



# Particular Specification for Ground Investigation Contract

Lower Tinnahinch Weir Refurbishment and Rock Fish Pass

Report No. TWF-AYE-ZZ-XX-SP-GE-0001

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[Waterways Ireland](#)

## Document Control

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### Client

Waterways Ireland

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## [1] Introduction

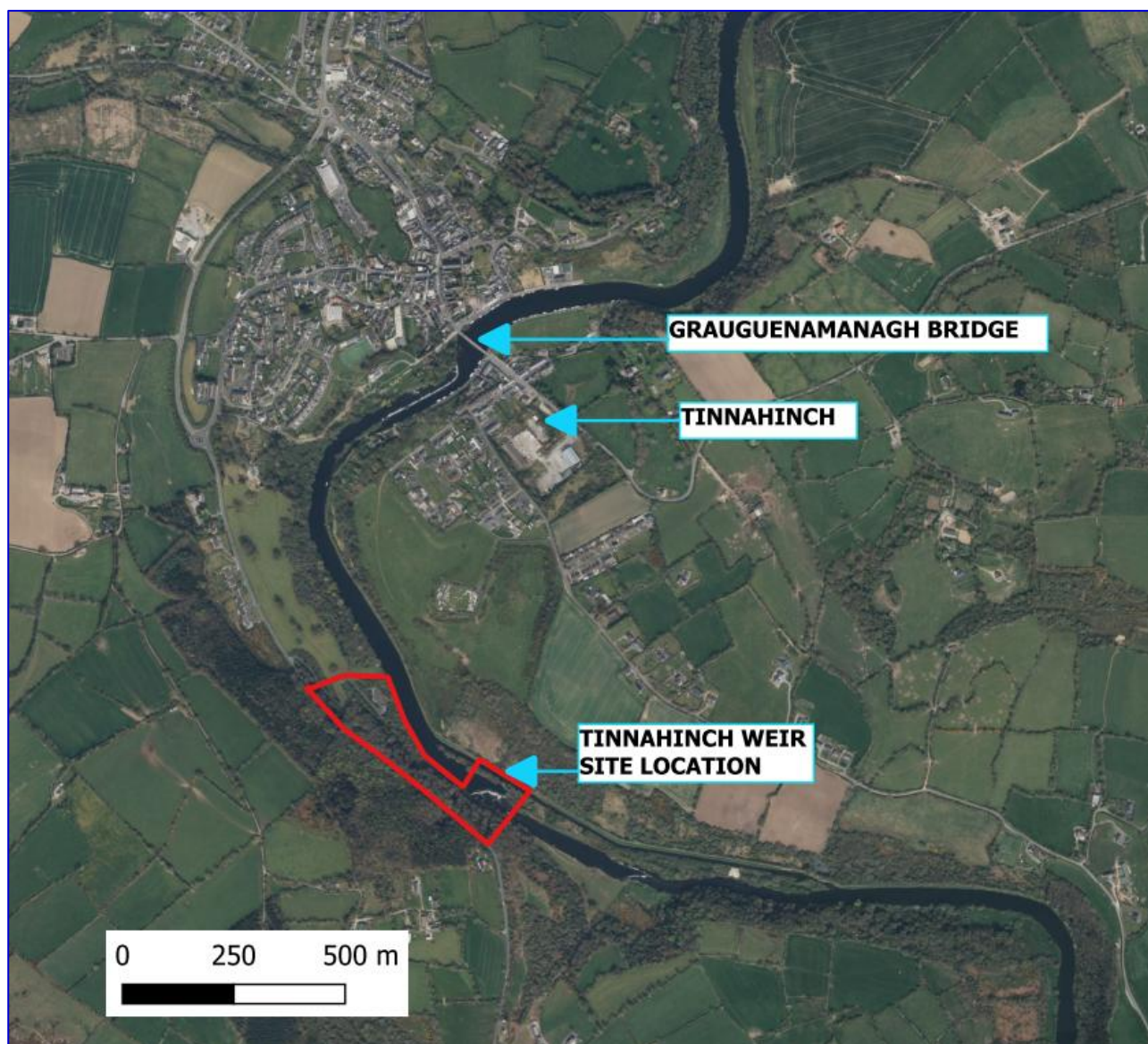
### [1.1] Site Location

The lower Tinnahinch Weir Refurbishment and Rock Ramp Fish Pass Project is located on the River Barrow, adjacent to the R705 in the townland of Lower Tinnahinch, Co. Carlow/Kilkenny, within the River Barrow and River Nore Special Area of Conservation (SAC) (site code: 002162).

The existing weir has been identified by Inland Fisheries Ireland as an obstruction to fish migration and the free movement of fish throughout the year. As such, it is considered non-compliant with Section 116 of the Fisheries (Consolidation) Act 1959 and the requirements of the European Habitats Directive.

The purpose of the project is to extend the operational life of the weir and to provide facilities that enable the passage of all endemic fish species. This will enhance fish stocks and biodiversity within the River Barrow, in accordance with the Conservation Objectives and management requirements of the River Barrow and River Nore SAC.

Tinnahinch Weir is situated on the River Barrow, which forms the boundary between Counties Kilkenny and Carlow. The Weir is located approximately 1km south of Graiguenamanagh Bridge, as shown in **Figure 1**.



**Figure 1: Site Location**

The site is accessed via the existing Uisce Éireann Wastewater Treatment Plant (WwTP) access road via the R705 public road, please refer to **Figure 2** for site layout details.

An existing pathway extends from the WwTP, along the right bank of the River Barrow, through a forested/vegetated area to the weir.

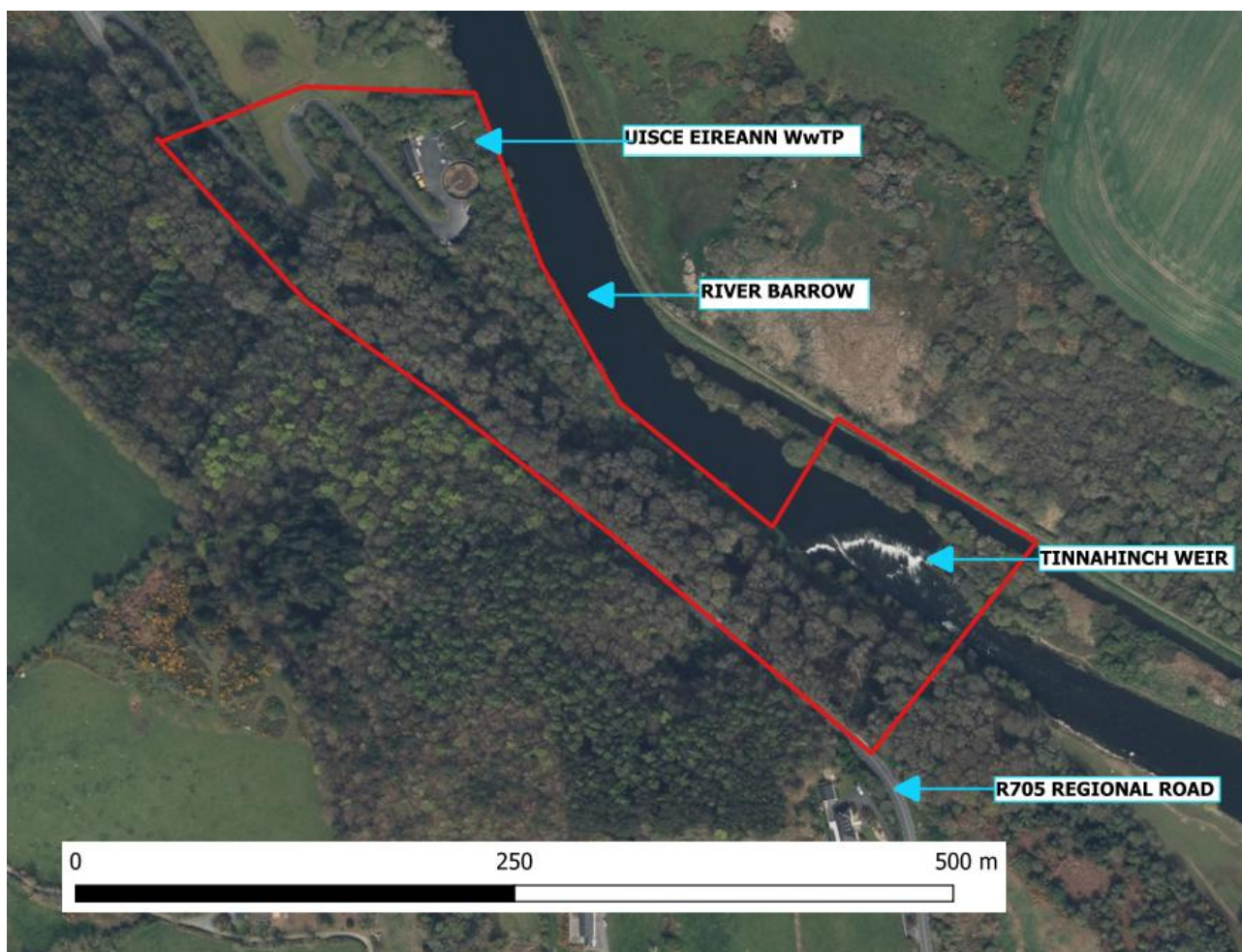


Figure 2: Site Layout

## [1.2] Ground Investigation Works

The Ground Investigation (GI) works have been developed in response to the scope and nature of the proposed remediation works at the existing weir. The GI has been designed to obtain sufficient geotechnical and geological data to inform the design and construction of the proposed elements, which comprise:

1. Construction of an access track to facilitate plant access for the execution of the remediation works;
2. Two-phase remediation of the existing weir structure; and
3. Construction of a Fishpass structure.

