	m ³	33.75		
	Reinstatement of Rotary Drillholes				
C81	Reinstatement of gravel hardstanding.	m ²			
C82	Reinstatement of asphalt/bituminous pavement.	m ²			
C83	Reinstatement of grass areas.	m ²			
C84	Provision of stock proof fencing to rotary drilling works area.	m ²			
C85	Disposal of excess or surplus inert arisings from rotary drilling operations (where standpipe or piezometer is not installed).	m ²			
	Subtotal Section C, carried to Summary				0

Bill D Pitting & Trenching					
Nr	Item Description	Unit	Quantity	Rate	Amount
D	Pitting & Trenching				
	Inspection Pits				
D1	Excavate inspection pit by hand to 1.2m depth.	nr	Inc. C60		
D2	Extra over item D1 for breaking out surface obstructions.	nr	Inc. C62		
	Trial pits and trenches (non paved areas)				
D3	Move equipment to the site of each trial pit or trench of note greater than 4.5m depth.	nr			
D4	Extra over item D3 for setting up on a slope of gradient greater than 20%.	nr			
D5	Extra over item D3 for trial pit or trench between 4.5 and 6m depth.	nr			
D6	Excavate trial out between existing ground level 3.0m depth.	m			
D7	As item D6 but between 3.0 and 4.5m depth.	m			
D8	As item D6 but between 4.5 and 6m depth.	m			
D9	Excavate trial trench between existing ground level and 3.0m depth.	m ³			
D10	As item D9 between 3.0 and 4.5m depth.	m ³			
D11	As item D9 between 4.5 and 6m depth.	m ³			
	Trial pits and trenches (paved areas)				
D12	Set up trail pit in road area to include erection of traffic management systems (works supervised by Engineer/Geologist with valid CSCS card for signing, lighting and guarding at roadworks).	nr			
D13	Set up at slit trench in road area to include erection of traffic management systems (works supervised by Engineer. Geologist with valid CSCS card for signing, lighting and guarding at roadworks).	nr			
D14	Saw cut paved areas in advance of works.	lin m			
D15	Breaking out hard material or surface obstructions.	h			
D16	Excavate trial pit in paved areas between ground level and 120m depth (works by either hand excavation or hand assisted machine excavation).	m depth			
D17	As D16 but depth range 1.2 to 3.0m.	lin m			
D18	Excavate slit trench in paved areas between ground level and 1.2m depth (works by either hand excavation or hand assisted machine excavation).	m ³			
D19	As item D18 but depth range 1.2 to 3.0m.	m ³			
D20	Standing time for excavation plant, equipment and crew for machine dug trial pit or trench.	h			
	Observation pits and trenches (Slit Trenches)				
D21	Move equipment to the site of each observation pit or trench of not greater than 4.5m depth.	nr	1		
D22	Extra over item D21 setting up on a slope of gradient greater than 20%.	nr			
D23	Extra over item D21 for trial pit or trench between 4.5 and 6m depth.	nr			
D24	Excavate observation pit between existing ground level and 3.0m depth.	m	1.2		
D25	As item D24 but between 3.0 and 4.5m depth.	m			

D26	As item D24 but between 4.5 and 6m depth.	m			
D27	Extra over item D24 for hand excavation.	m	1.2		
D28	Excavate observation trench between existing ground level and 3.0m depth.	m ³			
D29	As item D28 but between 3.0 and 4.5m depth.	m ³			
D30	As item D28 but between 4.5 and 6m depth.	m ³			
D31	Extra over item D28 for hand excavation.	m ³			
D32	Extra over items D24 to D26 for breaking out hard strata or obstructions.	h	1		
D33	Extra over items D28 to D30 for breaking out hard strata or observations.	h			
D34	Standing time for excavation plant, equipment and crew for machine dug observation pit or trench.	h	1		
D35	Standing time for excavation plant, equipment and crew for hand dug observation pit or slit trench.	h			
	<u>Daily provision of pitting crew and equipment.</u>				
D36	Provision of excavation plant equipment and crew for machine dug trial pits or trenches as directed by the Investigation Supervisor, maximum depth 3.0m.	day			
D37	As item D36 but between 3.0 and 4.5m depth.	day			
D38	As item D36 but between 4.5 and 6m depth.	day			
D39	Provision of excavation plant, equipment and crew for machine dug observation pit or trench as directed by the Investigation Supervisor (maximum depth 3.0m).	day			
D40	As item D39 between 3.0 and 4.5m depth.	day			
D41	As item D39 between 4.5 and 6m depth.	day			
D42	As item D39 but for hand excavation.	day			
D43	Extra over items D36-38 & D39-41 for breaking out hard strata or obstructions.	day			
	<u>General</u>				
D44	Bring pump to the position of each exploratory pit or trench.	nr	Rate Only		
D45	Pump water from pit or trench.	h	Rate Only		
D46	Extra over item D45 for temporary storage and disposal of contaminated groundwater from trial pit or trench.	provisional sum	Rate Only		
D47	Leave open observation pit or slit trench as instructed by Investigation Supervisor.	day			
D48	Leave open trial pit as instructed by Investigation Supervisor.	day			
	<u>Trial pit/slit trench backfill & reinstatement works</u>				
D49	Backfill trial pit or trench excavation with arisings/excavated materials.	nr			
D50	Reinstate grassed surface to include replacing of sod and reseeding.	nr	Rate Only		
D51	Backfill trenches and trial pits in paved areas with imported granular fill (CL 804 sub base).	m ³			
D52	Backfill trenches and trial pits in paved areas with lean mix concrete.	m ³			
D53	Reinstatement of asphalt/bituminous pavement.	m ²	5		
D54	Repair of road markings.	lin m			
D55	Disposal of excess or surplus inert arisings from trial pits or trenches (where imported granular fill or lean mix concrete is used as backfill).	m ³			
	Contract Specific additional bill items				
D56	Provision of a hydraulic breaker (for duration of contract)	nr	Rate Only		
D57	Excavate and backfill 0.50m by 0.50m foundation inspection pits by hand to a maximum depth of 1.2m bgl. Rate to include all costs associated with the foundation pit including breaking out surface obstructions, excavating the pit, recording the geometry, surveying, photographing, sketching the exposed foundations and backfilling the pit. Foundation sketched to be included with the relevant exploratory hole record within the factual report	mr	6		
D58	Extra over item D33 for extension of the foundation pit length to adequately expose the existing foundation edge.	m3	Rate Only		
D59	Extra over D49 to include reinstatement of equivalent material where hard surface is encountered at location of pit.	nr	6		
	Subtotal Section D, carried to Summary				0

Bill E Sampling and monitoring during intrusive investigation

Nr	Item Description	Unit	Quantity	Rate	Amount
E	Sampling and monitoring during intrusive investigation				
	<u>Samples for geotechnical analysis</u>				
E1	Jar sample	nr			
E2	Tub Sample.	nr	60		
E3	Bulk sample.	nr	60		
E4	Large bulk sample.	nr	Rate Only		
E5	Open tube thick walled sample (0-10m depth).	nr	16		
E6	Open tube thin walled sample (0-10m depth).	nr	Rate Only		
E7	Piston sample (0-10m)	nr	Rate Only		
E8.1	Extra over rate for item E5 in depth range 10 to 20m	sum	Rate Only		
E8.2	Extra over for Item E6 in depth range 10 to 20m.	sum			
E8.3	Extra over for item E7 in depth range 10 to 20m.	sum			
E9	Groundwater sample.	nr	Rate Only		
E10	Ground gas sample.	nr			
E11	Cut, prepare and protect core sub-sample.	nr			
	<u>Samples for environmental / contamination analysis</u>				
E12	Environmental / contamination sample for Suite E	nr			
E13	Environmental / contamination sample for Suite F	nr			
E14	Ground gas sample for Suite G	nr			
E15	Environmental / contamination sample for Suite H.	nr			
E16	Environmental / contamination sample for Suite I.	nr			
E17	Other specialist environmental / contamination sampling as specified by Investigation Supervisor (Suite J).	nr			
	Contract Specific additional bill items				
E18	Collection of geo-environmental soil samples to facilitate geo-environmental testing as detailed within the Technical Specification	nr	75		
	(Note sample rate includes provision of specialist containers, storage and transportation to testing laboratory).				
	Subtotal Section E, carried to Summary				0

