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Llanddulas & Kinmel Bay Coastal Defence Improvements OBC

Specification for Ground Investigation

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	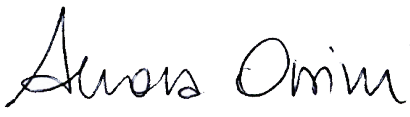	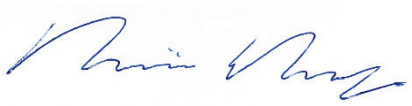

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Contents

The Specification shall be the UK Specification for Ground Investigation (Second Edition) produced by the Site Investigation Steering Committee and published by ICE Publishing with the following schedules:

Schedule 1 – Information and Site Specific Requirements

Schedule 2 – Exploratory Holes

Schedule 3 – Investigation Monitor's Facilities

Schedule 4 – Specification amendments

Schedule 5 – Specification Additions

1. Schedule 1: Information and site specific requirements

1.1. Name of Contract

Llanddulas & Kinmel Bay Coastal Defence Improvements OBC Ground Investigation.

1.2. Investigation supervisor

To be provided by the Engineer to the Contractor. Name and contact details to be advised.

1.3. Description of site

The coast of north Wales, along with north-west England, is mostly comprised of soft glacial and post glacial unconsolidated materials, which have had a long term trend of receding. These stretches of coastline have had continued issues of foreshore lowering and long term recession, with accretion occurring in estuaries and bays. Many of the natural beaches on this coastline are comprised of a combination of sand dunes, salt marshes, or shingle ridges.

On the west end at Llanddulas, poorly sorted shingle comprises most of the beach. Patches of coarse sand are scattered, suggesting the shingle is underlain with sand in some areas of the beach. Moving eastward shingle amounts decrease up to the River Clwyd, where a wide sandy beach and dune system dominates.

The upper shingle portion of much of this frontage is comprised of a series of shore parallel ridges that form a steep and reflective barrier, with downslope organization of material by shape and size. Two distinct shingle ridges are typically observed based on regular monitoring surveys, which are more notable to the western portion of the frontage. The shingle ridge at Abergele and Pensarn is wider than much of the rest of the frontage, with vegetation growing as well. This area is a designated Site of Special Scientific Interest (SSSI), representing over 10% of Wales' total resource of vegetated shingle (CCBC, 2017).

The existing coastal defences along this stretch of coastline consist of a combination of timber and rock groynes, revetments, cobbled beaches, seawalls and floodgates. Currently this section of coastline between Llanddulas and Kinmel Bay is subjected to frequent wave overtopping of the primary defences, leading to flooding of nearby properties and local infrastructure. This risk is expected to increase due the effects of climate change, which will primarily result in increased mean sea levels. The study areas are presented in the Figure below.

Figure 1.1: Llanddulas Quarry Jetty to Kinmel Bay Management Units

Source: HR Wallingford

1.4. Main works proposed and purpose of this contract

The main objectives of the protection scheme are:

- Reduce flood damages to residential and non-residential properties;
- Ensure community and stakeholder engagement to ensure 'buy-in' for the scheme;
- Develop a scheme that is deliverable within engineering and time constraints;
- Develop a scheme that is adaptable to change; and,
- Sustain and/or improve the tourist and amenity benefits though the continued operation of the beach and the North Wales Coastal route.

After considering the long list of options as discussed in the Outlined Business Case (OBC) for the alleviation of the flood damages along the coastal frontage from Llanddulas to Kinmel and reviewing the potential flood risk to the 11km frontage, a short list of options were selected to be taken forward to preliminary design and economic appraisal. The preferred option to be taken forward to detailed design from this appraisal was:

Option 4 - Hard Engineering Option.

1.5. Scope of Investigation

The GI is anticipated to include the following:

- 11 No. machine-excavated trial pits to 3.0m depth;
- Sampling for geotechnical purposes (bulk sampling);
- Geotechnical soils laboratory testing;
- Factual ground investigation report production.

The following schedules are not used in this GI specification:

- Schedule 4: Specification Amendments;
- Schedule 5: Specification Additions.

1.6. Geology and Ground Conditions

No previous ground investigation is available at or near the location of the proposed works. The following is intended as background information and is not to be relied on.

The coast of north Wales, along with north-west England, is mostly comprised of soft glacial and post glacial unconsolidated materials, which have had a long term trend of receding. Many of the natural beaches on this coastline are comprised of a combination of sand dunes, salt marshes, or shingle ridges.

On the west end at Llanddulas, poorly sorted shingle comprises most of the beach. Patches of coarse sand are scattered, suggesting the shingle is underlain with sand in some areas of the beach. Moving eastward shingle amounts decrease up to the River Clwyd, where a wide sandy beach and dune system dominates.

The upper shingle portion of much of this frontage is comprised of a series of shore parallel ridges that form a steep and reflective barrier, with downslope organization of material by shape and size. Two distinct shingle ridges are typically observed based on regular monitoring surveys, which are more notable to the

western portion of the frontage. The shingle ridge at Abergele and Pensarn is wider than much of the rest of the frontage, with vegetation growing as well.

1.7. Schedule of drawing(s) and documents

The following figures and documents form part of the Schedules:

Appendix A – Proposed exploratory hole location plans

Appendix B – Design drawings

Appendix C – C_Map & Navionics Figures

Appendix D – Method statement

Appendix E – Access routes

Potential specific routes across the site are indicated in Appendix E. The Contractor shall select the optimum route based on the equipment he will use to undertake the investigation and shall restrict movement to/from individual locations in order to minimise any damage.

1.8. General Requirements (Specification Section 3) particular restrictions / relaxations

Access to exploratory hole locations shall be agreed in advance of the main works with IS and relevant landowners where applicable. It is strongly recommended that the Contractor visits the site to establish access restrictions to borehole locations.

1.8.1. Quality Management System (Clause 3.3)

All deliverables shall be checked and reviewed in accordance with the Contractors quality management system.

1.8.2. Professional Attendance (Clause 3.5.2)

Full time professional attendance shall be required for the duration of the GI works and the Contractor shall provide a suitably qualified engineering geologist for logging of exploratory holes and recovery of samples.

The cost of professional attendance shall be included in the rates for drilling and boring within the Bill of Quantities.

1.8.3. Provision of ground practitioners and other personnel (Clauses 3.6.1 and 3.6.2

Not required.

1.8.4. Hazardous Ground, land affected by contamination and notifiable and invasive weeds (Clauses 3.7.1 and 3.22)

All work shall be carried out in accordance with the Site Investigation Steering Group "Guidelines for the Safe Investigation of Drilling of Landfills and Contaminated Land, 1993".

The IS shall be notified immediately if any evidence of potential contamination (i.e. unusual colour, odour, texture, appearance, etc.) is found during the investigation. If this occurs, the Contractor shall take all reasonable steps to prevent the migration of contamination.

No invasive species are anticipated to be present at the Site, however, the IS shall be notified immediately if the Contractor believes invasive species have been identified in the work area.

No UXO risk assessment has been completed for the site of the proposed ground investigation.

1.8.5. Additional information on services not shown on Contract drawings

Appendix C shows the approximate location of existing cables, including High Voltage cables of the Rhyl Flats Offshore Wind Farm. The information on the plans is given without warranty, and its accuracy cannot be guaranteed. No liability of any kind whatsoever is accepted by HR Wallingford or the Client for any error or omission. The Contractor should refer to any more current plans or other information that may be available from the Offshore Wind and other utility companies.

In relation to planning the work, locating and identifying buried services and safe excavation, attention is drawn to the Health & Safety Executive publication HSG 47 a free copy of which can be downloaded from the Health & Safety Executive website. HSG 47 outlines the potential dangers of working near underground services and gives advice on how to reduce any direct risks to people's health and safety, as well as the indirect risks arising through damage to services. It is the Contractor's responsibility to ensure that accurate and up-to-date information is provided to all persons working on or near buried services.