The scope of the GI is intended to adequately characterise ground conditions across all areas influenced by the above works, ensuring that appropriate design parameters can be derived and construction risks appropriately assessed and mitigated.

### [1.3] General

This document presents the specifications for the proposed Ground Investigation works at Tinnahinch Weir. The basis of this particular Specification is Engineers Ireland “Specification and Related Documents for Ground Investigation in Ireland,” Second Edition 2016, as extended by Appendices A&B. Modifications to the Engineers Ireland Specification are outlined herein and shall take precedence over the Engineers Ireland Specification. The body of this text acts as Schedule 4 and 5 of the Engineers Ireland Specification where amendments and additions to the Engineers Ireland Specification have been added, as necessary. Where no modifications or amendments are proposed in relation to the Engineers Ireland Specification, the corresponding section of this Specification is noted as ‘As Per Engineers Ireland Specification.’

A schedule of the proposed Ground Investigation is presented in Appendix C.

The term ‘Contractor’ in this Specification means the specialist contractor employed to conduct the work.

The term ‘Client’ in this Specification means Waterways Ireland (WI), who are acting as the Lead Authority for the Scheme.

Where the term ‘Investigation Supervisor’ has been used in this Specification and in the Engineers Ireland Specification, this shall mean Ayesa.

The term ‘Employers Representative’ in this Specification means Ayesa.

### [1.4] Specification

All materials, workmanship, and tests (where required) shall comply with the latest edition of the relevant Eurocodes and appropriate British Standards (BS5930), the Engineers Ireland Specification for Ground Investigation and shall be in accordance with the drawings and this Specification, all to the satisfaction of the Investigation Supervisor. Where conflicts exist between any Eurocode, British Standard and this Specification, the Specification shall take precedence.

The Employers Representative’s approval of a sample of materials and/or workmanship does not constitute approval of the actual materials and/or workmanship employed in the works, but only approval of the particular sample.

The Contractor shall check all drawings and schedules to ensure that he has sufficient information to conduct the work and that all the instructions, drawings, and schedules he has, provides compatible information on the work to be conducted. Such checking is to be conducted sufficiently in advance of the works to allow any errors, omissions, or discrepancies to be remedied without causing delay to the works. In the event of any discrepancy being found between such drawings or schedules or if the Contractor considers additional details are required, he shall notify the Employers Representative of such matters at least 10 working days prior to the details being required on site.

Tenderer’s shall check if they have sufficient access to site in order to carry out the works.

The Contractor shall be deemed to have made himself fully acquainted with the full nature of the work, the location and character of the site and means of access to the site, including any traffic restrictions imposed.

Should the Contractor consider it necessary to sub-contract any of his work, approval of his Specialist Sub-Contractor and the scope of the work must be obtained from the Employers Representative before proceeding. It will be the responsibility of the Contractor to ensure that this work is conducted in accordance with the Specification.

The Contractor shall submit a Preliminary Health & Safety Plan which shall include a risk assessment for the proposed work.

The Contractor shall facilitate the Employers Representative on site, if necessary, to monitor the progress and check technical aspects of the GI works.

The client reserves the right to amend the scope of works following appointment. If amendments to the scope of works are required, this will be communicated between the client and the contractor directly. Any rates provided within the tender documents will be deemed to apply to the amended quantities.

## **[1.5] Programme Submittal**

The Contractor shall prepare a programme of works for the investigation, which will give a detailed schedule showing proposed timescales for all aspects of the work in accordance with the attached schedules of the particular Specification and Bill of Quantities, details of all plant and equipment to be supplied with time schedules and a similar schedule for all the prepared personnel who will work on the project. Days shall be calendar days.

Instream construction works are constrained by the permissible instream working season (June to September 2026 inclusive). The contractor shall prepare a programme with this constraint in mind so that all works which require channel entry are completed from June to September inclusive.

Restrictions on seasonal working times due to presence of SPA is to be considered. Refer to Schedule 1.8.11 for information.

The Contractors programme will account for consulting with public authorities or public bodies (i.e. arranging access, etc.) and shall include in its price for same.

The Contractor shall begin work no later than three weeks following successful appointment of the contract.

The Contractor shall submit the final factual report, inclusive of the full AGS Digital Data, no later than two weeks following completion of the GI works and laboratory testing.

Any queries related to this tender shall be submitted within a week of the tender issue date. All tenders are to be returned within two weeks of the tender issue date.

## **[1.6] General Project / Site Conditions**

### **[1.6.1] Statutory Undertakers, Public Authorities and Privately owned Lands and Services**

The information available to the Employer's Representative on the locations of some existing services will be made available to the appointed Contractor at the appropriate time on the understanding that no guarantees will be given by the Employer's Representative or the Employer

for the accuracy of the information and no responsibility will be accepted for any damage or disruption of services caused as a result of the information supplied.

The Contractor is responsible for safely providing services at each exploratory hole location. Service drawings and data supplied by the Employer's Representative are for reference only. It is the Contractor's responsibility to confirm locations on site.

The Contractor shall consult with the relevant service providers with regards to the positions of mains, services, drains, sewers, and tunnels owned by statutory undertakers, public authorities, and private individuals. In addition, the Contractor shall make his own enquiries of the statutory undertakers and public authorities and satisfy himself as to the exact position of such apparatus and the depth, size, and gradient thereof. Where the presence of underground services is suspected, exploratory holes shall be started by means of CAT scanning and a hand-excavated inspection pit to a depth of not less than 1m deep.

Where necessary and/or required to comply with local regulations, the Contractor shall apply for and obtain any and all necessary permits required to complete the works proposed.

The Contractor will be required to engage and collaborate with the WI on how best to access land and also in selecting routes, methods and investigation locations that are least disruptive to the landowner. The Employer's Representative/Employer are to be kept informed on all planned landowner liaison and will provide support as needed. A liaison with landowners, local residents and all relevant statutory bodies is deemed to be included in the Tender Price.

The Contractor may occupy and use the site on receipt of permission from the Employer's Representative. Access to private lands, if necessary, will be through established gates. Where the contractor is required to travel along the site to reach the proposed investigation location, any disturbance to the ground shall be kept to a minimum. The cost associated with avoiding damage to crops and the compensation for the damage caused will be included in the rates.

The Contractor shall agree access routes to the exploratory hole locations with WI prior to commencement of the works and shall propose and agree alternative access arrangements (if required) in advance with the Investigation Supervisor / WI. Access routes on private lands, if necessary, will be agreed with Landowners.

The Contractor will be required to give a minimum of seven days' notice of entry to all landowners, occupiers, and tenants as appropriate. The Contractor will be responsible for providing access he considers to be necessary for his personnel and equipment, including removing and replacing any fence, etc. and shall make all reasonable endeavours to avoid any impact or damage to the property. If access cannot be obtained for good reason, the Employers Representative reserves the right to re-locate the hole/pit to another area of the scheme without additional cost to the Client.

The Contractor shall be responsible for reinstating the property and all surfaces at the earliest possible opportunity, and in all cases within 2 weeks of completion of the works within the private land (unless otherwise agreed with the landowner) to its original condition and shall be responsible for all costs associated with same.

The Contractor shall liaise with the WI and site users to schedule his activities to accommodate them.

## [1.6.2] Works in Environmentally Sensitive Areas – Environmental Operating Plan

The ground investigations will be undertaken adjacent to environmentally sensitive areas. An Environmental Operating Plan (EOP) for the ground investigation shall be prepared by the Contractor. This will describe the Environmental Management System of this phase of the Project and will be devised according to the criteria of ISO 14001:2004 – Environmental Management Systems and be prepared in accordance with the NRA “Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan” (NRA, 2008). The Contractor shall also refer to Appendix G – Environmental Commitments when producing their EOP and consider items relevant to the SI works.

Prior to any demolition, excavation or construction, a Construction Environmental Management Plan (CEMP) for the works.

A method statement shall be included for surface water management (if required). This Method Statement shall be circulated to the Employers Representative prior to commencement of works.

A method statement shall be included for the handling of any potential contaminated materials. The Method Statement shall be circulated to the Employers Representative prior to commencement of works.