Bill H In Situ Testing					
Nr	Item Description	Unit	Quantity	Rate	Amount
H	In situ testing				
H1.1	Standard penetration test in percussive borehole, depth range 0 to 10m.	nr	40 Rate Only		
H1.2	Standard penetration test in percussive borehole. Depth range 10 to 20m.	nr			
H1.3	Standard penetration test in percussive borehole, depth range 20 to 30m.	nr			
H1.4	Standard penetration test in percussive borehole, depth range 30 to 40m.	nr			
H2.1	Standard penetration test in rotary drillhole, depth range 0 to 10m.	nr			
H2.2	Standard penetration test in rotary drillhole, depth range 10 to 20m.	nr			
H2.3	Standard penetration test in rotary drillhole, depth range 20 to 30m.	nr			
H2.4	Standard penetration test in rotary drillhole, depth range 30 to 40m.	nr			
H3	In Situ Density Testing				
H3.1	Small pouring cylinder method.	nr	3 Rate Only Rate Only Rate Only		
H3.2	Large pouring cylinder method.	nr			
H3.3	Water replacement method	nr			
H3.4	Core cutter method.	nr			
H3.5	Nuclear gauge method.	day			
H4	California Bearing Ratio by plate bearing test by plunger method.	nr			
H4.1	California Bearing Ratio by TRL DCP method.	nr			
H5	Vane shear strength test in borehole.	nr			
H6	Penetration vane test, penetration from ground level.	nr			
H7	Hand penetrometer test (set of 3 readings).	nr			
H8	Hand shear vane test (set of 3 readings).	nr			
	<u>Other tests</u>				
H9	In situ geophysical techniques (resistivity and redox potential) for earthing analysis.	nr			
	<u>Permeability testing</u>				
H10	Set up, execute and dismantle variable head permeability test in cable percussive borehole.	hr			
H11	Set up, execute and dismantle constant head permeability test in cable percussive borehole.	hr			
H12	Set up, execute and dismantle variable head permeability test in rotary drillhole.	hr			
H13	Set up, execute and dismantle constant head permeability test in rotary drillhole.	hr			
H14	Set up, execute and dismantle variable head permeability test in standpipe or standpipe piezometer (rising or falling method).	hr			
H15	Set up and execute constant head permeability test in standpipe or piezometer.	hr			
H16	Set up and execute packer permeability test in rotary drillhole (0 to 10m depth).	hr			
H17	Set up and execute packer permeability test in rotary drillhole (10 to 20m depth).	hr			
	Note: rates for permeability tests in boreholes or rotary holes to include standing time rate for plant and equipment.				
	<u>Soil Infiltration Test (BRE Digest 365)</u>				
H18	Set up at each test location, evacuate trial hole and prepare test area.	nr			
H19	Backfill test hole with clean imported gravel where excavation sidewalls unstable.	m ³			
H20	Install 50mm standpipe in H18 to allow for monitoring of water levels.	nr			
H21	Carry out pre-soaking of test areas.	nr			
H22	Carry out soakway tests in accordance with BRE Digest 365 (3 cycles).	nr			
H23	Provision of water supply for infiltration testing.	sum			
H24	Protection and temporary fencing of works area as instructed by Investigation Supervisor.	nr			
H25	Calculation of infiltration rate for each test location.	nr			
	<u>Soil Infiltration Test (EPA Percolation Test)</u>				
H26	Set up at each location, excavate trial hole and prepare test area.	nr			
H27	Carry out infiltration tests in accordance with EPA guidelines (tests to be carried out by an approved Engineer / Geologist in accordance with EPA requirements).	nr			
H28	Provide report on percolation test (by Chartered Engineer or Professional Geologist).	sum			
	<u>Plate Bearing Test</u>				
H29	Set up at each plate test location to include kentledge/reaction weight for plate test using a 300mm diameter plate. Test in accordance with NRA SRW CL642.	nr			
H30	Set up at each plate test location to include all kentledge/reaction weight and carry out plate test using a 450mm diameter plate. Test in accordance with NRA SRW CL642.	nr			
H31	Set up at each plate test location to include kentledge/reaction weight and carry out plate test using a 600mm diameter plate. Test in accordance with NRA SRW CL642.	nr			
H32	Extra over items H29-H31 for test durations in excess of 2 hours per location.	hr			
H33	Provide plate test report with load steelement plot and calculation of Ks and CBR value to HD 25-26/10.	nr			
	<u>Other specialist in situ tests</u>				
H34	Reading of free product level in borehole using an interface probe.	nr			
H35	Provide contamination screening test kits (per sample).	nr			
H36	Carry out headspace testing on sample by FID or PID methods.	nr			
H37	Self-boring pressuremeter.	day			
H38	High Pressure dilatometer.	day			
H39	Menard pressuremeter.	day			
	Subtotal Section H , carried to Summary				0

Bill I Instrumentation

Nr	Item description	Unit	Quantity	Rate	Amount
I	Instrumentation				
	<u>Standpipes and Piezometers</u>				
I1	Backfill exploratory hole with cement / bentonite grout or bentonite pellets.	m	67.5		
I2	Provide and install 19mm casagrande piezometer tip.	nr	3		
I3	Provide and install sand cell to I2	m			
I4	Provide and install 19mm casing/piezometer plain pipe.	m	15		
I5	Provide and install bentonite seal to I4.	m			
I6	Provide and install proprietary slotted standpipe (50mm internal diameter).	m	9		
I7	Provide and install gravel pack to I6.	m	9		
I8	Provide and install proprietary casing / plain standpipe (50mm internal diameter).	m	58.5		
I9	Provide and install bentonite seals to I8.	m	58.5		
I10	Provide and install slotted proprietary standpipe (100mm internal diameter).	m			
I11	Provide and install gravel pack to I10.	m			
I12	Provide and install casing/plain standpipe (100mm internal diameter).	m			
I13	Provide and install bentonite seals to I12.	m			
I14	Provide and install end caps to I6 or I10.	nr			
I15	Provide and install quick release gas valve to I6 or I10.	nr	8		
I16	Provide and install protective cover (flush).	nr	8		
I17	Provide and install protective cover (raised).	nr			
I18	Extra over item I16 for heavy duty cover in pavements or highways.	nr			
I19	Supply and erect protective stock proof fencing around standpipe or piezometer installation.	nr			
I20	Supply and erect 1.5m high marker posts (3x1.5m).	nr			
	<u>Standpipe and piezometer development / purging</u>				
I21	Supply equipment and personnel to carry out purging.	sum	1		
I22	Develop standpipe or piezometer by purging (3 well volumes).	hr	8		
I23	As item I22 but by airlift pumping.	nr			
I24	As item I22 but by over pumping.	nr			
I25	As item I22 but by jetting.	nr			
I26	Disposal of purged water.	litre	Rate Only		
	<u>Inclinometer</u>				
I27	Supply and install inclinometer tubing in exploratory hole (not including forming/drilling of borehole).	m			
I28	Grout in place inclinometer in cable percussive or rotary drillhole.	m ³			
I29	Provision of calibrated inclinometer read out unit for monitoring during investigation.	per week			
I30	Carry out base set of inclinometer readings in inclinometer and process.	hr			
I31	Provide and install protective cover (flush).	nr			
	<u>Slip Indicator</u>				
I32	Provide and install protective cover (raised) slip indicators.	nr			
I33	Supply and install slip indicator in exploratory hole, including brass probe (not including forming/drilling or borehole).	m			
I34	Provide and install protective cover (flush).	nr			
I35	Provide and install protective headwork cover (upright).	nr			
	Subtotal Section I , carried to Summary				0

Bill J Installation Monitoring and Sampling (during fieldwork period)

Nr	Item description	Unit	Quantity	Rate	Amount
J	Installation Monitoring and Sampling (during fieldwork period)				
J1	Reading of water level in standpipe or standpipe piezometer.	nr	8		
J2	Ground gas measurement in standpipe.	nr	Rate Only		
J3	Provide Engineer or Geologist to take inclinometer readings as directed by Investigation Supervisor (per installation).	nr			
J4	Provide Engineer or Geologist to take measurement of slip indicator (per installation).	nr			
J5	Provide Engineer/Geologist to take water sample from standpipe or standpipe piezometer (rate not included purging or micro-purging).	nr			
J6	Extra over item J5 for purging or micro-purging in excess of 3 well volumes.	h			
J7	Provide Engineer/Geologist to recover ground gas sample from gas monitoring standpipe.	nr			
J8	Provide Engineer/Geologist to read free product level in standpipe using an interface probe.	nr			
	Installation Monitoring and Sampling (post fieldwork period).				
J9	Return visit to site following completion of fieldwork for field instrumentation.	nr	48		
J10	Extra over item J9 for groundwater measurements in standpipe or standpipe piezometer during return visit.	nr	48		
J11	Extra over item J9 for ground gas measurement in standpipe during return visit.	nr	48		
J12	Extra over item J9 for set of inclinometer readings per installation during return visit and report results.	nr			
J13	Extra over item J9 to check for ground slippage in slip indicator installation during return visit.	nr			
J14	Extra over item J9 for water sample from standpipe or standpipe piezometer during return visit to site, including purging 3 volumes or micro-purging up to 3.0 hours.	nr	8		
J15	Extra over item J14 for purging or micro-purging in excess of 3.0hrs	h	Rate Only		
J16	Extra over item J9 for ground gas sample from gas monitoring standpipe during return visit.	nr			
J17	Extra over item J9 for reading of free product level in standpipe using an interface probe during return visit.	nr			
J18	Provision of equipment to facilitate measuring free product in item J17.	sum			
J19	Provide and install data logger to measure groundwater levels in standpipes.	nr			
J20	Provide baro logger to monitor air pressure for item J19.	nr			
J21	Provide Engineer/Geologist to visit site to download and process data logger and baro logger.	day			
	<u>Surface water body sampling & testing</u>				
J22	Surface water body sample taken during fieldwork period.	day			
J23	Surface water body sample taken during return visit.	nr			
J24	Determination of dissolved oxygen, conductivity, ph and temperature of surface water body during fieldwork period.	nr			
J25	Determination of dissolved oxygen, conductivity, ph and temperature of surface water body during return visit.	nr			
	Subtotal Section J , carried to Summary				0