The Contractor must comply with relevant statutory distances, or safe distances if they exceed statutory distances, from any known or suspected services.

Where applicable for any safety critical services such as gas or electricity, the utility company must be brought out to site to trace their pipes and cables.

1.8.6. Known/suspected mine workings, mineral extractions etc. (Clause 3.7.3)

Not used.

1.8.7. Protected Species (Clause 3.7.4)

Not used.

1.8.8. Archaeological remains (Clause 3.7.5)

Not used.

1.8.9. Security of site (Clause 3.11)

Not required.

1.8.10. Traffic Management Measures (Clause 3.12)

Not required.

1.8.11. Restricted working hours

Normal working hours unless agreed with the Client.

1.8.12. Trainee site operatives (Clause 3.14.1)

Not permitted. All site operatives shall be able to demonstrate having achieved the required level of competence for operating plant and equipment, and for works undertaken on construction sites hold a CITB card. Furthermore evidence of current appropriate health and safety training shall be provided, including current CSCS card.

1.8.13. Contamination avoidance and/or aquifer protection measures required (Clauses 3.15.2 and 3.15.3)

Although unexpected, if contamination is encountered, equipment shall be decontaminated as appropriate prior to drilling subsequent exploratory holes.

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

Not used.

1.8.15. Reinstatement requirements (Clause 3.16)

Not used.

1.8.16. Hygiene facilities required (Clauses 2.20 and 3.16.1)

The Contractor shall provide appropriate welfare and hygiene facilities for his staff, the IS and visitors to the Site.

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

Unavoidable damage is required to be made good by the Contractor prior to demobilisation from site.

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

All exploratory positions shall be provided using the UK National Grid coordinate system to an accuracy of 0.1m.

The ground level elevation shall be established at all exploratory hole locations to an accuracy of 0.1m relative to Ordnance Datum.

1.8.19. Photography Requirements (Clause 3.25)

Not required.

1.9. Percussion boring (Specification Section 4) Particular restrictions / relaxations

Not required.

1.10. Percussion boring (Specification Section 4) Particular restrictions / relaxations

Not required.

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

1.11.1. Indirect detection of buried services and inspection pits

A GPR survey shall be undertaken to identify the location of buried services at the location of each proposed exploratory hole.

1.11.2. Restrictions on plant or pitting / trenching requirements

Not used.

1.11.3. Entry of personnel (Clause 6.5)

No person entry to excavations shall be permitted.

1.11.4. Alternative pit and trench dimensions (Clause 6.7)

Not used.

1.11.5. Abstracted groundwater from land affected by contamination (Clause 6.9.1 & 6.9.2)

Not used.

1.11.6. Backfilling (Clause 6.10)

After completion of sampling, in situ testing (where applicable) and a visual description of trial pits, the excavations will be backfilled in layers not more than 250mm thick and tamped into place by the excavator bucket. The material shall be replaced at a similar depth as encountered, especially for material

encountered near the top of the ground to avoid significantly effecting the erosion potential at the location of the trial pit.

1.11.7. Photographic requirements (Clause 6.12)

As specified.

1.11.8. Artificial lighting (Clause 6.12.2)

Not used.

1.11.9. Provision of pitting equipment and crew for Investigation

Not required.

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

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

Not used.

1.1.1. Retention and disposal of geotechnical samples (Clause 7.6.2)

Not used.

1.12.2. Frequency of sampling for geotechnical purposes (Clauses 7.6.3 to 7.6.11)

The sampling in trial pits shall be in accordance with the Specification.

1.12.3. Open tube and piston sample diameters (Clause 7.6.5)

Not used.

1.12.4. Retention of cutting samples (Clause 7.6.7)

Not used.

1.12.5. Delft and Mostap sampling

Not used.

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

As specified.

1.12.7. Special geotechnical sampling (Clause 7.8)

Not used.

1.12.8. Address for delivery of selected samples

Not used.

1.12.9. Retention and disposal of contamination WAC samples (Clause 7.9.3)

Not used.

1.12.10. Frequency of environmental sampling (Clause 7.9.4)

Not used.

1.12.11. Sampling Method (Clause 7.9.5)

Samples taken from boreholes, trial pits and hand-dug pits shall use the procedures identified in BS 10175 (2011+A1 2013) to avoid cross-contamination between samples. Disposable nitrile gloves are to be worn at each location.

1.12.12. Headspace Testing (Clause 7.9.8)

Not used.

1.12.13. Sample containers (Clause 7.9.6)

Not used.

1.12.14. Transportation and storage of samples (Clause 7.9.2)

As specified.

1.13. Probing and cone penetration testing

Not required.

1.14. Geophysical testing (Specification Section 9) Particular restrictions / relaxations

Not required.

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

1.15.1. Tests in accordance with British Standards (Clause 10.3)

Not required.

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

Not required.

1.16. Instrumentation (Section 11) Particular restrictions /relaxations

Not required.

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

Not required.

1.18. Daily Records (Specification Section 13) Particular restrictions / relaxations

1.18.1. Information for daily records

In addition to submission of daily records, the Contractor shall provide a telephone report to the IS each day during the fieldwork when he is not present on site.

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

Not used.

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

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

The Contractor will schedule sub-sampling and laboratory testing and issue to the IS for approval. The testing schedule sheets shall be supplied electronically in Microsoft Excel format (or similar) and be populated with sample identification data.

1.19.2. Tests required (Clause 14.1.2)

The following geotechnical/ laboratory tests may be required by the IS to be carried out on geotechnical soil samples:

- Particle size distribution (PSD) with sedimentation by pipette;
- Atterberg limit tests with natural moisture content determination;
- Shear box testing;
- Organic content.

1.19.3. Specifications for tests not covered by BS1377 and options under BS5930 (Clauses 14.2.1 and 14.4)

Not used.

1.19.4. UKAS accreditation to be adopted (Clause 14.5)

The testing shall be carried out in a laboratory accredited by UKAS.

1.19.5. Rock testing required (Clause 14.5)

Not required.

1.19.6. Chemical testing for aggressive ground / groundwater for concrete (Clause 14.6) (Test Suites A-D overleaf)

Not required.

1.19.7. Laboratory testing on site (Clause 14.7)

Not required.

1.19.8. Special laboratory testing (Clause 14.8)

Not required.

1.19.9. Laboratory Testing overdays

Not used.

1.20. Geoenvironmental laboratory testing (Specification Section 15) Particular restrictions / relaxations

Not required.

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

1.21.1. Form of exploratory hole logs (Clause 16.1 and 16.2.1)

As specified.

1.21.2. Information on exploratory hole logs

As specified in Section 3.2 of the Specification.

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

For data where no AGS format exists, data shall be supplied in Microsoft Excel compatible format (i.e. xlsx).

1.21.4. Preliminary digital data (Clause 16.5.3)

Not required.

1.21.5. Type(s) of report required (Clause 16.6)

A factual report only is required.

1.21.6. Electronic report requirements (Clause 16.6.3)

PDF reports shall be created directly from the source document and in accordance with the Specification.

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

Not required.

1.21.8. Contents of Ground Investigation Report (or specified part thereof) (Clause 16.8)

Not required.

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

Not required.

1.21.10. Times for supply of electronic information (Clause 16.10.1

Digital data shall be submitted with the Draft & Final Factual Reports.

1.21.11. Electronic information transmission media (Clause 16.10.2)

Draft and final digital data and draft and final Factual Report may be submitted by e-mail to the IS. The Final Factual Report shall be submitted in searchable, bookmarked PDF.

1.21.12. Report approval (Clause 16.11)

A Draft Factual report shall be submitted as a PDF copy including all attachments and appendices. The IS will require one week to review the draft report and return comments to the Contractor.