A Method Statement shall be submitted detailing the management and disposal of drilling returns, recovered sediments and any waste materials arising from the ground investigation works. The Method Statement shall be issued to the Employer’s Representative prior to commencement of the Works.

## [1.6.3] Works Carried Out Overwater

It should be noted that much of the proposed works will be carried out adjacent to water. The Contractor shall review the scope of works and ensure that works adjacent to water is accounted for in the Tender submission and price. The Contractor shall ensure a safe system of works is in place and a risk assessment is carried out prior to the commencement of works.

The Contractor shall liaise with the WI and agree upon a sequence of works prior to the commencement of the ground investigation works.

## [1.6.4] Potential Impacts & Mitigation Measures

It shall be ensured that the drilling supervisor and/or site geologists/engineers are fully aware of the ecological constraints and mitigation requirements.

There is potential for adverse impacts on water quality during the ground investigation as a result of ground disturbance, excavation and drilling activities generating sediment runoff into water bodies, which may also be polluted with hydrocarbons (e.g., diesel or oil from machinery), drilling fluids or grout. A mist flush system shall be used to cool the drill bit and lift cuttings to the surface. The mist flush generates minimal quantities of water, which will be absorbed into the ground local to the hole so there will be little or no discharge of water to local waterbodies.

Water required for ground investigation activities may require to be sourced through abstraction from the adjacent or nearby sources. The amounts of water abstracted will be minimal and will not impact the quantity of water necessary for the sustainable functioning of freshwater ecosystems.

There is potential for the accidental spillage of materials, e.g., fuel, grout, used during the operations and this shall be managed on site by the Contractor and addressed in their Method Statements.

Any incident or observation of anything that may be considered as causing or likely to cause disturbance or damage to the environment will be reported immediately to the Employer's Representative. For this purpose, each crew/engineer will have a mobile phone.

There is a potential to encounter underground services in the proposed area of works. The details of utilities within the site will be provided by WI indicating the presence of underground services and hence, the Contractor will need to take his own precautions where excavations are to take place so as to not come into contact with abandoned / existing underground services.

Given the proximity of the proposed ground investigation locations to the riverbank and designated SPA, the Contractor shall implement specific watercourse and groundwater protection measures for all cable percussion boreholes and trial pits.

The works shall be undertaken in accordance with best practice pollution prevention measures, including CIRIA C532 and Inland Fisheries Ireland guidance for works in and adjacent to waters. No arisings, groundwater, drilling flush, bentonite, fuel, oil, concrete washout, silt-laden runoff or other deleterious material shall be permitted to enter the river, riverbank, drainage ditches or adjacent sensitive habitat.

All trial pit arisings and borehole spoil shall be placed on impermeable sheeting, bunded where necessary, and set back as far as practicable from the riverbank. Any groundwater or surface water entering excavations shall be contained and managed appropriately, with no direct discharge to the watercourse. Spill kits shall be available at each working location, plant shall be checked for leaks prior to use, and refuelling shall be undertaken away from the riverbank within a designated bunded area.

Cable percussion boreholes shall be advanced using clean equipment and shall be sealed on completion to prevent the creation of preferential pathways between strata or to the watercourse. Trial pits shall be backfilled promptly following logging and sampling, with arisings reinstated and compacted to minimise settlement and surface water pathways.

Trial Pits shall be backfilled and existing surface shall be reinstated as per the EI specification requirements.

Where groundwater monitoring installations are required, standpipes shall be installed using appropriate filter packs, seals and bentonite/cement grout to prevent cross-contamination between strata and uncontrolled hydraulic connection with the watercourse. Works shall be supervised by a suitably competent person, and any pollution incident or suspected impact to the watercourse shall be reported immediately.

Environmental commitments (Appendix G) require monitoring for turbidity for works adjacent to water courses. As such, turbidity readings shall be taken both upstream and downstream of the works site prior to and following the ground investigation works.

## [2] Definitions

The following definitions apply in this project:

- The term '**Contractor**' in this Specification means the specialist contractor employed to conduct the work.
- The term '**Client**' in this Specification means **Waterways Ireland** who are acting as the Lead Authority for the Scheme.
- The term '**Investigation Supervisor**' in this Specification means **Ayesa**.
- The term '**Employers Representative**' in this Specification means **Ayesa**.

All other definitions are as per Engineers Ireland Specification.

### **[3] General Requirements**

#### **[3.1] Work Not Required**

As per Engineers Ireland Specification.

#### **[3.2] Irish Standards and Equivalent**

As per Engineers Ireland Specification.

#### **[3.3] Quality Management**

The following new sub-clauses shall be added:

1. The work shall be conducted in accordance with the relevant Irish Standards or equivalent British and European Standards for Ground Investigations and Investigations of Potentially Contaminated Sites current on the date of invitation to tender, in particular IS EN 1997-2:2007, BS 5930:2015 and BS 10175:2011. Any reference in the Contract to a Standard published by the British Standards Institution, or to the specification of another body, shall be construed equally as reference to an equivalent one. If an equivalent Standard is to be used, full details shall be provided to the Employers Representative, for his approval, at least 3 working days prior to commencement of work on site.
2. Any clauses of this Specification which relate to work or materials not required in the Contract shall be deemed not to apply.

#### **[3.4] Investigation Supervisor's Facilities**

As per Engineers Ireland Specification.

#### **[3.5] Management, Superintendence and Professional Attendance**

As per Engineers Ireland Specification.

#### **[3.6] Ground Practitioners & Other Personnel**

##### **[3.6.1] Other Personnel**

The following new sub-clauses shall be added:

1. The Contractor will provide a licensed Environmental Specialist(s) to monitor the works and supervise the investigations. The environmental specialist shall monitor soils and schedule environmental sampling where he deems necessary. Refer to Schedule 1.8 for information.

### [3.6.2] Archaeology

As per Engineers Ireland Specification.

## [3.7] Information on Existing Site Conditions

### [3.7.1] Hazardous ground and land affected by contamination

The following new sub-clauses shall be added:

1. Excavations may encounter polyaromatic hydrocarbons. The Contractor will allow for excavating, handling, and sampling potentially hazardous or contaminated material. All staff should wear Appropriate PPE. Without further information, it should be assumed that all spoil is considered contaminated.

### [3.7.2] Services

As per Engineers Ireland Specification.

## [3.8] Ground Safety Requirements

As per Engineers Ireland Specification.

## [3.9] Notice of Entry

As per Engineers Ireland Specification.

## [3.10] Access Routes

The following new sub-clause shall be added:

1. Where access to site to carry out the investigation during normal working hours is difficult, the Contractor may apply to WI for permission to work outside of normal working hours.
2. The Contractor shall liaise with the WI to confirm the sequence of works at least three weeks prior to the commencement of works.

## [3.11] Security of Site

As per Engineers Ireland Specification.

## [3.12] Traffic Safety and Management

The following new sub-clauses shall be added:

1. The Contractor shall carry out the investigations in such a manner as to cause as little interference as possible to the flow of traffic and pedestrians and shall make all necessary arrangements with the appropriate Authorities for the erection of signs and notices in

accordance with Chapter 8 of the Traffic and Signs Manual. Contractors Cardholders are required to be present on site at all times.

2. The Contractor shall be aware that a Road Opening, if necessary, has a required maintenance period of 24 months (from date of the Maintenance Period Commencement Certificate to each Road Reinstatement). Where excavations exceed 1.5m, a 3-year maintenance period shall apply.
3. Reactive Traffic Control may be required to be implemented by the Contractor. A stop/go traffic control system is to be implemented.
4. Road Opening Licenses (T2) are the responsibility of the Contractor. All costs associated with traffic management, road closures, road opening licences or any other permits including all advertisements, signs etc. are deemed to be included in the Contractor's tender price. The cost associated with the T1/T2 will be paid by the Contractor and be re-imbursed by the Client. The Contractor is required to pay the bond which will be refunded 24 months after sign-off. All administration costs associated with the required traffic management, road closures, road opening licences or any other permits including all advertisements, signs etc. are non-refundable and are to be paid by the Contractor.
5. The Contractors method statement for Traffic Management shall be approved by WI prior to commencement on site. The Contractor shall allow for liaison with the WI Engineer to address any comments or queries raised in their tender.
6. The Contractor should allow sufficient time for the Employer's Representative to review the proposed Method Statement for all Traffic Management prior to undertaking the works. No costs or extension of time will be allowed in relation to the application for any delay in the granting of the road opening licence.
7. The Contractor shall an emergency rescue plan prior to the commencement of works which will detail the procedures for stabilising and manoeuvring personnel off site in the case of emergency.

### **[3.13]Working Hours**

Please refer to Schedule 1.18.11 for information.

### **[3.14]Qualification of Site Operatives**

As per Engineers Ireland Specification.

### **[3.15]Care in Executing the Work**

As per Engineers Ireland Specification.