Bill K Geotechnical Laboratory Testing

Nr	Item description	Unit	Quantity	Rate	Amount
K	Geotechnical laboratory testing				
K1	<u>Classification</u>				
K1.1	Moisture content.	nr	36		
K1.2	Liquid and plastic limit.	nr	36		
K1.3	Volumetric shrinkage.	nr			
K1.4	Linear shrinkage.	nr			
K1.5	Density by linear measurement.	nr	6		
K1.6	Density by immersion in water or water displacement.	nr			
K1.7	Dry density and saturation moisture content for chalk.	nr			
K1.8	Particle density by gas jar or pycnometer.	nr	Rate Only		
K1.9	Particle size distribution by wet sieving.	nr	30		
K1.10	Particle size distribution by dry sieving.	nr			
K1.11	Sedimentation by pipette.	nr	30		
K1.12	Sedimentation by hydrometer.	nr	Rate Only		
K2	<u>Chemical and Electrochemical</u>				
K2.1	Organic matter content.	nr			
K2.2	Mass loss on ignition.	nr			
K2.3	Acid soluble sulphate content of soil sample.	nr	8		
K2.4	Water soluble sulphate content of soil sample (2:1 extract).	nr	8		
K2.5	Total sulphur content of soil sample.	nr			
K2.6	Sulphate content of groundwater sample.	nr			
K2.7	Carbonate content of groundwater sample.	nr			
K2.8	Chloride content of groundwater sample.	nr			
K2.9	Water soluble sulphate content of hardcore sample.	nr			
K2.10	Acid soluble sulphate content of hardcore sample (2:1 extract).	nr			
K2.11	Total sulphate content of hardcore sample.	nr			
K2.12	pH value.	nr	8		
K2.13	Resistivity.	nr			
K2.14	Redox potential.	nr			
K3	<u>Compaction Related</u>				
K3.1	Dry density/moisture content relationship using 2.5kg rammer (5pt).	nr			
K3.2	Dry density/moisture content relationship using 4.5kg rammer (5pt).	nr			
K3.3	Dry density/moisture content relationship using vibrating rammer (5pt)	nr			
K3.4	Extra over items K3.1 K3.2 and K3.3 for use of CBR mould.	nr			
K3.5	Moisture condition value at natural moisture content.	nr			
K3.6	Moisture condition value/moisture content relationship (5pt).	nr			
K3.7	Chalk crushing value.	nr			
K3.8	California bearing ratio on re-compacted disturbed sample.	nr			
K3.9	Extra over item K3.9 for soaking.	day			
K3.10	California bearing ratio on push-in mould sample (unsoaked).	nr			
K4	<u>Compressibility, permeability and durability</u>				
K4.1	One dimensional consolidation properties, test period 5 days.	nr	3		
K4.2	Extra over item K4.1 for test period in excess of 5 days.	day	Rate Only		
K4.3	Measurements of swelling pressure test period 2 days.	nr			
K4.4	Measurement of swelling, test period 2 days.	nr			
K4.5	Measurement of settlement on saturation, test period 1 day.	nr			
K4.6	Extra over items K4.3 to K4.5 for test period in excess of 2 days or 1 day.	day			
K4.7	Permeability by constant head method.	nr			
K4.8	Dispersibility by pinhole method.	nr			
K4.9	Dispersibility by crumb method.	nr			
K4.10	Dispersibility by dispersion method.	nr			
K4.11	Frost heave of soil.	nr			
K5	<u>Consolidation and permeability in hydraulic cells</u>				
K5.1	Consolidation properties of a 76mm diameter specimen in hydraulic consolidation cell, test period 4 days.	nr			
K5.2	As item K5.1 but using a 100 diameter specimen.	nr			
K5.3	As item K5.1 but using a 150mm diameter specimen.	nr			
K5.4	As item K5.1 but using a 250mm diameter specimen.	nr			
K5.5	Extra over items K5.1 – K5.4 for test period in excess of 4 days.	day			
K5.6	Permeability of a 76mm diameter specimen in hydraulic consolidation cell, test period 4 days.	nr			
K5.7	As item K5.6 but using a 100mm diameter specimen.	nr			
K5.8	As item K5.6 but using a 150mm diameter specimen.	nr			
K5.9	As item K5.6 but using a 250mm diameter specimen.	nr			
K5.10	Extra over items K5.6 – K5.9 for test period in excess of 4 days.	day			
K5.11	Isotropic consolidation properties in a triaxial cell, test period 4 days.	nr			
K5.12	Extra over item K5.11 for test periods in excess of 4 days.	day			
K5.13	Permeability in a triaxial cell, test period 4 days.	nr			
K5.14	Extra over item K5.13 for test period in excess of 4 days.	day			
K6	<u>Shear strength (total stress)</u>				
K6.1	Shear strength by laboratory vane method (set of 3)	nr			
K6.2	Shear strength by hand vane (set of 3)	nr			
K6.3	Shear strength by hand penetrometer (set of 3)	nr			
K6.4	Shear strength of a set of three 60mm x 60mm square specimens by direct shear, test duration not exceeding 1 day per specimen.	nr			
K6.5	Extra over Item K6.4 for test durations in excess of 1 day per specimen.	sp. day			
K6.6	Shear strength of a single 300mm x 300mm square specimen by direct shear, test duration not exceeding 1 day.	nr			
K6.7	Extra over item K6.6 for test durations in excess of 1 day.	day			
K6.8	Residual shear strength of a set of three 60mmx60mm square specimens by direct shear, test duration not exceeding 4 days per specimen.	nr			
K6.9	Extra over item K6.8 for test durations in excess of 4 days per specimen.	sp. Day			
K6.10	Residual shear strength of a 300mm square specimen by direct shear, test duration not exceeding 4 days.	nr			
K6.11	Extra over item K6.10 for test duration in excess day of 4 days.	day			
K6.12	Residual shear strength using the small ring shear apparatus at three normal pressures, test duration not exceeding 4 days.	nr			

K6.13	Extra over item K6.12 for test duration in excess of 4 days.	day			
K6.14	Unconfined compressive strength of 38mm diameter specimen.	nr			
K6.15	Undrained shear strength of a set of three 38mm diameter specimens in triaxial compression without the measurement of pore pressure.	nr	Rate Only		
K6.16	Undrained strength of a single 100mm diameter specimen in triaxial compression without the measurement of pore pressure.	nr	6		
K6.17	Undrained shear strength of single 100mm diameter specimen in triaxial compression with multi stage loading and without measurement of pore pressure.	nr			
K7	<u>Shear strength (effective stress)</u>				
K7.1	Consolidated undrained triaxial compression test with measurement of pore pressure (set of 30mm specimens), test duration not exceeding 4 days per specimen.	nr			
K7.2	As K7.1 but single stage or multi stage test using 100mm diameter specimen.	nr	3		
K7.3	Consolidated drained triaxial compression test with measurement of volume change (set of three 38mm specimens), test duration not exceeding 4 days per specimen.	nr	Rate Only		
K7.4	As item K7.3 but single stage or multi stage test using 100mm diameter specimen, test duration not exceeding 4 days.	nr	3		
K7.5	Extra over items K7.1 and K7.3 for test duration in excess of 4 days per specimen.	sp. day	Rate Only		
K7.6	Extra over items K7.2 and K7.4 for test duration in excess of 4 days.	day	6		
K8	<u>Rock and aggregate testing</u>				
K8.1	Natural water content of rock sample.	nr	Rate Only		
K8.2	Porosity/density using saturation and calliper techniques.	nr			
K8.3	Porosity/density using saturation and buoyancy.	nr			
K8.4	Slake durability.	nr			
K8.5	Water absorption.	nr			
K8.6	Magnesium sulphate soundness.	nr			
K8.7	Flakiness index.	nr			
K8.8	Los Angeles abrasion.	nr			
K8.9	Aggregate impact value.	nr			
K8.10	Aggregate crushing value.	nr			
K8.11	Polished stone value.	nr			
K8.12	Aggregate frost heave.	nr			
K8.13	Resistance to freezing and thawing.	nr			
K8.14	Uniaxial compressive strength.	nr	16		
K8.15	Deformability in uniaxial compression.	nr	8		
K8.16	Indirect tensile strength by Brazilian test.	nr			
K8.17	Triaxial compression without measurements of pore water pressure.	nr			
K8.18	Point load strength index on rock core (axial or diametral).	nr	40		
K8.19	Point load strength index on irregular lump sample (set of ten individual determinations).	nr	8		
K8.20	Swelling pressure test.	nr			
K8.21	Direct shear strength of single specimen.	nr			
	<u>Special tests on rock core or trial pit samples to assess potential for pyrite induced expansion or swelling.</u>				
K9.2	Chemical analysis on rock core or bulk sample (test methods to RL 447 and test suite to include total sulphur, acid soluble sulphate and water soluble sulphate and derivation of oxidisable sulphide and equivalent pyrite content).		16		
	Subtotal Section K, carried to Summary				0