2. Schedule 2: Exploratory Holes

Llanddulas & Kinmel Bay Coastal Defence Improvements OBC Ground Investigation.

Table 2.1: Exploratory holes (coordinate system EPSG:27700)

Hole number	Scheduled depth (m BGL)*	Easting (m)	Northing (m)	Remarks
TP01	3.0	291648	378430	Machine excavated trial pit
TP02	3.0	291698	378388	Machine excavated trial pit
TP03	3.0	293029	378246	Machine excavated trial pit
TP04	3.0	295463	379108	Machine excavated trial pit
TP05	3.0	296346	379489	Machine excavated trial pit
TP06	3.0	296553	379614	Machine excavated trial pit
TP07	3.0	297709	380200	Machine excavated trial pit
TP08	3.0	297886	380310	Machine excavated trial pit
TP09	3.0	299024	380882	Machine excavated trial pit
TP10	3.0	299200	380968	Machine excavated trial pit
TP11	3.0	299337	381015	Machine excavated trial pit

**Depth required should be the maximum possible in the ground conditions encountered (up to a 4.5m depth), as satisfied by the IS.*

3. Schedule 3: Investigation Supervisor's Facilities

Not used.

4. Schedule 4: Specification amendments

Not used.

5. Schedule 5: Specification additions

Not used.

Annex – Bill of Quantities for Ground Investigation

Bill A General items, provisional services and additional items

Number	Item description	Unit	Quantity	Rate	Amount £
A	**General items, provisional services and additional items**				
A1	Offices and stores for the Contractor and sub-contractor	sum	1		
A2	Establish on site all plant, equipment and services for a Green Category site	sum	1		
A3	Extra over Item A2 for a Yellow Category site	sum			
A4	Maintain on site all site safety equipment for a Yellow Category site	week			
A5	Decontamination of equipment during and at end of intrusive investigation for a Yellow Category site	sum			
A6	Appropriate storage, transport and off-site disposal of contaminated arisings and any PPE equipment, excluding laboratory testing	provisional sum			
A7	Provide professional attendance in accordance with Clause 3.5.2	p.day			
A7.1	Provide Technician	p.day			
A7.2	Provide graduate ground engineer	p.day			
A7.3	Provide Experienced Ground Engineer	p.day			
A7.4	Provide Registered Ground Engineering Professional	p.day			
A7.5	Provide Registered Ground Engineering Specialist	p.day			
A7.6	Provide Registered Ground Engineering Advisor	p.day			
A8	Establish the location and elevation of the ground at each site	sum	11		
A9	Preparation of Health and Safety documentation and Safety Risk Assessment.	sum	1		
A15	Special testing and sampling required by Investigation Supervisor	provisional sum			
A16	Traffic safety and management and fencing off exploratory hole locations	sum			

Number	Item description	Unit	Quantity	Rate	Amount £
A19	One master copy of the Ground Investigation Report (or specified part thereof)	sum	1		
A21	Electronic copy of Ground Investigation Report (or specified part thereof)	sum	1		
A25	Digital data in AGS transfer format	sum	1		
			Total section A carried to summary:		

Bill of Quantities Section B: Percussion boring

Number	Item description	Unit	Quantity	Rate	Amount £
B	**Percussion boring**				
B1-B20	Not used	sum			
			Total section B carried to summary:		

Bill of Quantities Section C: Rotary drilling

Number	Item description	Unit	Quantity	Rate	Amount £
C	**Rotary drilling**				
C1-C91	Not used	sum			
			Total section C carried to summary:		

Bill of Quantities Section D: Pitting and Trenching

Number	Item description	Unit	Quantity	Rate	Amount £
D	**Pitting and trenching**				
	Inspection pits				
D1	Excavate inspection pit by hand to 1.2m depth	nr			
	Trial pits and trenches				
D3	Move equipment to the site of each trial pit or trench of not greater than 4.5m depth	nr	11		

Number	Item description	Unit	Quantity	Rate	Amount £
D6	Excavate trial pit between existing ground level and 3.0m depth	m	33		
D7	As Item D6 but between 3.0 and 4.5m depth	m	Rate only		
D13	Standing time for excavation plant, equipment and crew for machine dug trial pit or trench	h	5		
	Contract specific additional bill items				
			Total section D carried to summary:		

Bill of Quantities Section E: Sampling and monitoring during intrusive investigation

Number	Item description	Unit	Quantity	Rat	Amount £
E	Sampling and monitoring during intrusive investigation				
	Samples for geotechnical purposes				
E1	Small disturbed sample	nr			
E2	Bulk disturbed sample	nr	33		
E3	Large bulk disturbed sample	nr			
E4.2	Open tube sample using thin walled (OS-T/W) sampler	nr			
E6	Groundwater sample	nr			
E8	Cut, prepare and protect core sub sample	nr			
	Contract specific additional bill items				
			Total section E carried to summary:		

Bill of Quantities Section F: Probing and cone penetration testing

Number	Item description	Unit	Quantity	Rate	Amount £
F	Probing and cone penetration testing				
F	Not used	sum			
			Total section F carried to summary:		

Bill of Quantities Section G: Geophysical testing

Number	Item description	Unit	Quantity	Rate	Amount £
G	Geophysical testing				
G	Not used	sum			
			Total section G carried to summary:		

Bill of Quantities Section H: In situ testing

Number	Item description	Unit	Quantity	Rate	Amount £
H	In situ testing				
H	Not used	nr			
			Total section H carried to summary:		

Bill of Quantities Section I: Instrumentation

Number	Item description	Unit	Quantity	Rate	Amount £
I	Instrumentation				
I	Not used	sum			
			Total section I carried to summary:		

Bill of Quantities Section J: Installation monitoring and sampling (during fieldwork period)

Number	Item description	Unit	Quantity	Rate	Amount £
J	Installation monitoring and sampling (during fieldwork period)				
J	Not used	sum			
			Total section J carried to summary:		

Bill of Quantities Section K: Geotechnical laboratory testing

Number	Item description	Unit	Quantity	Rate	Amount £
K1	**Classification**				
K1.1	Moisture content	nr	33		
K1.2	Liquid limit, plastic limit and plasticity index	nr	33		
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	33		
K1.10	Sedimentation by pipette	nr			
K1.11	Sedimentation by pipette or hydrometer	nr	Rate only		
K2	**Chemical and electrochemical**				
K2.1	Organic matter content	nr	Rate only		
K2.2	Mass loss on ignition	nr			
K2.3	Sulphate content of acid extract from soil	nr			
K2.4	Sulphate content of water extract from soil	nr			
K2.5	Sulphate content of groundwater	nr			
K2.6	Carbonate content of rapid titration	nr			
K2.7	Carbonate content by gravimetric method	nr			
K2.8	Water soluble chloride content	nr			
K2.9	Acid soluble chloride content	nr			
K2.10	Total sulphur content	nr			
K2.11	Total dissolved solids	nr			
K2.12	pH value	nr			
K2.13	Resistivity	nr			
K2.14	Redox potential	nr			
K3	**Compaction related**				
K3.1	Dry density/moisture content relationship using 2.5 kg rammer	nr			
K3.2	Dry density/moisture content relationship using 4.5 kg rammer	nr			
K3.3	Dry density/moisture content relationship using vibrating rammer	nr			