### **[3.16]Working Areas**

As per Engineers Ireland Specification.

### **[3.17]Claims for Damage**

As per Engineers Ireland Specification.

### **[3.18]Method of Investigations**

As per Engineers Ireland Specification.

### **[3.19]Locations of Exploratory Holes**

The following new sub-clauses shall be added:

1. The Contractor, within 14 days of completion of the works on site, will submit to the Employer's Representative a survey drawing detailing the location of all exploratory excavations carried out as per S1.21 of Schedule 1.

### **[3.20]Ground Elevation of Exploratory Holes**

As per Engineers Ireland Specification.

### **[3.21]Exploratory Work**

As per Engineers Ireland Specification.

### **[3.22]Notifiable and Invasive Weeds**

As per Engineers Ireland Specification.

### **[3.23]Anomalous Conditions**

As per Engineers Ireland Specification.

### **[3.24]Surface Water Control**

As per Engineers Ireland Specification.

### **[3.25]Photographs**

As per Engineers Ireland Specification.

### **[3.26]Disposal of Arisings**

As per Engineers Ireland Specification.

## [4] Percussion Boring

No additions or amendments to Engineers Ireland Specification requirements.

## [5] Rotary Drilling

No additions or amendments to Engineers Ireland Specification requirements.

## [6] Pitting and Trenching

No additions or amendments to Engineers Ireland Specification requirements.

## [7] Sampling and Monitoring During Intrusive Investigation

No additions or amendments to Engineers Ireland Specification requirements.

## [8] Probing and Cone Penetration Testing

No additions or amendments to Engineers Ireland Specification requirements.

## [9] Geophysical Testing

Please Refer to Appendix E.

## [10] In-Situ Testing

No additions or amendments to Engineers Ireland Specification requirements.

## [11] Instrumentation

No additions or amendments to Engineers Ireland Specification requirements.

## [12] Installation Monitoring and Sampling

No additions or amendments to Engineers Ireland Specification requirements.

## [13] Daily Records

### [13.1]General

The following new sub-clauses shall be added:

1. Daily reports shall be submitted at the end of each day's work. Refer to S1.18 of Schedule 1.

## [14] Geotechnical Laboratory Testing

No additions or amendments to Engineers Ireland Specification requirements.

## [15] Geo-environmental Laboratory Testing

No additions or amendments to Engineers Ireland Specification requirements.

Please refer to **Appendix F** for contamination testing requirements of Grab Samples.

## [16] Reporting

No additions or amendments to Engineers Ireland Specification requirements.

## [17] References

No additions or amendments to Engineers Ireland Specification requirements.

## Appendix A – Schedules

|      |                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| S1.1 | Name of Contract                                 | Tinnahinch Weir and Fishpass Ground Investigation Contract No.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| S1.2 | Investigation Supervisor                         | Ayesa                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| S1.3 | Description of sites                             | The ground investigation works are to be completed adjacent to the Tinnahinch WwTP, Co. Kilkenny. Further information in main body of text.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| S1.4 | Main works proposed and purpose of this Contract | <p>This contract relates to the ground investigation which will be used to provide confirmation of ground conditions and geotechnical parameters for use in the ongoing project development. The works are proposed to take place within the jurisdiction of Waterways Ireland (WI) who will require to be consulted by the Contractor throughout the works with any criteria imposed by WI to be adhered to.</p> <p>The aims of the ground investigation work under this Contract are to:</p> <ul style="list-style-type: none"> <li>• Investigate the nature of the geological strata.</li> <li>• Determine the engineering properties of the ground for use in verifying proposed temporary works requirements, foundation designs and remediation works.</li> <li>• Detect the presence of any irregularities, cavities, in the geological structure that may affect the proposed construction work.</li> <li>• Evaluate the strength at the formation level of the proposed works to establish its suitability for the entire remediation works.</li> <li>• Assess the presence and extent of soft ground.</li> <li>• Determine contaminants (if any) present in material to be excavated in the course of the future construction works; and</li> <li>• Produce a Ground Investigation Factual Report.</li> </ul> |
| S1.5 | Scope of investigation                           | <p>The proposed investigation includes the following:</p> <ul style="list-style-type: none"> <li>• Cable percussion to maximum depth of 10m BGL or when Rock is encountered.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

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|      |                               | <ul style="list-style-type: none"> <li>• Window sample to a maximum of 10m BGL or when Rock is encountered (<b>Provisional on the basis that access for a cable percussion rig is not feasible</b>)</li> <li>• In-situ SPT N testing in all boreholes</li> <li>• Soil sampling.</li> <li>• Surface level Grab Sampling (See Appendix F for details of contamination test requirements)</li> <li>• Mackintosh Probing to 5.0m BGL or refusal where grab samples are carried out</li> <li>• Photographs of samples to allow for permanent record of strata.</li> <li>• In-situ and laboratory geotechnical testing.</li> <li>• Bathymetric Survey</li> <li>• Geophysical Survey (land and marine)</li> <li>• Completion of daily field reports and detailed logs recording all exploratory hole data.</li> <li>• Reinstatement of exploratory locations</li> <li>• Restoration of disturbed areas once operations are complete, where required.</li> <li>• Liaise with WI.</li> <li>• Contractor to perform the role of Project Supervisor Construction Stage (PSCS) for the Ground Investigation.</li> <li>• Factual reporting and production of electronic data (including pdf of final reports, as-built location drawings and AGS data).</li> </ul> <p>Appendix C includes detailed requirements and schedules for each exploratory location.</p> |
| S1.6 | Geology and ground conditions | <p>To be confirmed during ground investigation works. A geological desktop review suggests the following geology:</p> <p>The area comprises predominantly alluvial deposits with adjacent bedrock outcrop suggesting alluvial deposits are predominantly granular in nature. Adjacent bedrock outcrop also may indicate relatively shallow bedrock.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

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| S1.7 | Schedule of drawings and documents                        | <p>The following drawing is issued in conjunction with this Specification:</p> <ul style="list-style-type: none"> <li>TWF-AYE-ZZ-XX-DR-PM-0101</li> </ul> <p>This drawing is included in Appendix D of this document. The above drawings and this specification form 'Volume A – Works Requirements.' The drawing outlines:</p> <ul style="list-style-type: none"> <li>The undertaking of intrusive exploratory investigations to establish ground conditions.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| S1.8 | General Requirements and Particular Contract restrictions | <p><u>General</u></p> <p>The drawing detailed in S1.7 above show the scope of the exploratory works envisaged.</p> <p><u>S1.8.1 Quality Management System</u></p> <p>The Contractor shall operate a quality management system in accordance with ISO 9001. The Contractor shall complete the works in accordance with the '<i>Code of Practice for Avoiding Danger from Underground Services; Second Edition February 2010</i>' and '<i>A Guide to Safety in Excavations, 2007</i>' published by the Health and Safety Authority.</p> <p>An Environmental Operating Plan (EOP) for the ground investigation shall be prepared by the Contractor. This will describe the Environmental Management System of this phase of the Project and will be devised according to the criteria of ISO 14001:2004 – Environmental Management Systems and be prepared in accordance with the NRA '<i>Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan</i>' (NRA, 2008).</p> <p><u>S1.8.2 Professional Attendance</u></p> <p>The contractor shall provide an experienced lead geotechnical site supervisor full time on site for the supervision of all activities, logging exploratory holes, taking samples, and providing daily records and preliminary logs. The Tenderer shall <b>submit a CV</b> for this role with their submitted Tender.</p> <p><u>S1.8.3 Specialists</u></p> <p>N/A</p> <p><u>S1.8.4 Hazardous ground, land affected by contamination and notifiable invasive weeds</u></p> <p>Any potential hazardous arisings shall be disposed of in accordance with EPA guidelines.</p> |