Bill L Geoenvironmental Laboratory Testing

Nr	Item description	Unit	Quantity	Rate	Amount
L	Geoenvironmental Laboratory Testing				
	(Contamination testing of soil, groundwater, gas and fill material).				
L1	Test Suite E				
L2	Test Suite F	nr			
L3	Test Suite G	nr			
L4	Test Suite H	nr			
L5	Test Suite I	nr			
L6	Test Suite J	nr			
	Contract Specific additional bill items				
L7.1	MML Soil Suite (as per Appendix C of the specification)	nr	30		
L7.2	MML Leachate Suite (as per Appendix C of the specification)	nr	15		
L7.3	MML Groundwater Suite (as per Appendix C of the specification)	nr	16		
L7.4	MML Speciated VOC Suite (as per Appendix C of the specification)	nr	Rate Only		
L7.5	MML Speciated SVOC Suite (as per Appendix C of the specification)	nr	Rate Only		
L7.6	MML Full WAC Suite (as per Table B.6, Appendix B of the specification)	nr	10		
	Subtotal Section L, carried to Summary				0

Summary of Bill of Quantities

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A General Items, provisional services and additional items	0
B Percussion Boring	Not Used
C Rotary Boring	0
D Pitting & Trenching	0
E Sampling and monitoring during intrusive investigation	0
F Probing and Cone Penetration Testing	Not Used
G Geophysical Surveying	Not Used
H In Situ Testing	0
I Instrumentation	0
J Installation Monitoring and Sampling (during fieldwork period)	0
K Geotechnical Laboratory Testing	0
L Geoenvironmental Laboratory Testing	0
Total	0

Midlands Regional Hospital, Portlaoise
New Ward Block Technical Specification for Ground Investigations Package 2
Bill of Quantities

Summary Scope
 Geophysical Survey lines for Electrical Resistivity Tomography (ERT) and Seismic Refraction (SR) to profile the ground and identify potential karstic features.

Bill A General Items, provisional services and additional items					
Nr.	Item Description	Unit	Quantity	Rate	Amount
A	General Items and Provisional Services				
A1	Offices and stores for the Contractor	sum	1		
A2.1	Establish on site cable percussion ('shell/auger') boring plant and equipment for a Green Category site	sum			
A2.2	Establish on site rotary drilling plant and equipment for a Green Category site.	sum			
A2.3	Establish on site Geobor S rotary drilling plant and equipment for a Green Category site.	sum			
A2.4	Establish on site trial pitting and trenching plant and equipment for a Green Category site.	sum			
A2.5	Establish on site in situ test and sampling equipment for a Green Category site.	sum			
A2.6	Establish on site cone penetration testing (CPT) plant and equipment for a Green category site.	sum			
A2.7	Establish on site dynamic sampling and probing plant and equipment for a Green Category site.	sum			
A2.8	Establish on site geophysical survey equipment for a Green Category site.	sum	1		
A2.9	Establish instrumentation equipment on site as required for Green Category site.	sum			
A3.1	Extra over item A2.1 –A2.9 for yellow category site.	sum	1		
A3.2	As Item A3.1 but for Red Category Site.	sum			
A4.1	Maintain on site all site safety equipment for a Yellow Category site.	per week	1		
A4.2	As Item A4.1 but for Red Category site	per week			
A5	Decontamination of equipment during and at the end of fieldworks for a Yellow Category site.	sum	1		
A5.1	As item A5 but for Red Category site.	sum			
A6	Appropriate storage, transport and off-site disposal of excess contaminated arisings from borehole, trial pit or slit trench to EPA regulated landfill site (includes any PPE equipment but excludes laboratory testing on suspected contaminated materials). Note item to be re-measured with delivery dockets and records maintained by the Contractor.	provisional sum			
A6.1	Contractors uplift on item A6.	%			
A7	Professional attendance to meet the contract requirements detailed in Technical Specification S1.8.2. Costs to include for any specialist training to facilitate delivery of the works in accordance with the GI Contract.	sum	1		
A7.1	Provide Technician.	per day			
A7.2	Provide Engineer/Geologist (as per item 2.3 of Specification).	per day			
A7.3	Provide Chartered Engineer/Professional Geologist (as per item 2.3 of specification).	per day			
A7.4	Provide Chartered Engineer/Professional Geologist (+10 yr experience post charter).	per day			
A7.5	Provide Chartered Engineer/Professional Geologist (+20 yr experience post charter).	per day			
A8	Set out location at each exploratory hole or point.	nr	13		
A8.1	Establish the location and elevation (X, Y, Z) of ground at each 'as-built' exploratory hole or point.	nr	13		
A9	Preparation of Health and Safety documentation and Safety Risk Assessment.	sum	1		
A10	Facilities for the Investigation Supervisor .	per week	Rate Only		
A11	Vehicle(s) for the Investigation Supervisor.	vehicle week			
A11.1	Provision of fuel and tolls for A11 (to be reimbursed under the contract).	provisional sum			
A11.2	Contractors Uplift on item A11 and 11.1.	% Uplift			
A12	Provision of phone and internet for the Investigation Supervisor (to be reimbursed under the contract).	provisional sum			
A12.1	Contractors Uplift on item A12.	% Uplift			
A13	Deliver selected cores and samples to specified Client address.	provisional sum			
A14	Special additional testing and sampling required by Investigation Supervisor.	provisional sum			
A15	Traffic safety and management to include preparation of traffic management TM drawings for investigations on roads or pavement areas.	provisional sum	1		
A16	Provision of road opening licences and road damages bond.	provisional sum			
A17	Contractors Uplift on items A15 and A16.	% Uplift			
A18	One master copy of Desk Study Report.	sum			
A18.1	Additional hard copy of Desk Study Report.	nr			
A18.2	Electronic copy of Desk Study Report (PDF).	sum			
A19	One master copy of Ground Investigation Report (Factual).	sum			
A19.1	Additional copy of Ground Investigation Report (Factual).	nr			
A19.2	Electronic copy of Ground Investigation Report.	sum			
A20	One master copy of Geophysical Report.	sum	1		
A20.1	Additional hard copy of Geophysical Report.	nr			
A20.2	Electronic Copy of Geophysical Report (PDF).	sum			
A21	One master copy of Geotechnical Interpretative Report.	sum			
A21.1	Additional copy of Geotechnical Interpretative Report.	nr			
A21.2	Electronic copy of Geotechnical Interpretative Report.	sum			

A22	Digital field/engineering logs in AGS transfer format.	sum			
A23	Digital laboratory test data in AGS transfer files.	sum			
A24	Digital copy of trial pit slit trench or core photographs.	nr			
A25	Storage of samples (geotechnical or environmental) following completion of fieldworks.	wk			
A26	Storage of core boxes following completion of fieldworks.	wk			
A27	Provision of water supply for the fieldworks.	sum			
A28	Provision of Insurances.	sum			
A29	Provision of performance bond.	sum			
A30	Perform the role of PSCS.	sum	1		
A31	Contractor liaison with external bodies to obtain road opening licence, foreshore licence for marine investigations etc. (Specify).	sum			
Contract Specific additional bill items					
A32	Provision on appropriate security measures including safety fencing, dust screens, acoustic barriers etc.	sum	1		
A33	Pre- and Post-fieldwork condition survey of the site	sum	1		
A34	Procure necessary utilities/service information for the GI Contract	sum	1		
A35	PAS 128 Survey at Geophysical Survey Locations	sum	1		
Subtotal Section A, carried to Summary					0

Bill G Geophysical Surveying					
Nr	Item Description	Unit	Quantity	Rate	Amount
G	Geophysical Surveying				
	<u>Land geophysical surveying</u>				
G1	Conduct and process ground penetrating radar (GPR) profiles.	lin m			
G2	Conduct and process electromagnetic conductivity (EMC) Profiles.	lin m			
G3	Conduct and process electrical resistivity tomography (ERT) profiles.	lin m	1271		
G4	Conduct and process seismic refraction spreads (P or S wave).	lin m	1271		
G5	Conduct and process surface wave spreads (1D or 2D MASW).	lin m			
	<u>Borehole geophysical surveying</u>				
G6	Establish down hole geophysical logging equipment and personnel to the site of each exploratory hole and set up at each location.	sum			
G7	Conduct and process down the hole calliper, natural gamma, resistivity, sonic, fluid, temperature, conductivity and fluid flow logging.	m			
G8	Conduct and process cross-hole seismic readings at specified intervals.	nr			
	<u>Marine (overwater) geophysical surveying</u>				
G9	Establish geophysical personnel and field equipment and demobilisation on completion.	sum			
G10	Conduct and process echo sounding, side-scan sonar, magnetic, sub-bottom profile surveying.	day			
	Subtotal Section G, carried to Summary				

Summary of Bill of Quantities

	€
A General Items, provisional services and additional items	0
B Percussion Boring	Not Used
C Rotary Boring	Not Used
D Pitting & Trenching	Not Used
E Sampling and monitoring during intrusive investigation	Not Used
F Probing and Cone Penetration Testing	Not Used
G Geophysical Surveying	0
H In Situ Testing	Not Used
I Instrumentation	Not Used
J Installation Monitoring and Sampling (during fieldwork period)	Not Used
K Geotechnical Laboratory Testing	Not Used
L Geoenvironmental Laboratory Testing	Not Used
Total	0

Midlands Regional Hospital, Portlaoise
New Ward Block Technical Specification for Ground Investigations Package 3
Bill of Quantities

Summary Scope

Hand Dug pit to a maximum depth of 1.2m bgl for retrieval of geo-environmental soil samples.