Number	Item description	Unit	Quantity	Rate	Amount £
K3.4	Extra over Items K3.1, K3.2, K3.3 for use of CBR mould	nr			
K3.5	Maximum and minimum dry density for granular soils	nr			
K3.6	Moisture condition Value at natural moisture content	nr			
K3.7	Moisture Condition Value/moisture content relationship	nr			
K.3.8	Chalk crushing value	nr			
K3.9	California Bearing Ratio on re-compacted disturbed sample	nr			
K3.10	Extra over Item K3.9 for soaking	day			
K4	**Compressibility, permeability and durability**				
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	Measure of swelling on saturation, test period 1 day	nr			
K4.6	Extra over Items K4.3 to K4.5 for test period in excess of 2 or 1 day(s)	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	**Consolidation and permeability in hydraulic cells**				
K5.1	Consolidation properties of a 76mm diameter specimen using a hydraulic cell, test period 4 days	nr			
K5.2	As Item K5.1 but using a 100mm 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 200mm diameter specimen	nr			
K5.5	Extra over Items K5.1 to 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 of 4 days	nr			
K5.7	As Item K5.6 but using a 100 mm diameter specimen	nr			
K5.8	As Item K5.6 but using a 150 mm diameter specimen	nr			
K5.9	As Item K5.6 but using a 200 mm diameter specimen	nr			
K5.10	Extra over Items K5.6 to K5.9 for test period in excess of 4 days	day			

Number	Item description	Unit	Quantity	Rate	Amount £
K5.11	Isotropic consolidation properties in a triaxial cell, test period of 4 days	nr			
K5.12	Extra over Item K5.11 for test period 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	**Shear strength (total stress)**				
K6.1	Shear strength by the laboratory vane method (set of 3)	nr			
K6.2	Shear strength by hand vane method (set of 3)	nr			
K6.3	Shear strength by hand penetrometer (set of 3)	nr			
K6.4	Shear strength of a set of three 60 mm x 60 mm 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 × 300mm square specimen by direct shear, test duration not exceeding 1 day	nr	16		
K6.7	Extra over Item K6.6 for test durations in excess of 1 day	day	Rate only		
K6.8	Residual shear strength of a set of three 60 mm x 60 mm square specimens by direct shear, test duration not exceeding 4 days per specimen	nr			
K6.9	Extra over Item K6.8 for test duration in excess of 4 days per specimen	sp.day			
K6.10	Residual strength of a 300 mm square specimen by direct shear , test duration not exceeding 4 days	nr			
K6.11	Extra over Item K6.10 for test duration in excess of 4 days per specimen	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 38 mm 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			

Number	Item description	Unit	Quantity	Rate	Amount £
K7	**Shear strength (effective stress)**				
K7.1	Consolidated undrained triaxial compression test with measurement of pore pressure (set of three 38mm 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	Consolidation drained triaxial compression test with measurement of volume change (set of three 38 mm specimens), test duration not exceeding days per specimen	nr			
K7.4	As Item K7.3 but single stage or multi-stage test using 100 mm 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	**Rock Testing**				
K8.1 – K8.22	Not required	nr			
K9	**Ground/groundwater aggressivity**				
K9.1	Suite A (Greenfield site – pyrite absent Schedule 1.19.6)	nr			
K9.2	Suite B (Greenfield site – pyrite present Schedule 1.19.6)	nr			
K9.3	Suite C (Brownfield site – pyrite absent Schedule 1.19.6)	nr			
K9.4	Suite D (Brownfield site – pyrite present Schedule 1.19.6)	nr			
	Contract specific additional bill items				
		Total section K carried to summary:			

Bill of Quantities Section L: Geoenvironmental laboratory testing

Number	Item description	Unit	Quantity	Rate	Amount £
L	**Geoenvironmental laboratory testing**				
L	Not used	sum			
		Total section L carried to summary:			

Appendices

A. Location plans

Kinmel Bay to Llanddulas Beach

Trial pits locations (1/3)

Legend

- Trial Pit
- CCBC profiles
- CMU

Trial pits coordinates

Point	Easting	Northing
TP01	291648	378430
TP02	291698	378388
TP03	293029	378246
TP04	295463	379108
TP05	296346	379489
TP06	296553	379614
TP07	297709	380200
TP08	297886	380310
TP09	299024	380882
TP10	299200	380968
TP11	299337	381015

0 500 1,000 m

Coordinate System
EPSG:27700

N

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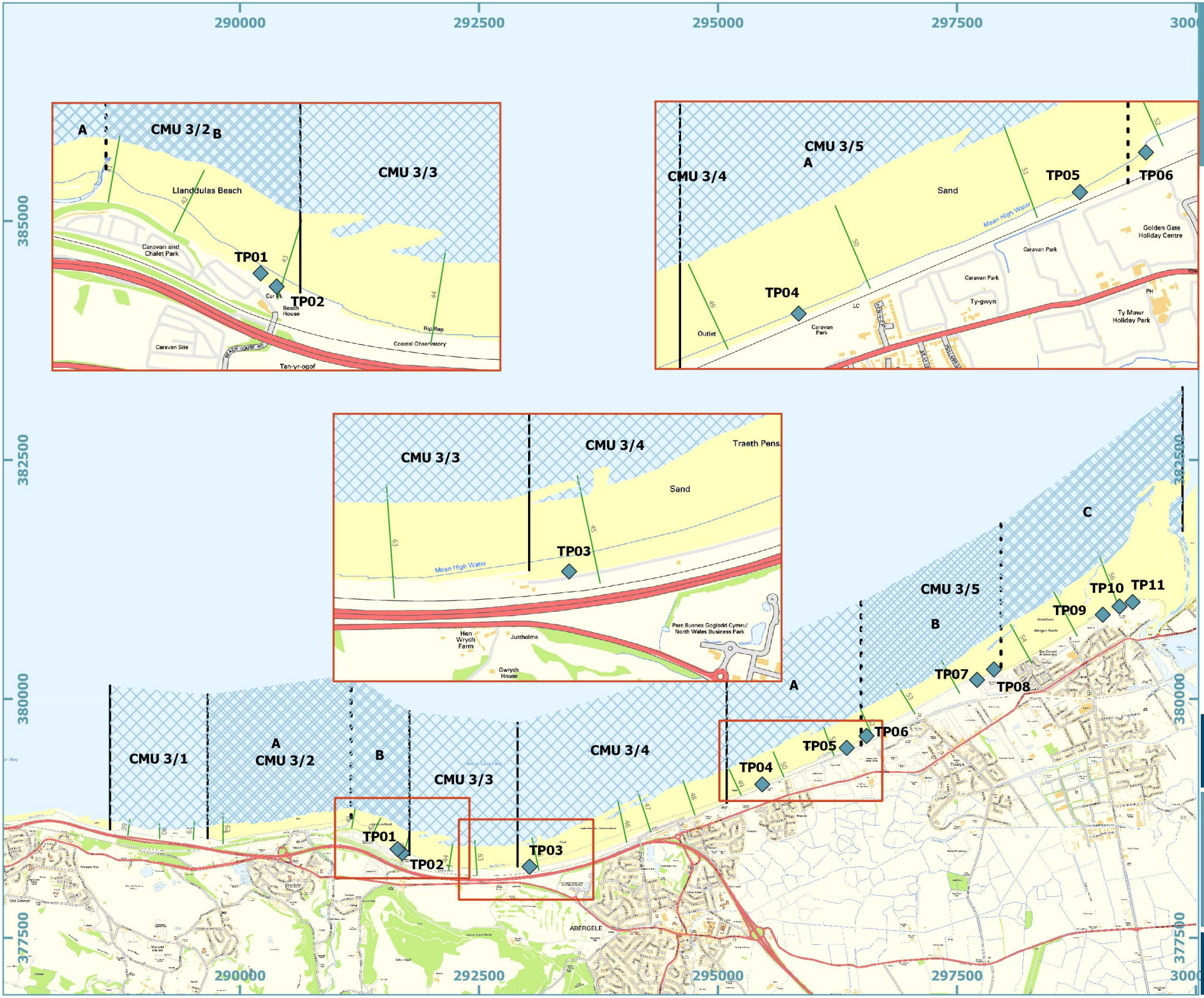

Kinmel Bay to Llanddulas Beach

Trial pits locations (2/3)