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|  |  | <p><u>S1.8.5 Additional information on services</u></p> <p>Refer to Clause 3.7.2 of the Specification.</p> <p><u>S1.8.9 Security of Site</u></p> <p>All test sites shall have temporary fencing to demarcate the working area and to limit public access and create a safe zone.</p> <p><u>S1.8.11 Restricted working hours</u></p> <p>The normal working week shall be Monday to Friday 8am until 6pm. Work outside of these hours will be at the express permission of the Client. <u>The permissible instream working season due to the presence of an SPA is June to September 2026 inclusive.</u></p> <p><u>S1.8.13 Contamination avoidance</u></p> <p>The Contractor shall comply with Clause 3.15.2 and 3.15.3 of the Specification and shall ensure that no contamination of the marine environment or designated European Sites occurs during the execution of the site investigation works.</p> <p>The Contractor shall include for all necessary equipment, personnel, protection systems, containment measures and monitoring to ensure that drill arisings, flushing fluids, fuels, lubricants, or other potentially contaminating substances are not discharged into the surrounding environment.</p> <p><u>S1.8.14 Maximum period for boring through obstruction</u></p> <p>1 hour, following this consult with Ayesa.</p> <p><u>S1.8.15 Reinstatement Requirements</u></p> <p>Boreholes to be backfilled with bentonite pellets in accordance with EI specification requirements.</p> <p>Any costs associated with traffic management, road closures, road opening licences or any other permits including all advertisements, signs etc. are deemed to be included in the Contractor's tender price, if necessary for him to complete the works. All administration costs associated with the required traffic management, road closures, road opening licences or any other permits including all advertisements, signs etc. are non-refundable and are to be paid by the Contractor.</p> <p>Please refer to section 1.6.4 regarding environmental considerations and mitigation measures to be adhered to during the SI works.</p> <p><u>S1.8.18 Accuracy of Hole Locations</u></p> |
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|  |  | <p>Refer to Clause 3.19 for Specification additions.</p> <p><u>S1.8.20 Position and Elevation of Exploratory Holes</u></p> <p>The Contractor shall submit samples of the format by which they propose to present exploratory hole records, laboratory test results, in situ test results or other information of such nature to the Employer's Representative for approval within 3 days of appointment. The location and elevation of all exploratory holes shall be defined in relation to ITM Co-ordinates and Ordnance Datum</p> <p><u>S1.8.21 Access</u></p> <p>The Contractor will be required to engage with WI to agree on a sequence of works at least 2 weeks prior to the commencement of works. This sequence will include dates and times that vehicles and personnel will be required to enter/leave site.</p> <p>A representative of WI and another from the chosen Contractor will attend a weekly meeting arranged by WI to advise on upcoming works to ensure that any potential delays in programme are voiced with the Client.</p> <p>Liaison with landowners, local residents and all relevant statutory bodies is deemed to be included in the Tender Price.</p> <p>The cost associated with avoiding damage and the compensation for any damage caused will be included in the rates. Any vegetation clearing works which the Contractor deems necessary should be discussed and agreed WI in advance. Any vegetation clearing works required should be included in the rates.</p> <p>Where the contractor is required to travel along a field to reach the proposed investigation location, any disturbance to the ground shall be kept to a minimum. The Contractor shall be responsible for reinstating the property and all surfaces at the earliest possible opportunity, and in all cases within 2 weeks of completion of the works within the private land (unless otherwise agreed with the landowner) to its original condition and shall be responsible for all costs associated with same.</p> <p>Any temporary works created to provide the access shall be discussed with the Employer's Representative if deemed necessary and reinstated as soon as possible after the completion of the exploratory works.</p> <p><u>S1.8.22 Notice of Entry</u></p> <p>The contractor shall provide WI the maximum period of notice as is possible (minimum period of three weeks) prior to the</p> |
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|      |                                                                                   | <p>commencement of works. In no circumstance shall the period of notice be less than three weeks. Following this, access to site shall be coordinated between the Contractor and WI for the duration of the works. The Employers Representative will endeavour to contact all private landowners in advance of the award of the Contract to advise them of the proposed works if necessary. A data protection disclaimer will be required to be signed by the Contractor.</p> <p><u>S1.8.23 Deliverables</u></p> <p>All laboratory testing shall be completed, and draft reports and drawings shall be submitted to the Employer's Representative within 21 days of completion of the site works. The Contractor shall allow 7 days for review of the draft reports and drawings by the Employer's Representative. The final reports and drawings are required within 7 days of receipt of the Employer's Representative's comments.</p> <p><u>S1.8.24 Making Good</u></p> <p>All walls, fences and hedges etc. breached or otherwise disturbed during the progress of the Works shall be immediately repaired with stockproof barriers irrespective of whether stock is occupying the land or not and in the case of gates an equivalent replacement shall be provided.</p> <p><u>S1.8.25 Maintenance Period</u></p> <p>The Contractor will be responsible for the maintenance of all reinstated openings for a 24-month period after the Performance Period.</p> |
| S1.9 | Percussion boring (Specification Section 4) Particular restrictions / relaxations | <p>As per Specification except:</p> <p><u>S1.9.4 Inspection pits</u></p> <p>The boreholes shall be commenced by hand digging an inspection pit to 1.2m depth where services can be predicted.</p> <p><u>S1.9.5 Refusal</u></p> <p>Where a borehole meets refusal before the scheduled depth, the Contractor shall proceed as per Cl. 4.3 of the EI Specification.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

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| S1.10 | Rotary drilling<br>(Specification Section 5) Particular restrictions / relaxations       | As per Specification.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| S1.11 | Pitting and trenching<br>(Specification Section 6) Particular restrictions / relaxations | <p>As per Specification except:</p> <p><u>S1.11.1 Buried Services</u></p> <p>The contractor shall ensure that a safe system of work is put in place for all exploratory holes which is in line with the guidance provided by the HSA Code of Practice for Avoiding Danger from Underground Services. The contractor shall consult all relevant drawings of existing services. Although it is not envisaged to encounter underground services for the duration of the works, all boreholes and trial pits are to be preceded by a CAT scan and a hand dug pit to a depth of 1.0m to check for buried services.</p> <p><u>S1.11.2 Restrictions on plant or pitting/trenching methods</u></p> <p>The Contractor shall allow for dewatering of trial pits in his price. It is expected to require some level of dewatering due to tidal presence. The Environmental specialist will be required to assess the water taken from the pit in order to deem it clean/dirty which will determine its method of disposal.</p> <p><u>S1.11.6 Backfilling</u></p> <p>Backfilling of the pits and trenches shall be conducted as soon as practicable with material replaced at a similar depth as encountered. The backfill shall be compacted using excavation plant in such a manner as to minimise any subsequent depression at the ground surface. In paved areas, reinstatement shall be undertaken in accordance with Clause 3.16.3 or 3.16.4 as appropriate.</p> <p><u>S1.11.7 Photographic Requirements</u></p> <p>All pits / excavations to be photographed. Photographs should include a graduated scale and photos of spoil heaps should</p> |

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|       |                                                                                                                        | also be included for each excavation. All photographs are to be Geo-tagged.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| S1.12 | Sampling and monitoring during intrusive investigation (Specification Section 7) Particular restrictions / relaxations | <p>As per Specification except:</p> <p><u>S1.12.3 Frequency of Geotechnical Sampling</u></p> <p>Disturbed bulk samples to be collected at 1m intervals and at changes in strata type. In boreholes, U100 samples shall be taken in cohesive strata at 1m intervals or as directed by the Investigation Supervisor and immediately followed by an SPT test. U100 sample tubes are to be in accordance with BS EN ISO 22475-1:2006 and to be manufactured by metal. Use of plastic liners is not permitted.</p> <p>Bulk samples of 10-20kg required for grab samples between surface level and 0.5mBGL. Sample weight required on the basis that coarse granular material is obtained to be able to effectively carry out PSDs.</p>                                          |
| S1.13 | Probing and cone penetration testing (Specification Section 8) Particular restrictions / relaxations                   | As per Specification. Probing is to be Dynamic Probe Super Heavy (DPSH). Mackintosh probing required for the marine grab samples and shall be carried out to a depth of 5m BGL or refusal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| S1.14 | Geophysical testing (Specification Section 9) Particular restrictions / relaxations                                    | Please Refer to Appendix E.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| S1.15 | In situ testing (Specification Section 10) Particular restrictions / relaxations                                       | <p>As per Specification except:</p> <p><u>S.15.1 Insitu Standard Penetration Tests</u></p> <p>SPTs to be conducted at 1.0m intervals, from completion of initial inspection pit (1.2m BGL), or 0.5m where inspection pits are not required, for full depth of all boreholes.</p> <p><u>S.15.1 Insitu Permeability Tests</u></p> <p>Insitu permeability is to be completed in all boreholes with standpipes. Insitu permeability test shall comprise either variable (falling) head or constant head tests. Contractor to allow for quantity as stated in pricing document BOQ. The Investigation Supervisor shall determine the choice of test (variable or constant). Prior to backfilling boreholes, the Contractor must contact the Investigation Supervisor with a</p> |