Machine excavated trial pits to a maximum depth of 4.5m bgl (using tracked excavator / JCB to achieve scheduled depth) with retrieval of soil, potentially rock (if encountered at shallow depth, i.e. within 2m of ground surface) and groundwater samples for laboratory testing (geotechnical and geo-environmental). In-situ testing (hand-vanes to be undertaken as detailed in Schedule 2).

Dynamic Cone Penetrometer tests (TRL type) to a maximum of 3.0m bgl to gain CBR values to inform pavement design.

Infiltration test to be undertaken at a depth of 1.0m bgl to inform drainage design of the proposed car

Bill A General Items, provisional services and additional items					
Nr.	Item Description	Unit	Quantity	Rate	Amount
A	General Items and Provisional Services				
A1	Offices and stores for the Contractor	sum	1		
A2.1	Establish on site cable percussion ('shell/auger') boring plant and equipment for a Green Category site	sum			
A2.2	Establish on site rotary drilling plant and equipment for a Green Category site.	sum			
A2.3	Establish on site Geobor S rotary drilling plant and equipment for a Green Category site.	sum			
A2.4	Establish on site trial pitting and trenching plant and equipment for a Green Category site.	sum	1		
A2.5	Establish on site in situ test and sampling equipment for a Green Category site.	sum	1		
A2.6	Establish on site cone penetration testing (CPT) plant and equipment for a Green category site.	sum			
A2.7	Establish on site dynamic sampling and probing plant and equipment for a Green Category site.	sum			
A2.8	Establish on site geophysical survey equipment for a Green Category site.	sum			
A2.9	Establish instrumentation equipment on site as required for Green Category site.	sum			
A3.1	Extra over item A2.1 –A2.9 for yellow category site.	sum	1		
A3.2	As Item A3.1 but for Red Category Site.	sum			
A4.1	Maintain on site all site safety equipment for a Yellow Category site.	per week	1		
A4.2	As Item A4.1 but for Red Category site	per week			
A5	Decontamination of equipment during and at the end of fieldworks for a Yellow Category site.	sum	1		
A5.1	As item A5 but for Red Category site.	sum			
A6	Appropriate storage, transport and off-site disposal of excess contaminated arisings from borehole, trial pit or slit trench to EPA regulated landfill site (includes any PPE equipment but excludes laboratory testing on suspected contaminated materials). Note item to be re-measured with delivery dockets and records maintained by the Contractor.	provisional sum			
A6.1	Contractors uplift on item A6.	%			
A7	Professional attendance to meet the contract requirements detailed in Technical Specification S1.8.2. Costs to include for any specialist training to facilitate delivery of the works in accordance with the GI Contract.	sum	1		
A7.1	Provide Technician.	per day			
A7.2	Provide Engineer/Geologist (as per item 2.3 of Specification).	per day			
A7.3	Provide Chartered Engineer/Professional Geologist (as per item 2.3 of specification).	per day			
A7.4	Provide Chartered Engineer/Professional Geologist (+10 yr experience post charter).	per day			
A7.5	Provide Chartered Engineer/Professional Geologist (+20 yr experience post charter).	per day			
A8	Set out location at each exploratory hole or point.	nr	16		
A8.1	Establish the location and elevation (X, Y, Z) of ground at each 'as-built' exploratory hole or point.	nr	16		
A9	Preparation of Health and Safety documentation and Safety Risk Assessment.	sum	1		
A10	Facilities for the Investigation Supervisor .	per week	Rate Only		
A11	Vehicle(s) for the Investigation Supervisor.	vehicle week			
A11.1	Provision of fuel and tolls for A11 (to be reimbursed under the contract).	provisional sum			
A11.2	Contractors Uplift on item A11 and 11.1.	% Uplift			
A12	Provision of phone and internet for the Investigation Supervisor (to be reimbursed under the contract).	provisional sum			
A12.1	Contractors Uplift on item A12.	% Uplift			
A13	Deliver selected cores and samples to specified Client address.	provisional sum			

A14	Special additional testing and sampling required by Investigation Supervisor.	provisional sum			
A15	Traffic safety and management to include preparation of traffic management drawings for investigations on roads or pavement areas.	provisional sum			
A16	Provision of road opening licences and road damages bond.	provisional sum			
A17	Contractors Uplift on items A15 and A16.	% Uplift			
A18	One master copy of Desk Study Report.	sum			
A18.1	Additional hard copy of Desk Study Report.	nr			
A18.2	Electronic copy of Desk Study Report (PDF).	sum			
A19	One master copy of Ground Investigation Report (Factual).	sum	1		
A19.1	Additional copy of Ground Investigation Report (Factual).	nr			
A19.2	Electronic copy of Ground Investigation Report.	sum			
A20	One master copy of Geophysical Report.	sum			
A20.1	Additional hard copy of Geophysical Report.	nr			
A20.2	Electronic Copy of Geophysical Report (PDF).	sum			
A21	One master copy of Geotechnical Interpretative Report.	sum	1		
A21.1	Additional copy of Geotechnical Interpretative Report.	nr			
A21.2	Electronic copy of Geotechnical Interpretative Report.	sum			
A22	Digital field/engineering logs in AGS transfer format.	sum	1		
A23	Digital laboratory test data in AGS transfer files.	sum	1		
A24	Digital copy of trial pit slit trench or core photographs.	nr	1		
A25	Storage of samples (geotechnical or environmental) following completion of fieldworks.	wk			
A26	Storage of core boxes following completion of fieldworks.	wk			
A27	Provision of water supply for the fieldworks.	sum			
A28	Provision of Insurances.	sum			
A29	Provision of performance bond.	sum			
A30	Perform the role of PSCS.	sum	1		
A31	Contractor liaison with external bodies to obtain road opening licence, foreshore licence for marine investigations etc. (Specify).	sum			
Contract Specific additional bill items					
A32	Provision on appropriate security measures including safety fencing, dust screens, acoustic barriers etc.	sum	Rate Only		
A33	Pre- and Post-fieldwork condition survey of the site	sum	1		
A34	One Master copy of the Generic Quantitative Risk Assessment	sum	1		
A35	Procure necessary utilities/service information for the GI Contract	sum	1		
A36	PAS 128 Survey at Exploratory hole Locations	sum	1		
Subtotal Section A, carried to Summary					0
Bill D Pitting & Trenching					
Nr	Item Description	Unit	Quantity	Rate	Amount
D	Pitting & Trenching				
	<u>Inspection Pits / Hand Dug Pits</u>				
D1	Excavate inspection pit by hand to 1.2m depth.	nr	1		
D2	Extra over item D1 for breaking out surface obstructions.	nr	1		
	<u>Trial pits and trenches (non paved areas)</u>				
D3	Move equipment to the site of each trial pit or trench of note greater than 4.5m depth.	nr	5		
D4	Extra over item D3 for setting up on a slope of gradient greater than 20%.	nr	Rate Only		
D5	Extra over item D3 for trial pit or trench between 4.5 and 6m depth.	nr			
D6	Excavate trial out between existing ground level 3.0m depth.	m	15		
D7	As item D6 but between 3.0 and 4.5m depth.	m	7.5		
D8	As item D6 but between 4.5 and 6m depth.	m			
D9	Excavate trial trench between existing ground level and 3.0m depth.	m³			
D10	As item D9 between 3.0 and 4.5m depth.	m³			
D11	As item D9 between 4.5 and 6m depth.	m³			
	<u>Trial pits and trenches (paved areas)</u>				
D12	Set up trial pit in road area to include erection of traffic management systems (works supervised by Engineer/Geologist with valid CSCS card for signing, lighting and guarding at roadworks).	nr			
D13	Set up at slit trench in road area to include erection of traffic management systems (works supervised by Engineer. Geologist with valid CSCS card for signing, lighting and guarding at roadworks).	nr			
D14	Saw cut paved areas in advance of works.	lin m			
D15	Breaking out hard material or surface obstructions.	h			
D16	Excavate trial pit in paved areas between ground level and 120m depth (works by either hand excavation or hand assisted machine excavation).	m depth			
D17	As D16 but depth range 1.2 to 3.0m.	lin m			
D18	Excavate slit trench in paved areas between ground level and 1.2m depth (works by either hand excavation or hand assisted machine excavation).	m³			
D19	As item D18 but depth range 1.2 to 3.0m.	m³			
D20	Standing time for excavation plant, equipment and crew for machine dug trial pit or trench.	h			
	<u>Observation pits and trenches</u>				
D21	Move equipment to the site of each observation pit or trench of not greater than 4.5m depth.	nr			
D22	Extra over item D21 setting up on a slope of gradient greater than 20%.	nr			
D23	Extra over item D21 for trial pit or trench between 4.5 and 6m depth.	nr			
D24	Excavate observation pit between existing ground level and 3.0m depth.	m			
D25	As item D24 but between 3.0 and 4.5m depth.	m			
D26	As item D24 but between 4.5 and 6m depth.	m			
D27	Extra over item D24 for hand excavation.	m			