Legend

- Trial Pit
- CCBC profiles
- CMU

Trial pits coordinates

Point	Easting	Northing
TP01	291648	378430
TP02	291698	378388
TP03	293029	378246
TP04	295463	379108
TP05	296346	379489
TP06	296553	379614
TP07	297709	380200
TP08	297886	380310
TP09	299024	380882
TP10	299200	380968
TP11	299337	381015

0 500 1,000 m

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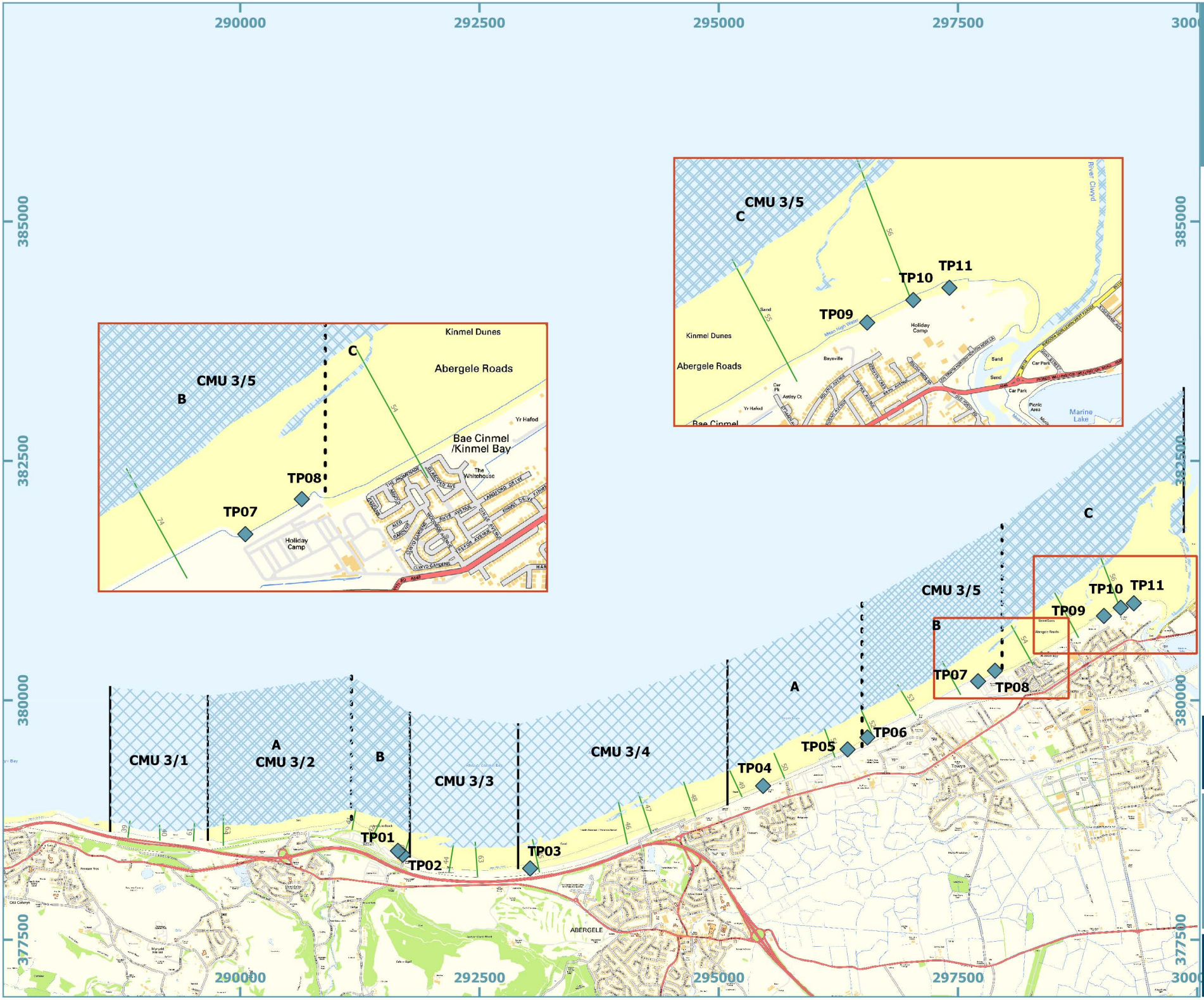

Kinmel Bay to Llanddulas Beach

Trial pits locations (3/3)

Legend

- Trial Pit
- CCBC profiles
- CMU

Trial pits coordinates

Point	Easting	Northing
TP01	291648	378430
TP02	291698	378388
TP03	293029	378246
TP04	295463	379108
TP05	296346	379489
TP06	296553	379614
TP07	297709	380200
TP08	297886	380310
TP09	299024	380882
TP10	299200	380968
TP11	299337	381015

0 500 1,000 m

Coordinate System
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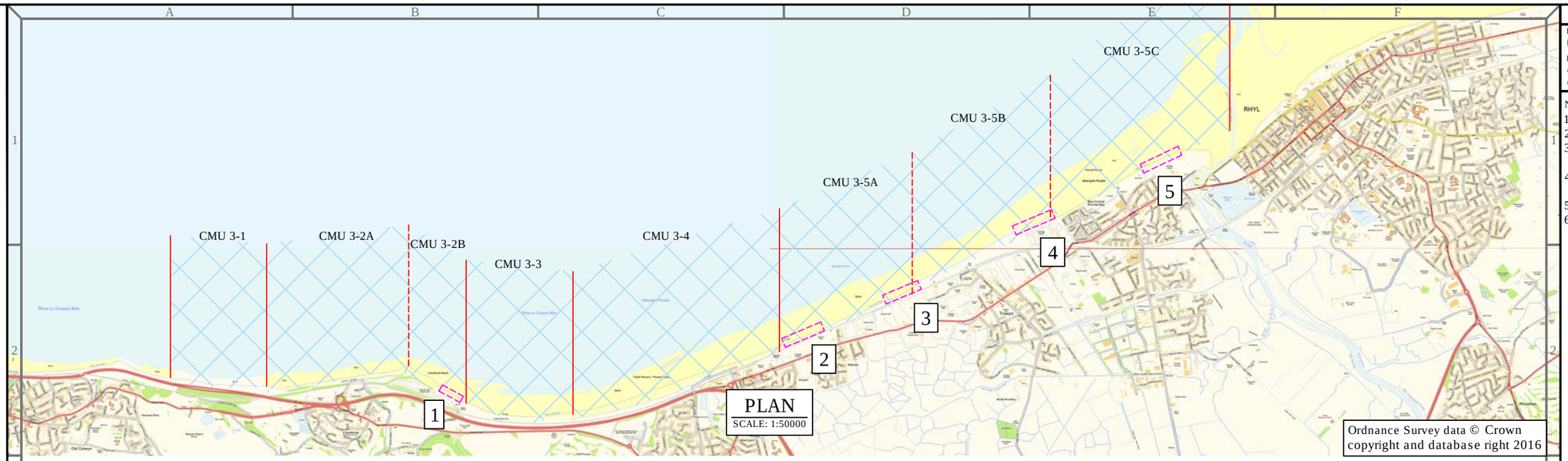
B. Design information



PLAN
SCALE: 1:50000

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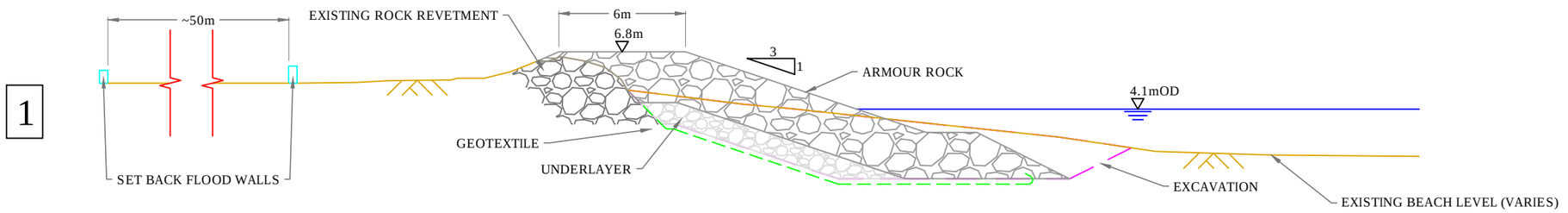