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|       |                                                                                                             | brief description of the borehole log, at which point the Investigation Supervisor will instruct to proceed with a permeability test. A method statement is required prior to conducting any permeability test.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| S1.16 | Instrumentation<br>(Specification Section 11)<br>Particular restrictions / relaxations                      | <p>As per Specification except:</p> <p><u>S1.16.1 Protective covers for installations</u></p> <p>The standpipe installation shall be a flush lockable cover type as per the Specification. Heavy duty caps are required for instrumentation located at hard standing and paved areas. Refer to pricing document.</p> <p><u>S1.16.3 Standpipe and standpipe piezometer installations</u></p> <p>Standpipe piezometers are required in selected boreholes. The depths of these installations are to be confirmed by the Investigation Supervisor depending on the ground conditions encountered. Following completion of boreholes, the Investigation Supervisor is to be contacted to determine response zones. Refer to Appendix B for the general requirements for these installations. Dataloggers to be installed in all standpipes for a period of 6 weeks following end of fieldwork.</p> <p><u>S1.16.5 Development of standpipes and standpipe piezometers</u></p> <p>At the completion of drilling and standpipe installation, the hole shall be cleaned and developed prior to any subsequent sampling of groundwater</p> |
| S1.17 | Installation monitoring and sampling<br>(Specification Section 12)<br>Particular restrictions / relaxations | <p>As per Specification except:</p> <p><u>S1.17.1 Groundwater level readings in installations</u></p> <p>Each standpipe shall be read twice manually (dipped) during the fieldwork period. Dataloggers shall be installed and read for a period of 6 weeks following the fieldworks. The 6-week period for all dataloggers shall commence on the last day of fieldwork as agreed with the Employer's Representative. The Contractor shall visit site after 3 weeks and again after 6 weeks to manually dip standpipes to use as a cross check of final data logger data. The Contractor shall deliver the results in editable tabular format as agreed with the Employer's Representative. Both water level and base of hole/installation shall be recorded in the field records</p>                                                                                                                                                                                                                                                                                                                                              |

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| S1.18 | Daily records (Specification Section 13) Particular restrictions / relaxations                        | <p>As per Specification except:</p> <p><u>S1.18.1 Information for Daily Records</u></p> <p>The Daily Report shall be accompanied by relevant digital photographs of slit trenches, inspection pits etc. and shall be submitted by email to the Employers Representative at the beginning of the following working day. Contact details TBC at project kick off. The Contractor shall also call the Employer's Representative at the end of each day to make the Employer's Representative aware of progress.</p>                                                                                                                                                                                                       |
| S1.19 | Geotechnical laboratory testing (Specification Section 14) Particular Restrictions / relaxations      | <p>As per Specification except:</p> <p><u>S1.19.1 Investigation Supervisor or Contractor to schedule testing.</u></p> <p>Investigation Supervisor to schedule testing. The Contractor shall prepare a draft log and laboratory testing schedule for approval by the Employer's Representative.</p> <p>Contractor to provide the ER with a blank testing schedule for each exploratory hole, populated with the samples taken, and the associated draft exploratory hole log within 48 hours of the completion of each hole to facilitate the scheduling of testing.</p> <p><u>S.19.2 Tests Required</u></p> <p>As per attached BOQ/ pricing document. Refer to Appendix C.</p>                                         |
| S1.20 | Geo-environmental laboratory testing (Specification Section 15) Particular restrictions / relaxations | <p><u>Tests Required</u></p> <p>Refer to Appendix F for details.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| S1.21 | Reporting (Specification Section 16) Particular restrictions / relaxations                            | <p>As per Specification except:</p> <p><u>Daily Reports</u></p> <p>As per Clause S1.18 of Schedule 1.</p> <p><u>Reporting</u></p> <p>Within 14 days of completion of the works on site, the Contractor shall submit to the Employer's Representative a draft report detailing the work undertaken. Drawings appended to the Report shall also be submitted in AutoCAD format and shall detail the 'X' and 'Y' co-ordinates of each test excavation hole to ITM Grid System. A 'Z' coordinate should be provided on logs. The Contractor shall be responsible for the submission of the report and shall submit one electronic draft version of the Final report within 14 days of completion of the site works for</p> |

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|  |  | <p>approval. On approval, 1 no. soft copy in PDF format and 2 no. hard copies of the report shall be submitted within 7 days.</p> <p><u>Drawings</u></p> <p>Drawings shall be provided in both PDF and native CAD (DWG) Format which shall be referenced to the ITM Grid System. The Contractor will supply detailed plan and sectional drawings showing reference marker, ground levels (in mOD)</p> <p><u>Digital Data</u></p> <p>Preliminary issues of digital data are required, as detailed in Clause 16.1 of the EI Specification. 1 No. digital copy of the Draft Factual Reports shall be provided by the Contractor for approval. 1 No. digital copy of the Final Factual Report and AGS format data shall be provided by the Contractor. All data shall be supplied in AGS v4 format. A digital copy of all photographs shall be supplied to the Employer's Representative. Photographs should include a graduated scale and photos of spoil heaps should also be included for each excavation.</p> |
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## Appendix B – Standpipe & Standpipe Piezometer Details

### B1.1 Standpipes

1. The standpipe shall consist of un-plasticised polyvinylchloride (uPVC), or high-density polyethylene (HDPE) tubing as specified and not less than 19mm internal diameter.
2. The base of the tubing shall be plugged and the lower 1.0m of tubing perforated by holes not greater than 5mm in diameter at intervals of approximately 75mm or an equivalent area of slots not greater than 5mm width.
3. The filter shall be pea gravel, or similar material, as approved by the Employer's Representative, 6-10mm in diameter.
4. Where the depth of the exploratory hole is greater than the depth to which the filter and tubing are to be installed then the exploratory hole shall be backfilled with impermeable materials (cement bentonite grout), approved by the Employer's Representative, to the base of the filter.
5. The gravel filter shall be placed in the exploratory hole up to the level of the proposed base of the tubing.
6. The tubing with a centralising device attached within the perforated zone shall be lowered carefully down the exploratory hole to the level of the filter material and the exploratory hole backfilled to within 1.0m of ground level with filter gravel or other materials approved by the Employer's Representative. The elevations of the base of the tubing and top and base of the filter shall be recorded.
7. The top of the tubing shall be covered by a plastic cap or similar, as approved by the Employers Representative. An air vent shall be provided as indicated on Drawing B1.1 below.
8. Arrangements to prevent the ingress of surface water and to protect the top of the tubing shall use a steel barrel of 75mm diameter, a 150mm stopcock cover, or an alternative as agreed with the Employers Representative. The protective cover shall be set in concrete. Protective fencing, where required, shall be in accordance with Clause 4.4.

### B1.2 Standpipe piezometers

1. The final details of any piezometer installation will be decided by the Employers Representative and will depend upon the actual subsoil and groundwater conditions found. The installation shall be generally as shown in Drawing B1.2 below.
2. The piezometer tip shall consist of a porous ceramic element or other suitable element not less than 150mm long with a diameter not less than 19mm and shall be protected at each end by un-plasticised polyvinylchloride (uPVC) fittings. The ceramic shall have a pore diameter of the order of 60 microns and permeability of the order of  $3 \times 10^{-4}$  m/s.
3. The uPVC tubing shall be according to BS 3506 Class 6 nominal size 19mm and shall be supplied and installed in not less than 3m lengths, except for one shorter length as required to suit the total standpipe dimensions. The tubes shall be jointed together and to the porous element with approved couplings and glue in such a manner that the joints remain leakproof under the anticipated head of water.

4. Where the depth of the completed exploratory hole is greater than the depth at which the porous element and sand filter are to be installed then the lower part of the exploratory hole shall be grouted. A grout consisting of cement and bentonite in the proportions of 1:1 by weight shall be prepared by thorough mixing with approved equipment and with only sufficient water to form a pumpable mix. Where the exploratory hole is dry, sufficient grout shall be placed in the hole using a tremie reaching to the bottom of the hole, such that the top of the grout shall just reach its interface with the sand filter. Where there is water in the exploratory hole, the top of the grout shall finish 1.0m below the proposed grout/filter interface. A similarly proportional mixture of cement/bentonite shall then be prepared but having just sufficient water to form a cohesive paste. This mix shall be formed into balls of approximately 75mm diameter and placed in the exploratory hole and punned with a suitably shaped punner to form a homogeneous plug to the exploratory hole without significant voids between adjacent bags. The top of this plug shall be at the interface with the sand filter. Compressed bentonite pellets may be used as an alternative to the grout balls where the inflow of water into the piezometer is sufficient for immediate saturation.
5. If water in the exploratory hole becomes contaminated by grout, it shall be replaced by clean water, the method being to the approval of the Employers Representative.
6. The sand filter surround to the porous elements shall be clean and fall wholly between the limits of grading 1200 and 210 microns, and the volume of the sand filter placed shall be recorded.
7. That portion of the sand filter below the porous element shall be placed first, and methods such as tremie pipe shall be used to ensure that no sand adheres to the soil in the sides of an unlined exploratory hole. Where there is water in an exploratory hole the Contractor shall allow sufficient time for all the sand to settle. The final elevation of the top of this sand shall be recorded. The porous element shall be placed in the hole with the vertical axis of the porous element co-incident with the vertical axis of the exploratory hole. The remaining sand filter shall then be added as described above.
8. Further grout balls or compressed bentonite pellets shall be placed on top of this sand filter to form a plug not less than 0.5m thick. The remainder of the exploratory hole shall be filled with grout to ground level according to the procedure described in Sub-clause 4 above.
9. The top of the uPVC tubing shall be covered by a plastic cap or similar as approved by the Employer's Representative. An air vent shall be provided as shown on Drawing B1.2 below.
10. Arrangements to prevent the ingress of surface water and to protect the top of the uPVC tubing shall use a steel water barrel of 75mm diameter, a 150mm stopcock or an alternative as agreed with the Employers Representative. The protective cover shall be set in concrete. Protective fencing where required shall be in accordance with Clause 4.4.
11. The groundwater level shall be recorded immediately before and after installation of the piezometers
12. Before readings commence the piezometers shall be filled with water and its correct functioning demonstrated to the Employers Representative. Each piezometer shall be clearly and permanently labelled with a metal stamp or tag giving the exploratory hole number.