D28	Excavate observation trench between existing ground level and 3.0m depth.	m³			
D29	As item D28 but between 3.0 and 4.5m depth.	m³			
D30	As item D28 but between 4.5 and 6m depth.	m³			
D31	Extra over item D28 for hand excavation.	m³			
D32	Extra over items D24 to D26 for breaking out hard strata or obstructions.	h			
D33	Extra over items D28 to D30 for breaking out hard strata or observations.	h			
D34	Standing time for excavation plant, equipment and crew for machine dug observation pit or trench.	h			
D35	Standing time for excavation plant, equipment and crew for hand dug observation pit or slit trench.	h			
	<u>Daily provision of pitting crew and equipment.</u>				
D36	Provision of excavation plant equipment and crew for machine dug trial pits or trenches as directed by the Investigation Supervisor, maximum depth 3.0m.	day			
D37	As item D36 but between 3.0 and 4.5m depth.	day			
D38	As item D36 but between 4.5 and 6m depth.	day			
D39	Provision of excavation plant, equipment and crew for machine dug observation pit or trench as directed by the Investigation Supervisor (maximum depth 3.0m).	day			
D40	As item D39 between 3.0 and 4.5m depth.	day			
D41	As item D39 between 4.5 and 6m depth.	day			
D42	As item D39 but for hand excavation.	day			
D43	Extra over items D36-38 & D39-41 for breaking out hard strata or obstructions.	day			
	<u>General</u>				
D44	Bring pump to the position of each exploratory pit or trench.	nr			
D45	Pump water from pit or trench.	h			
D46	Extra over item D45 for temporary storage and disposal of contaminated groundwater from trial pit or trench.	provisional sum			
D47	Leave open observation pit or slit trench as instructed by Investigation Supervisor.	day			
D48	Leave open trial pit as instructed by Investigation Supervisor.	day			
	<u>Trial pit/slit trench backfill & reinstatement works</u>				
D49	Backfill trial pit or trench excavation with arisings/excavated materials.	nr	5		
D50	Reinstate grassed surface to include replacing of sod and reseeding.	nr	5		
D51	Backfill trenches and trial pits in paved areas with imported granular fill (CL 804 sub base).	m³			
D52	Backfill trenches and trial pits in paved areas with lean mix concrete.	m³			
D53	Reinstatement of asphalt/bituminous pavement.	m²			
D54	Repair of road markings.	lin m			
D55	Disposal of excess or surplus inert arisings from trial pits or trenches (where imported granular fill or lean mix concrete is used as backfill).	m³			
	Contract Specific additional bill items				
D56	Provision of a hydraulic breaker (for duration of contract)	nr			
	Subtotal Section D, carried to Summary				0

Bill E Sampling and monitoring during intrusive investigation

Nr	Item Description	Unit	Quantity	Rate	Amount
E	Sampling and monitoring during intrusive investigation				
	<u>Samples for geotechnical analysis</u>				
E1	Jar sample	nr			
E2	Tub Sample.	nr	27		0
E3	Bulk sample.	nr	27		0
E4	Large bulk sample.	nr	Rate Only		
E5	Open tube thick walled sample (0-10m depth).	nr			
E6	Open tube think walled sample (0-10m depth).	nr			
E7	Piston sample (0-10m)	nr			
E8.1	Extra over rate for item E5 in depth range 10 to 20m	sum			
E8.2	Extra over for Item E6 in depth range 10 to 20m.	sum			
E8.3	Extra over for item E7 in depth range 10 to 20m.	sum			
E9	Groundwater sample.	nr	Rate Only		
E10	Ground gas sample.	nr			
E11	Cut, prepare and protect core sub-sample.	nr			
	<u>Samples for environmental / contamination analysis</u>				
E12	Environmental / contamination sample for Suite E	nr			
E13	Environmental / contamination sample for Suite F	nr			
E14	Ground gas sample for Suite G	nr			
E15	Environmental / contamination sample for Suite H.	nr			
E16	Environmental / contamination sample for Suite I.	nr			
E17	Other specialist environmental / contamination sampling as specified by Investigation Supervisor (Suite J).	nr			
	Contract Specific additional bill items				
E18	Collection of geo-environmental soil samples to facilitate geo-environmental testing as detailed within the Technical Specification	nr	33		
	(Note sample rate includes provision of specialist containers, storage and transportation to testing laboratory).				
	Subtotal Section E, carried to Summary				0

Bill F Probing and Cone Penetration Testing

Nr	Item Description	Unit	Quantity	Rate	Amount
F	Probing and Cone Penetration Testing				
	<u>Dynamic Probing (DPH)</u>				
F1	Bring dynamic probe equipment (DCP TRL Type) to the site of each test location.	nr	9		
F2	Extra over item F1 for setting up on a slope of gradient greater than 20%.	nr			
F3	Carry out dynamic probe test from 0 to 5m depth.	m	27		
F4	As item F3 but between 5 and 10m depth.	m	rate only		
F5	As item F3 but between 10 and 15m depth.	m	rate only		
F6	Standing time for dynamic probe test equipment and crew.	h	9		
F7	Provision of dynamic probing equipment and crew for probing at locations as specified by the Investigation Supervisor (0-15m depth).	day			
	<u>Cone penetration testing</u>				
F8	Bring static cone penetration test equipment to the site of each test location.	nr			
F9	Extra over item F8 for setting up on a slope of gradient greater than 20%.	nr			
F10	Carry out static cone penetration test measuring both cone and sleeve resistance from existing ground level to 10m depth.	m			
F11	As item F10 but between 10 and 20m depth.	m			
F12	As item F10 but between 20 and 30m depth.	m			
F13	As item F10 but between 30 and 40m depth.	m			
F14	Extra over items F10 to F13 for use of piezocone.	m			
F15	Extra over items F10 to F13 for interpretation of CPT/CPTU data.	m			
F16	Carry out dissipation test up to 1 hour duration.	nr			
F17	Extra over item F16 for test duration exceeding 1 hour.	h			
F18	Standing time for static cone penetration test equipment and crew.	h			
F19	Extra over items F10 to F13 for use of seismic cone.	m			
F20	Carry out seismic cone test.	nr			
F21	Extra over item F20 for interpretation of seismic cone data.	nr			
F22	Standing time for seismic cone test equipment and crew.	h			
	Subtotal Section F , carried to Summary				0