LLANDULAS BEACH TYPICAL SECTION

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2. DO NOT SCALE. USE ONLY WRITTEN DIMENSIONS.
3. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.
4. TOPOGRAPHY SURVEY PROVIDED BY CONWY COUNTY BOROUGH COUNCIL.
5. CREST ELEVATIONS GIVEN IN mOD.
6. TIDE LEVELS:

MHWS	4.1mOD
MHWN	2.3mOD
MLWN	-1.4mOD
MLWS	-3.0mOD

REV	DRAWING STATUS	DRN.	APPR.	AUTH.	DATE
1	ISSUED TO CLIENT	WST	POM	AUO	05 MAR 19

CLIENT:

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Tel: +44(0)1491 835381
Fax: +44(0)1491 832233

PROJECT:

KINMEL BAY

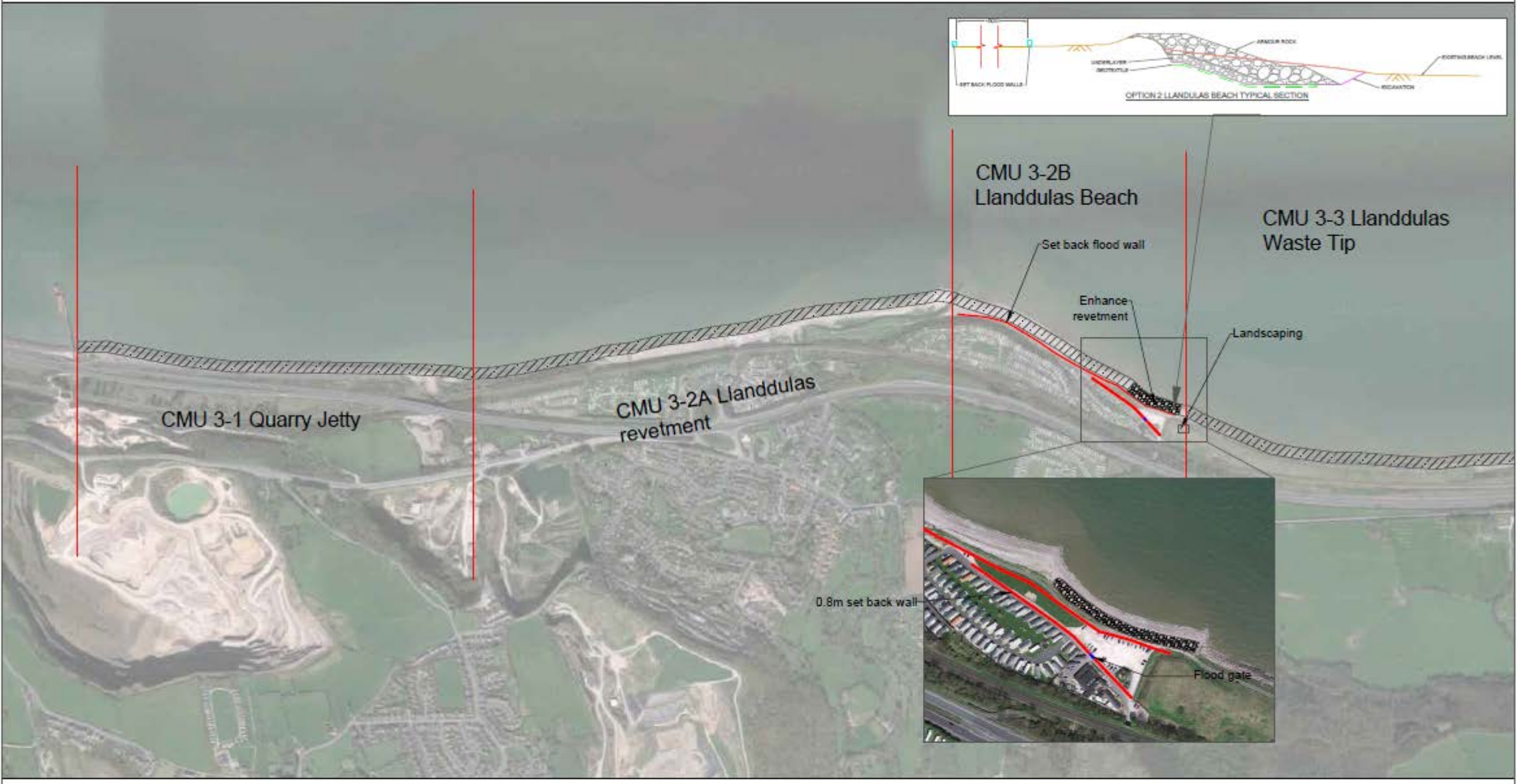
DRAWING TITLE:

OPTION 4 PLAN LOCATION AND CROSS SECTIONS
CMU3-2B

SCALE: 1:250
SHEET SIZE: A3

DRAWING No: DKR5929/D001
REV: 1

05/03/19 WST \\hrw-uk.local\projects\live\dkr5929$\5_deliverables\drawings\SECTION_DRAWINGS_2.dwg