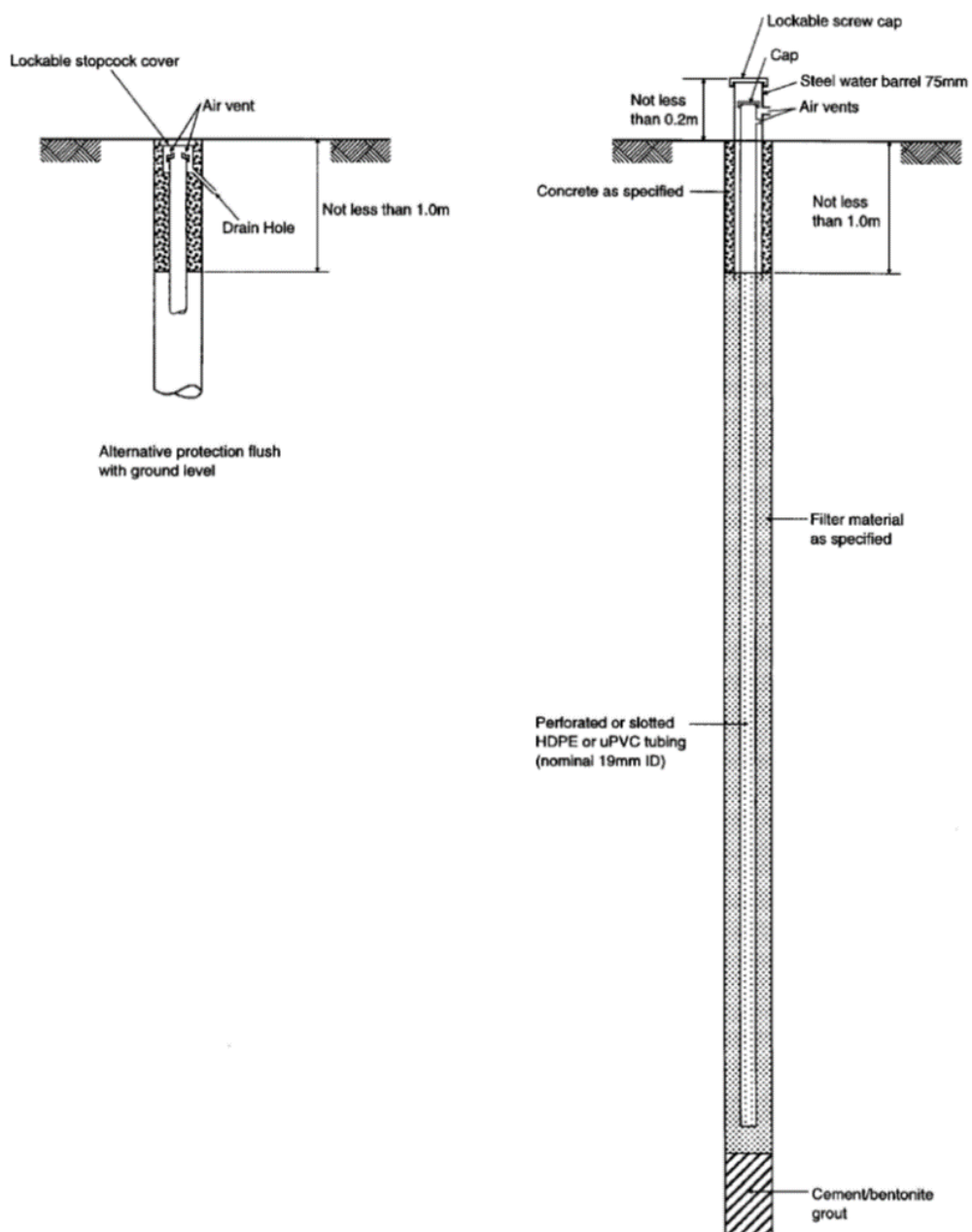


Figure B1.1: Standpipe Details

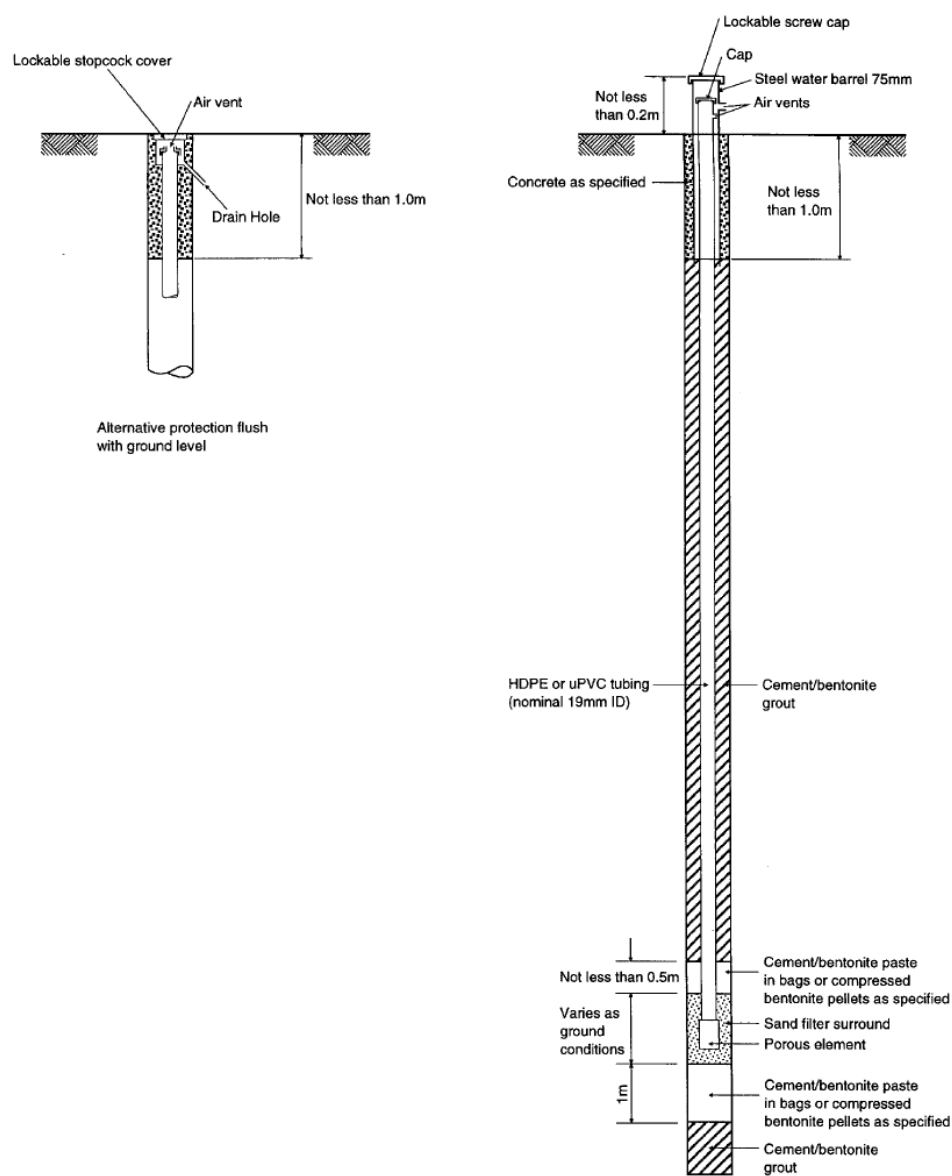


Figure B1.2: Standpipe Piezometer Detail

## Appendix C – Exploratory Hole Schedules

## Appendix D – Drawings

## Appendix E – Geophysical Survey Requirements

### River Based Geophysics Requirements

#### E1. Scope and Objectives

A river-based geophysical survey shall be undertaken within the extents of the proposed works, including the weir, fish pass, scour protection measures and associated access corridor.

The objectives of this survey are to:

- Determine riverbed levels
- Establish the thickness and lateral extent of superficial deposits (overburden)
- Infer the depth to and profile of rockhead
- Identify any significant subsurface features (e.g. buried channels, obstructions, variable strata)

The survey shall be designed and executed by a suitably qualified and experienced marine geophysical contractor.

#### E2. Survey Extents and Line Spacing

The survey shall be undertaken within the extents shown on the Contract Drawings.

Survey lines shall include:

- Longitudinal lines parallel to river flow
- Transverse cross-sections across the channel

Minimum line spacing shall be:

- 5 to 10m centres in critical areas (weir, fish pass, scour protection zones)
- Up to 15-20m centres in less critical areas, subject to agreement with the investigation supervisor

Additional infill lines shall be undertaken where initial data quality is poor or where interpretation is uncertain.