Bill H In Situ Testing

Nr	Item Description	Unit	Quantity	Rate	Amount
H	In situ testing				
H1.1	Standard penetration test in percussive borehole, depth range 0 to 10m.	nr			
H1.2	Standard penetration test in percussive borehole. Depth range 10 to 20m.	nr			
H1.3	Standard penetration test in percussive borehole, depth range 20 to 30m.	nr			
H1.4	Standard penetration test in percussive borehole, depth range 30 to 40m.	nr			
H2.1	Standard penetration test in rotary drillhole, depth range 0 to 10m.	nr			
H2.2	Standard penetration test in rotary drillhole, depth range 10 to 20m.	nr			
H2.3	Standard penetration test in rotary drillhole, depth range 20 to 30m.	nr			
H2.4	Standard penetration test in rotary drillhole, depth range 30 to 40m.	nr			
H3	<u>In Situ Density Testing</u>				
H3.1	Small pouring cylinder method.	nr			
H3.2	Large pouring cylinder method.	nr			
H3.3	Water replacement method	nr			
H3.4	Core cutter method.	nr			
H3.5	Nuclear gauge method.	day			
H4	California Bearing Ratio by plate bearing test by plunger method.	nr			
H4.1	California Bearing Ratio by TRL DCP method.	nr			
H5	Vane shear strength test in borehole.	nr			
H6	Penetration vane test, penetration from ground level.	nr			
H7	Hand penetrometer test (set of 3 readings).	nr			
H8	Hand shear vane test (set of 3 readings).	nr	10		
	<u>Other tests</u>				
H9	In situ geophysical techniques (resistivity and redox potential) for earthing analysis.	nr			
	<u>Permeability testing</u>				
H10	Set up, execute and dismantle variable head permeability test in cable percussive borehole.	hr			
H11	Set up, execute and dismantle constant head permeability test in cable percussive borehole.	hr			
H12	Set up, execute and dismantle variable head permeability test in rotary drillhole.	hr			
H13	Set up, execute and dismantle constant head permeability test in rotary drillhole.	hr			
H14	Set up, execute and dismantle variable head permeability test in standpipe or standpipe piezometer (rising or falling method).	hr			
H15	Set up and execute constant head permeability test in standpipe or piezometer.	hr			
H16	Set up and execute packer permeability test in rotary drillhole (0 to 10m depth).	hr			
H17	Set up and execute packer permeability test in rotary drillhole (10 to 20m depth).	hr			
	Note: rates for permeability tests in boreholes or rotary holes to include standing time rate for plant and equipment.				
	<u>Soil Infiltration Test (BRE Digest 365)</u>				
H18	Set up at each test location, evacuate trial hole and prepare test area.	nr	1		
H19	Backfill test hole with clean imported gravel where excavation sidewalls unstable.	m³	Rate Only		
H20	Install 50mm standpipe in H18 to allow for monitoring of water levels.	nr			
H21	Carry out pre-soaking of test areas.	nr			
H22	Carry out soakway tests in accordance with BRE Digest 365 (3 cycles).	nr	1		
H23	Provision of water supply for infiltration testing.	sum	1		
H24	Protection and temporary fencing of works area as instructed by Investigation Supervisor.	nr	Rate Only		
H25	Calculation of infiltration rate for each test location.	nr	1		
	<u>Soil Infiltration Test (EPA Percolation Test)</u>				
H26	Set up at each location, excavate trial hole and prepare test area.	nr			
H27	Carry out infiltration tests in accordance with EPA guidelines (tests to be carried out by an approved Engineer / Geologist in accordance with EPA requirements).	nr			
H28	Provide report on percolation test (by Chartered Engineer or Professional Geologist).	sum			
	<u>Plate Bearing Test</u>				
H29	Set up at each plate test location to include kentledge/reaction weight for plate test using a 300mm diameter plate. Test in accordance with NRA SRW CL642.	nr			
H30	Set up at each plate test location to include all kentledge/reaction weight and carry out plate test using a 450mm diameter plate. Test in accordance with NRA SRW CL642.	nr			
H31	Set up at each plate test location to include kentledge/reaction weight and carry out plate test using a 600mm diameter plate. Test in accordance with NRA SRW CL642.	nr			
H32	Extra over items H29-H31 for test durations in excess of 2 hours per location.	hr			
H33	Provide plate test report with load stelement plot and calculation of Ks and CBR value to HD 25-26/10.	nr			
	<u>Other specialist in situ tests</u>				
H34	Reading of free product level in borehole using an interface probe.	nr			
H35	Provide contamination screening test kits (per sample).	nr			
H36	Carry out headspace testing on sample by FID or PID methods.	nr			
H37	Self-boring pressuremeter.	day			
H38	High Pressure dilatometer.	day			
H39	Menard pressuremeter.	day			
	Subtotal Section H, carried to Summary				0

Bill I Instrumentation					
Nr	Item description	Unit	Quantity	Rate	Amount
I	Instrumentation				
	<u>Standpipes and Piezometers</u>				
I1	Backfill exploratory hole with cement / bentonite grout or bentonite pellets.	m			
I2	Provide and install 19mm casagrande piezometer tip.	nr			
I3	Provide and install sand cell to I2	m			
I4	Provide and install 19mm casing/piezometer plain pipe.	m			
I5	Provide and install bentonite seal to I4.	m			
I6	Provide and install proprietary slotted standpipe (50mm internal diameter).	m			
I7	Provide and install gravel pack to I6.	m			
I8	Provide and install proprietary casing / plain standpipe (50mm internal diameter).	m			
I9	Provide and install bentonite seals to I8.	m			
I10	Provide and install slotted proprietary standpipe (100mm internal diameter).	m			
I11	Provide and install gravel pack to I10.	m			
I12	Provide and install casing/plain standpipe (100mm internal diameter).	m			
I13	Provide and install bentonite seals to I12.	m			
I14	Provide and install end caps to I6 or I10.	nr			
I15	Provide and install quick release gas valve to I6 or I10.	nr			
I16	Provide and install protective cover (flush).	nr			
I17	Provide and install protective cover (raised).	nr			
I18	Extra over item I16 for heavy duty cover in pavements or highways.	nr			
I19	Supply and erect protective stock proof fencing around standpipe or piezometer installation.	nr			
I20	Supply and erect 1.5m high marker posts (3x1.5m).	nr			
I21	<u>Standpipe and piezometer development / purging</u>				
I21	Supply equipment and personnel to carry out purging.	sum			
I22	Develop standpipe or piezometer by purging (3 well volumes).	hr			
I23	As item I22 but by airlift pumping.	nr			
I24	As item I22 but by over pumping.	nr			
I25	As item I22 but by jetting.	nr			
I26	Disposal of purged water.	litre			
	<u>Inclinometer</u>				
I27	Supply and install inclinometer tubing in exploratory hole (not including forming/drilling of borehole).	m			
I28	Grout in place inclinometer in cable percussive or rotary drillhole.	m ³			
I29	Provision of calibrated inclinometer read out unit for monitoring during investigation.	per week			
I30	Carry out base set of inclinometer readings in inclinometer and process.	hr			
I31	Provide and install protective cover (flush).	nr			
	<u>Slip Indicator</u>				
I32	Provide and install protective cover (raised) slip indicators.	nr			
I33	Supply and install slip indicator in exploratory hole, including brass probe (not including forming/drilling or borehole).	m			
I34	Provide and install protective cover (flush).	nr			
I35	Provide and install protective headwork cover (upright).	nr			
	Subtotal Section I , carried to Summary				0

Bill J Installation Monitoring and Sampling (during fieldwork period)

Nr	Item description	Unit	Quantity	Rate	Amount
J	Installation Monitoring and Sampling (during fieldwork period)				
J1	Reading of water level in standpipe or standpipe piezometer.	nr			
J2	Ground gas measurement in standpipe.	nr			
J3	Provide Engineer or Geologist to take inclinometer readings as directed by Investigation Supervisor (per installation).	nr			
J4	Provide Engineer or Geologist to take measurement of slip indicator (per installation).	nr			
J5	Provide Engineer/Geologist to take water sample from standpipe or standpipe piezometer (rate not included purging or micro-purging).	nr			
J6	Extra over item J5 for purging or micro-purging in excess of 3 well volumes.	h			
J7	Provide Engineer/Geologist to recover ground gas sample from gas monitoring standpipe.	nr			
J8	Provide Engineer/Geologist to read free product level in standpipe using an interface probe.	nr			
	<u>Installation Monitoring and Sampling (post fieldwork period).</u>	nr			
J9	Return visit to site following completion of fieldwork for field instrumentation.	nr			
J10	Extra over item J9 for groundwater measurements in standpipe or standpipe piezometer during return visit.	nr			
J11	Extra over item J9 for ground gas measurement in standpipe during return visit.	nr			
J12	Extra over item J9 for set of inclinometer readings per installation during return visit and report results.	nr			
J13	Extra over item J9 to check for ground slippage in slip indicator installation during return visit.	nr			
J14	Extra over item J9 for water sample from standpipe or standpipe piezometer during return visit to site, including purging 3 volumes or micro-purging up to 3.0 hours.	nr			
J15	Extra over item J14 for purging or micro-purging in excess of 3.0hrs	h			
J16	Extra over item J9 for ground gas sample from gas monitoring standpipe during return visit.	nr			
J17	Extra over item J9 for reading of free product level in standpipe using an interface probe during return visit.	nr			
J18	Provision of equipment to facilitate measuring free product in item J17.	sum			
J19	Provide and install data logger to measure groundwater levels in standpipes.	nr			
J20	Provide baro logger to monitor air pressure for item J19.	nr			
J21	Provide Engineer/Geologist to visit site to download and process data logger and baro logger.	day			
	<u>Surface water body sampling & testing</u>				
J22	Surface water body sample taken during fieldwork period.	day			
J23	Surface water body sample taken during return visit.	nr			
J24	Determination of dissolved oxygen, conductivity, ph and temperature of surface water body during fieldwork period.	nr			
J25	Determination of dissolved oxygen, conductivity, ph and temperature of surface water body during return visit.	nr			
	Subtotal Section J , carried to Summary				0