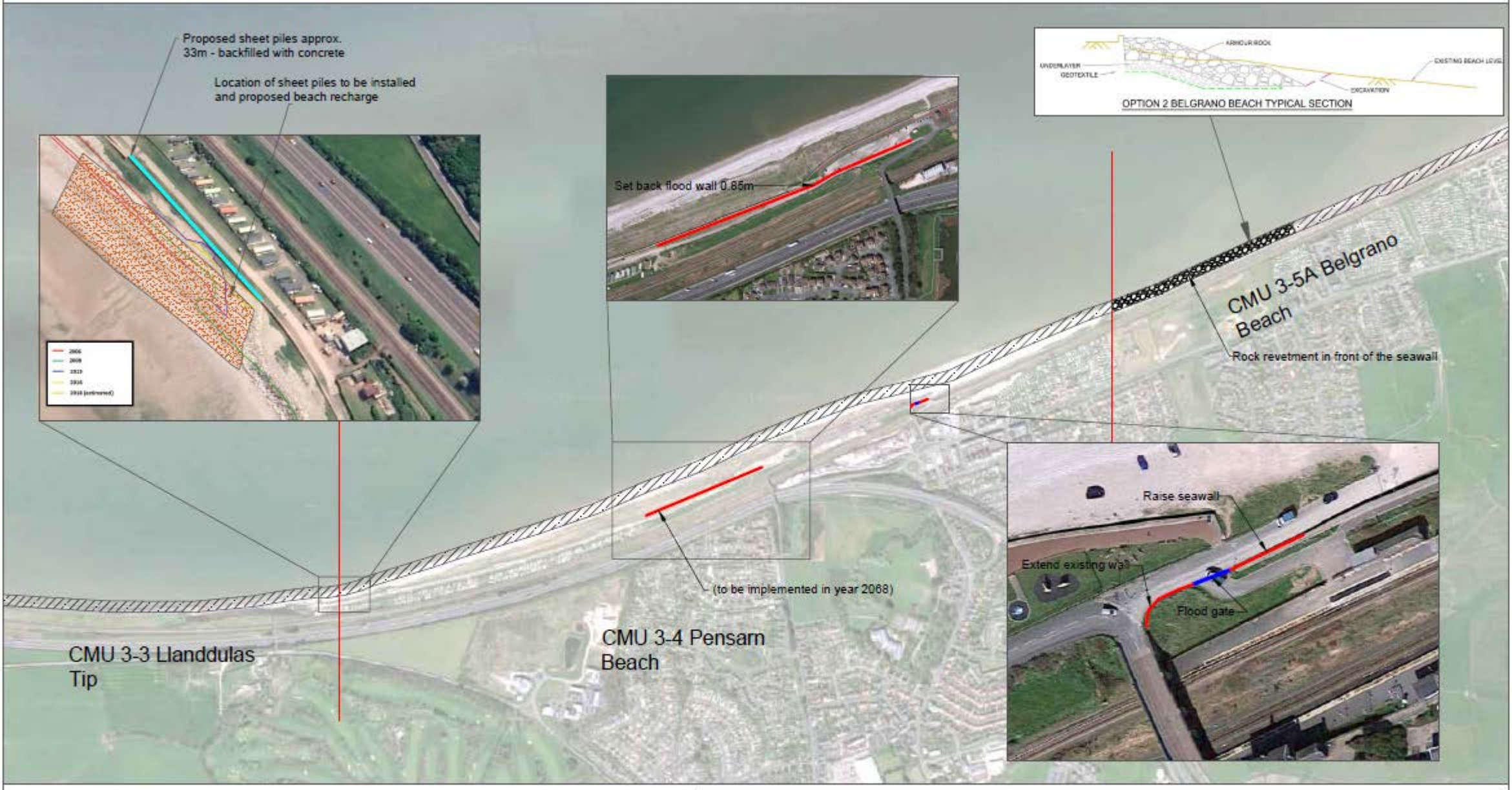


Do minimum

Rock protection

Set back flood wall

Flood gate



WHS

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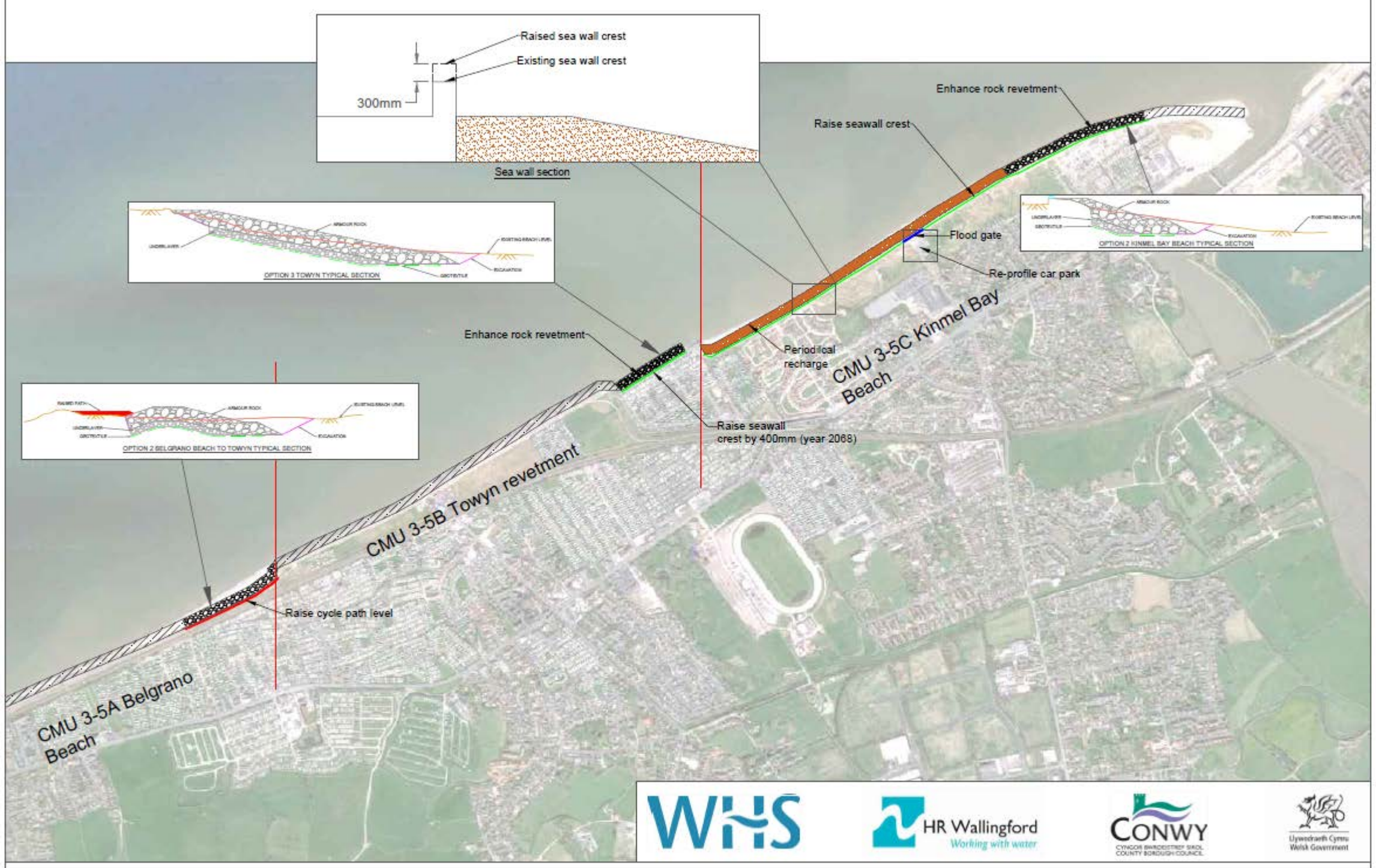
COUNTY BOROUGH COUNCIL

Llywodraeth Cymru
Welsh Government

Do minimum | Rock protection | Beach recharge | Set back flood wall | Flood gate | Sheet piles



WHS

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Working with water

CONWY
CYNGOR BWRDEISTREF SIROL
COUNTY BOROUGH COUNCIL

Llywodraeth Cymru
Welsh Government

Do minimum

Rock protection

Beach recharge

Set back flood wall

Flood gate

Raise sea wall crest

C. Approximate location of existing cables

https://www.c-map.com/en-gb/chartexplorer/

here, select ☆≡ then ☆, and drag to the Favourites Bar folder. Or import from another browser. Import favourites

C-MAP

CHARTS APP SOCIAL MAP SEARCH CHARTS DEVICE SEARCH CHART EXPLORER SUPPORT

United Kingdom

DISCOVER & REVEAL 4D

Shaded Relief - Seafloor Layer
(only available with REVEAL)

Layers
Standard (HRB OFF)
HRB ON

IRISH SEA
VRHYL FLATS
LIVERPOOL BAY
RHYL
River Clwyd
Magnetic Var (-1,2020,(12))
Fishing Zone
Outfall
Harbour Limit

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https://webapp.navionics.com/?lang=en#boating@11&key=kjjdI%7C~wT