#### E3. Survey Methodology

##### E3.1. Bathymetric Survey

A bathymetric survey shall be carried out to determine river bed levels using:

- Single beam or multibeam echo sounding

The survey shall:

- Provide full coverage of the survey extents
- Be corrected for water level variations
- Be referenced to the project datum (mOD)

### **E3.2. Sub-bottom Profiling (Primary Method)**

High-resolution sub-bottom profiling shall be undertaken using:

- CHIRP acoustic profiler or equivalent approved system

The system shall be capable of:

- Penetrating underlying sediments
- Resolving key subsurface interfaces
- Identifying the boundary between overburden and competent strata/rock

The survey shall produce continuous profiles along all survey lines.

### **E3.3. Supplementary Geophysical Methods**

Where sub-bottom profiling alone does not provide sufficient penetration or resolution to confidently identify rockhead, the Contractor shall implement supplementary techniques, which may include:

- Seismic refraction
- Seismic reflection

The Contractor shall assess ground conditions and justify the selected method(s) within the method statement.

### **E3.4. MASW (Optional)**

Multichannel Analysis of Surface Waves (MASW) may be proposed as a supplementary technique to:

- Identify stiffness contrasts within subsurface materials
- Support interpretation of stratigraphy

MASW shall not be used as the sole method for determining rockhead depth.

## **E4. Survey Control and Positioning**

All survey data shall be accurately positioned using:

- Differential GPS (DGPS) or equivalent

Accuracy requirements:

- Horizontal accuracy:  $\pm 0.5\text{m}$  or better
- Vertical accuracy:  $\pm 0.1\text{m}$  or better

All levels shall be reduced to the project datum (mOD)

## **E5. Survey Control and Positioning**

The Contractor shall account for site-specific constraints, including:

- Shallow and variable water depths
- Flow conditions and turbulence (Particularly in the vicinity of the weir)

- Aerated water affecting acoustic signal quality
- Vegetation, debris and obstructions
- Access limitations

Where data quality is compromised

- Additional survey passes shall be undertaken
- Alternative methods shall be considered

## **E6. Ground Truthing and Correlation**

Geophysical data shall be correlated with intrusive ground investigation, including:

- Boreholes
- Probing locations

The Contractor shall ensure that:

- Survey lines pass close to intrusive investigation locations
- Interpretations are calibrated against known ground conditions

Geophysical data shall not be used in isolation for design purposes

## **E7. Deliverables**

The Contractor shall provide the following:

### **E7.1. Raw Data**

- Bathymetric survey data
- Geophysical survey records

### **E7.2. Processed Data**

- Corrected bathymetric surfaces
- Processed sub-bottom profiles
- Seismic records (where applicable)

### **E7.3. Interpretive Outputs**

- Longitudinal sections
- Excavatability assessment
- Cross sections
- Plans showing the following:
  - Riverbed levels
  - Overburden thickness
  - Inferred rockhead levels and contours

#### **E7.4. Interpretive Report**

The report shall include:

- Description of survey methods and equipment
- Survey coverage and line spacing
- Data processing techniques
- Geological and geophysical interpretation
- Identification of key strata boundaries
- Interpretation of rockhead profile
- Excavatability Assessment
- Assessment of confidence and limitations of the data

#### **E8. Method Statements**

Prior to commencement of works, the Contractor shall submit a detailed method statement for approval, including:

- Proposed survey techniques
- Equipment specifications
- Survey line layout
- Quality assurance procedures
- Health and safety considerations
- Contingency measures for poor data quality

#### **E9. Standards and Guidance**

All works shall be carried out in accordance with the relevant industry standards and best practice for marine geophysical surveys.

## **Land Based Geophysics Requirements**

### **E10. Scope of Works**

The Contractor shall undertake a programme of land-based geophysical surveys along the river bank and adjacent areas to support the geotechnical assessment of the proposed works.

The purpose of the survey is to:

- Determine the depth to rockhead
- Establish the thickness and variability of overburden deposits
- Identify zones of weak or saturated ground
- Assist in the development of a refined ground model
- Support and optimise the location of intrusive Ground Investigation (GI)

The geophysical data shall be correlated with available GI data and the river-based geophysical survey results.

### **E11. Survey Methods**

The survey shall comprise the following techniques as a minimum:

#### **E11.1 Multichannel Analysis of Surface Waves (MASW)**

- MASW surveys shall be carried out to determine shear wave velocity ( $V_s$ ) profiles.
- The results shall be used to:
  - Infer stratigraphy
  - Identify stiffness contrasts
  - Estimate depth to competent strata / rockhead
- Survey parameters shall include:
  - Minimum spread length appropriate to achieve target investigation depth (typically 10–30 m)
  - Adequate geophone spacing to ensure sufficient resolution
  - Use of an appropriate seismic source (e.g. sledgehammer or weight drop)

#### **E11.2 Electrical Resistivity Tomography (ERT)**

- ERT surveys shall be undertaken to define:
  - Variations in material type
  - Moisture/saturation conditions
  - Potential soft or organic deposits
  - Rockhead where resistivity contrast permits

- The Contractor shall:
  - Select an appropriate electrode array (e.g. Wenner, Schlumberger or dipole-dipole)
  - Ensure electrode spacing is suitable to achieve the required depth of investigation
  - Account for ground conditions to ensure good electrode contact

### **E11.3 Seismic Refraction (Optional)**

- Where considered appropriate, seismic refraction may be used to supplement MASW data to assist in identifying rockhead levels.
- The suitability of this method shall be assessed based on expected ground conditions.

### **E12. Survey Layout**

- Survey lines shall be positioned to complement the proposed GI locations and river-based geophysical data.
- As a minimum:
  - Survey lines shall be oriented perpendicular to the river channel to capture lateral variability.
  - Additional longitudinal lines may be required where significant variability is anticipated.
- Survey coverage shall extend:
  - From the river bank inland, where access permits
  - Across key features such as:
    - Proposed access tracks
    - Fish pass alignment
    - Weir interface zones
- Final survey locations shall be agreed with the Employer's Representative prior to commencement.

### **E13. Data Acquisition Requirements**

The Contractor shall:

- Ensure appropriate ground contact for all equipment:
  - Good geophone coupling for MASW
  - Adequate electrode contact for ERT

- Adjust methodology where necessary to suit:
  - Soft ground
  - Vegetation cover
  - Variable moisture conditions
- Record all relevant metadata including:
  - Survey locations (to be surveyed to an agreed coordinate system)
  - Ground conditions at each line
  - Equipment used and acquisition parameters

#### **E14. Data Processing and Interpretation**

The Contractor shall:

- Process all data using industry-standard software
- Provide interpreted outputs including:
  - Shear wave velocity (Vs) sections (MASW)
  - Resistivity sections (ERT)
  - Interpreted ground profiles
- Interpretations shall include:
  - Estimated depth to rockhead
  - Overburden thickness
  - Identification of soft/weak zones
  - Correlation with existing GI and river-based geophysical data
- Any uncertainties or limitations in the interpretation shall be clearly stated.

#### **E15. Deliverables**

The Contractor shall provide a Geophysical Interpretative Report including:

- Survey methodology and equipment used
- Survey layout plans and coordinates
- Processed geophysical sections
- Interpreted ground models
- Correlation with GI data
- Identification of anomalies and areas requiring further investigation

All data shall be provided in digital format, including:

- Raw data files
- Processed data
- CAD/GIS-compatible outputs

## **E16. Quality Assurance**

- All works shall be carried out by suitably qualified and experienced personnel.
- Equipment shall be calibrated and maintained in accordance with manufacturer requirements.
- Data quality shall be reviewed on site to ensure:
  - Adequate signal quality
  - Sufficient depth penetration
  - Repeatability where required

## **E17. Health, Safety and Environmental Considerations**

The Contractor shall:

- Undertake all works in accordance with relevant health and safety legislation
- Consider risks associated with:
  - Uneven ground
  - Proximity to watercourses
  - Buried services
- Minimise disturbance to:
  - Vegetation
  - River bank stability
  - Environmentally sensitive areas

## Appendix F – Environmental Contamination Testing Requirements

Contamination testing is required for the following GI locations:

AY-TP 09 – Surface level

AY-TP 10 – Surface level

AY-GS 01 – Surface level

AY-GS 02 – Surface level

AY-GS 03 – Surface level

AY-GS 04 – Surface level

AY-GS 05 – Surface level

AY-GS 06 – Surface level

AY-GS 07 – Surface level

AY-GS 08 – Surface level

The scope of the contamination testing (To be carried out on the above GI samples) shall follow the EI specification Suite I – Non-Hazardous / Hazardous WAC Testing (Schedule 1.20.5). The above samples shall glass jar samples.

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## Appendix G – Environmental Commitments