Bill K Geotechnical Laboratory Testing

Nr	Item description	Unit	Quantity	Rate	Amount
K	Geotechnical laboratory testing				
K1	<u>Classification</u>				
K1.1	Moisture content.	nr	17		
K1.2	Liquid and plastic limit.	nr	17		
K1.3	Volumetric shrinkage.	nr			
K1.4	Linear shrinkage.	nr			
K1.5	Density by linear measurement.	nr			
K1.6	Density by immersion in water or water displacement.	nr			
K1.7	Dry density and saturation moisture content for chalk.	nr			
K1.8	Particle density by gas jar or pycnometer.	nr			
K1.9	Particle size distribution by wet sieving.	nr	17		
K1.10	Particle size distribution by dry sieving.	nr			
K1.11	Sedimentation by pipette.	nr	17		
K1.12	Sedimentation by hydrometer.	nr	Rate Only		
K2	<u>Chemical and Electrochemical</u>				
K2.1	Organic matter content.	nr			
K2.2	Mass loss on ignition.	nr			
K2.3	Acid soluble sulphate content of soil sample.	nr			
K2.4	Water soluble sulphate content of soil sample (2:1 extract).	nr			
K2.5	Total sulphur content of soil sample.	nr			
K2.6	Sulphate content of groundwater sample.	nr			
K2.7	Carbonate content of groundwater sample.	nr			
K2.8	Chloride content of groundwater sample.	nr			
K2.9	Water soluble sulphate content of hardcore sample.	nr			
K2.10	Acid soluble sulphate content of hardcore sample (2:1 extract).	nr			
K2.11	Total sulphate content of hardcore sample.	nr			
K2.12	pH value.	nr			
K2.13	Resistivity.	nr			
K2.14	Redox potential.	nr			
K3	<u>Compaction Related</u>				
K3.1	Dry density/moisture content relationship using 2.5kg rammer (5pt).	nr			
K3.2	Dry density/moisture content relationship using 4.5kg rammer (5pt).	nr			
K3.3	Dry density/moisture content relationship using vibrating rammer (5pt)	nr			
K3.4	Extra over items K3.1 K3.2 and K3.3 for use of CBR mould.	nr			
K3.5	Moisture condition value at natural moisture content.	nr			
K3.6	Moisture condition value/moisture content relationship (5pt).	nr			
K3.7	Chalk crushing value.	nr			
K3.8	California bearing ratio on re-compacted disturbed sample.	nr			
K3.9	Extra over item K3.9 for soaking.	day			
K3.10	California bearing ratio on push-in mould sample (unsoaked).	nr			
K4	<u>Compressibility, permeability and durability</u>				
K4.1	One dimensional consolidation properties, test period 5 days.	nr			
K4.2	Extra over item K4.1 for test period in excess of 5 days.	day			
K4.3	Measurements of swelling pressure test period 2 days.	nr			
K4.4	Measurement of swelling, test period 2 days.	nr			
K4.5	Measurement of settlement on saturation, test period 1 day.	nr			
K4.6	Extra over items K4.3 to K4.5 for test period in excess of 2 days or 1 day.	day			
K4.7	Permeability by constant head method.	nr			
K4.8	Dispersibility by pinhole method.	nr			
K4.9	Dispersibility by crumb method.	nr			
K4.10	Dispersibility by dispersion method.	nr			
K4.11	Frost heave of soil.	nr			
K5	<u>Consolidation and permeability in hydraulic cells</u>				
K5.1	Consolidation properties of a 76mm diameter specimen in hydraulic consolidation cell, test period 4 days.	nr			
K5.2	As item K5.1 but using a 100 diameter specimen.	nr			
K5.3	As item K5.1 but using a 150mm diameter specimen.	nr			
K5.4	As item K5.1 but using a 250mm diameter specimen.	nr			
K5.5	Extra over items K5.1 – K5.4 for test period in excess of 4 days.	day			
K5.6	Permeability of a 76mm diameter specimen in hydraulic consolidation cell, test period 4 days.	nr			
K5.7	As item K5.6 but using a 100mm diameter specimen.	nr			
K5.8	As item K5.6 but using a 150mm diameter specimen.	nr			
K5.9	As item K5.6 but using a 250mm diameter specimen.	nr			
K5.10	Extra over items K5.6 – K5.9 for test period in excess of 4 days.	day			
K5.11	Isotropic consolidation properties in a triaxial cell, test period 4 days.	nr			
K5.12	Extra over item K5.11 for test periods in excess of 4 days.	day			
K5.13	Permeability in a triaxial cell, test period 4 days.	nr			
K5.14	Extra over item K5.13 for test period in excess of 4 days.	day			
K6	<u>Shear strength (total stress)</u>				
K6.1	Shear strength by laboratory vane method (set of 3)	nr			
K6.2	Shear strength by hand vane (set of 3)	nr			
K6.3	Shear strength by hand penetrometer (set of 3)	nr			
K6.4	Shear strength of a set of three 60mm x 60mm square specimens by direct shear, test duration not exceeding 1 day per specimen.	nr			
K6.5	Extra over Item K6.4 for test durations in excess of 1 day per specimen.	sp. day			
K6.6	Shear strength of a single 300mm x 300mm square specimen by direct shear, test duration not exceeding 1 day.	nr			
K6.7	Extra over item K6.6 for test durations in excess of 1 day.	day			
K6.8	Residual shear strength of a set of three 60mmx60mm square specimens by direct shear, test duration not exceeding 4 days per specimen.	nr			
K6.9	Extra over item K6.8 for test durations in excess of 4 days per specimen.	sp. Day			
K6.10	Residual shear strength of a 300mm square specimen by direct shear, test duration not exceeding 4 days.	nr			

K6.11	Extra over item K6.10 for test duration in excess day of 4 days.	day			
K6.12	Residual shear strength using the small ring shear apparatus at three normal pressures, test duration not exceeding 4 days.	nr			
K6.13	Extra over item K6.12 for test duration in excess of 4 days.	day			
K6.14	Unconfined compressive strength of 38mm diameter specimen.	nr			
K6.15	Undrained shear strength of a set of three 38mm diameter specimens in triaxial compression without the measurement of pore pressure.	nr			
K6.16	Undrained strength of a single 100mm diameter specimen in triaxial compression without the measurement of pore pressure.	nr			
K6.17	Undrained shear strength of single 100mm diameter specimen in triaxial compression with multi stage loading and without measurement of pore pressure.	nr			
K7	<u>Shear strength (effective stress)</u>				
K7.1	Consolidated undrained triaxial compression test with measurement of pore pressure (set of 30mm specimens), test duration not exceeding 4 days per specimen.	nr			
K7.2	As K7.1 but single stage or multi stage test using 100mm diameter specimen.	nr			
K7.3	Consolidated drained triaxial compression test with measurement of volume change (set of three 38mm specimens), test duration not exceeding 4 days per specimen.	nr			
K7.4	As item K7.3 but single stage or multi stage test using 100mm diameter specimen, test duration not exceeding 4 days.	nr			
K7.5	Extra over items K7.1 and K7.3 for test duration in excess of 4 days per specimen.	sp. day			
K7.6	Extra over items K7.2 and K7.4 for test duration in excess of 4 days.	day			
K8	<u>Rock and aggregate testing</u>				
K8.1	Natural water content of rock sample.	nr			
K8.2	Porosity/density using saturation and calliper techniques.	nr			
K8.3	Porosity/density using saturation and buoyancy.	nr			
K8.4	Slake durability.	nr			
K8.5	Water absorption.	nr			
K8.6	Magnesium sulphate soundness.	nr			
K8.7	Flakiness index.	nr			
K8.8	Los Angeles abrasion.	nr			
K8.9	Aggregate impact value.	nr			
K8.10	Aggregate crushing value.	nr			
K8.11	Polished stone value.	nr			
K8.12	Aggregate frost heave.	nr			
K8.13	Resistance to freezing and thawing.	nr			
K8.14	Uniaxial compressive strength.	nr			
K8.15	Deformability in uniaxial compression.	nr			
K8.16	Indirect tensile strength by Brazilian test.	nr			
K8.17	Triaxial compression without measurements of pore water pressure.	nr			
K8.18	Point load strength index on rock core (axial or diametral).	nr			
K8.19	Point load strength index on irregular lump sample (set of ten individual determinations).	nr			
K8.20	Swelling pressure test.	nr			
K8.21	Direct shear strength of single specimen.	nr			
	<u>Special tests on rock core or trial pit samples to assess potential for pyrite induced expansion or swelling.</u>				
K9.2	Chemical analysis on rock core or bulk sample (test methods to RL 447 and test suite to include total sulphur, acid soluble sulphate and water soluble sulphate and derivation of oxidisable sulphide and equivalent pyrite content).	nr			
Subtotal Section K, carried to Summary					0

Bill L Geoenvironmental Laboratory Testing

Nr	Item description	Unit	Quantity	Rate	Amount
L	Geoenvironmental Laboratory Testing				
	(Contamination testing of soil, groundwater, gas and fill material).				
L1	Test Suite E				
L2	Test Suite F	nr			
L3	Test Suite G	nr			
L4	Test Suite H	nr			
L5	Test Suite I	nr			
L6	Test Suite J	nr			
Contract Specific additional bill items					
L7.1	MML Soil Suite (as per Table B.1, Appendix B of the specification)	nr	10		
L7.2	MML Leachate Suite (as per Table B.2, Appendix B of the specification)	nr	5		
L7.3	MML Groundwater Suite (as per Table B.3, Appendix B of the specification)	nr			
L7.4	MML Speciated VOC Suite (as per Table B.4, Appendix B of the specification)	nr	Rate Only		
L7.5	MML Speciated SVOC Suite (as per Table B.5, Appendix B of the specification)	nr	Rate Only		
L7.6	MML Full WAC Suite (as per Table B.6, Appendix B of the specification)	nr	3		
Subtotal Section L, carried to Summary					0

Summary of Bill of Quantities		€
A General Items, provisional services and additional items		0
B Percussion Boring		Not Used
C Rotary Boring		Not Used
D Pitting & Trenching		0
E Sampling and monitoring during intrusive investigation		0
F Probing and Cone Penetration Testing		0
G Geophysical Surveying		Not Used
H In Situ Testing		0
I Instrumentation		0
J Installation Monitoring and Sampling (during fieldwork period)		0
K Geotechnical Laboratory Testing		0
L Geoenviromental Laboratory Testing		0
	Total	0
		0