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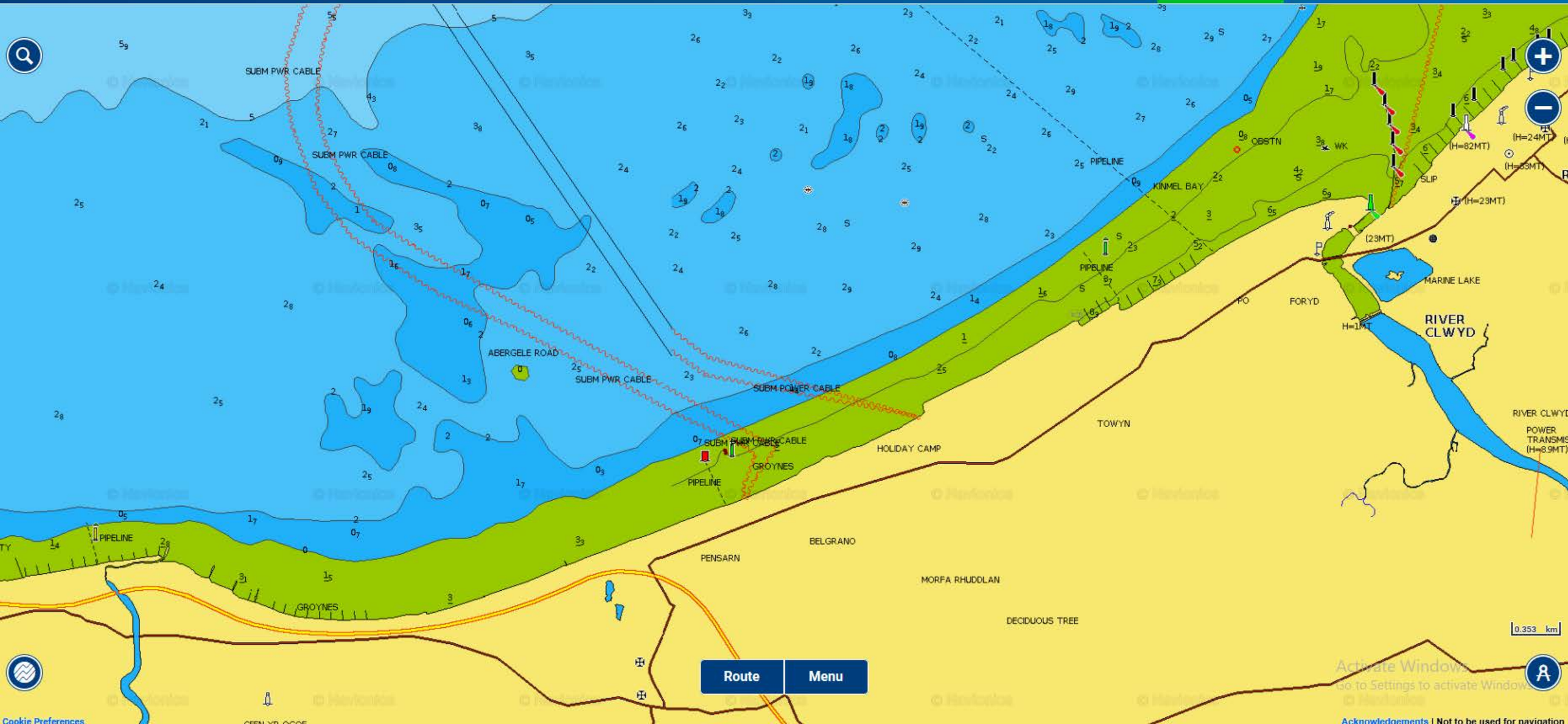

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D. Method statement

D.1. Introduction

This method statement presents the methodology to be implemented for the execution of geotechnical investigation for the Llanddulas & Kinmel Bay Coastal Defence Improvements OBC project.

The purpose of this investigation is to determine the properties of surface and subsurface materials and its stratification in order to inform subsequent stages of the design and the construction of the proposed improvements.

D.2. Scope of work

The GI is anticipated to include the 11 No. machine-excavated trial pits to 3.0m depth, sampling for geotechnical purposes (bulk sampling), geotechnical soils laboratory testing and preparation of a factual ground investigation report.

D.3. Methodology

All trial pits shall originally be set out using hand held GPS. After drilling is completed, the accurate Easting, Northing and ground level shall be surveyed by independent means. Eleven (11) trial pits shall be excavated to a minimum 3.0m depth or bedrock level whichever occurs first. Where possible based on the ground conditions encountered, the trial pits could extend beyond 3.0m depth (to a maximum of 4.5m depth) as satisfied by the IS.A backhoe actor type JCB or similar capable of reaching down to a minimum 3.0m depth (preferably to 4.5m depth) shall be used as means of mechanical excavation. At all exploratory hole locations where services might be expected to be at shallow depth, an inspection pit will be hand dug to a maximum depth of 1.2m before any mechanical excavation commences. The digging shall be carried out with great care using picks and shovels. A radio operated metal/cable detector shall be regularly used as digging proceeds.

Bulk disturbed samples shall be collected at each change of strata and at 1.0m intervals within the same strata. A minimum of two photographs shall be taken for each trial pit. One for the hole and one for the spoil before the trial pit is backfilled in layers with the arising and compacted with the back of the backhoe bucket.

All trial pits shall be logged on site by a professional and competent geotechnical engineer or geologist. Samples shall be bagged and labelled before they are sent to the temporary storage facility or the laboratory.

The GI is anticipated to include the following 11 No. machine-excavated trial pits to 3.0m depth, sampling for geotechnical purposes (bulk sampling) and geotechnical soils laboratory testing. The following geotechnical/ laboratory tests are anticipated to be carried out on geotechnical soil samples.

- Particle size distribution (PSD) with sedimentation by pipette;
- Atterberg limit tests with natural moisture content determination;
- Shear box testing;
- Organic content.

Immediately after completion of each trial pit, the excavations will be backfilled in layers. It is important to ensure, as much as practical, that the material is replaced at a similar depth as encountered during the

excavation. The material placed at the top of the excavated area should be similar to the material encountered before the excavation and the material encountered in the surrounding area.

D.4. Reporting

The ground investigation report will be prepared by the Contractor and include factual information only. The report write up will include scope of the GI works, description of the site, description of the fieldworks and laboratory works, site plan, location plan, summary tables for laboratory test results. The report appendices shall include logs, colour photographs, in-situ test sheets including summaries and laboratory test sheets.

D.5. Limitations

The access to the site is limited to some specific locations at Pensarn, Belgrano Beach slipway and Kinmel Bay and LLanddulas beach. The limited access points to the site is likely to impact on the ground investigation schedule.

Care should be taken on site given the conditions of the lower sandy beach along some of the sections and potential soft areas and it is likely that a safe access for vehicles onto the beach will need to be created.

Access to Llanddulas beach is likely to be constrained by the existing small access road. Access to exploratory hole locations shall be agreed in advance of the works with IS and relevant landowners where applicable (e.g. for access through private roads). As required to facilitate safe access/egress of working areas and to alert/warn pedestrians and road users of works adjacent to the public areas.

Tidal restrictions will apply, which could impact the schedule. Equipment will need to be stored away from the intertidal area. The figures in Appendix E show the MHWS contour line in relation to the proposed TPs.

Appendix E of this document shows anticipated access routes to the proposed investigation point locations. It is important that the Contractor visits the site to establish access restrictions to investigation point locations and determine the suitability of his equipment to undertake the proposed investigation and take into due consideration Health and Safety.

Appendix C shows the approximate location of existing cables, including High Voltage cables of the Rhyl Flats Offshore Wind Farm. It is the responsibility of the GI Contractor to make enquires as to the exact position of all existing services at the exploratory hole positions owned by statutory undertakers, public authorities and private companies/landowners prior to any work commencing.

E. Access routes

Kinmel Bay to Llanddulas Beach

Access to the trial pits 1/7

TP01

TP02

Legend

- Trial Pit
- MHWS

Proposed access to trial pits

- Access through the car park (requires removal of bollards)
- Access through the path

0 50 100 m

N

Coordinate System
EPSG:27700

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Kinmel Bay to Llanddulas Beach

Access to the trial pits 2/7

Distance through the beach: 1.1 km

Google earth

TP03

Legend

- Trial Pit
- MHWS

Proposed access to trial pits

- Access through the beach

0 20 40 m

N

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295000

Distance through the beach: 830 m

Google earth

TP04

Google Street View

5.40 m

Access point

Kinmel Bay to Llanddulas Beach

Access to the trial pits 3/7

Legend

- Trial Pit
- MHWS

Proposed access to trial pits

- Access through the beach

0 20 40 m

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Kinmel Bay to Llanddulas Beach

Access to the trial pits 4/7

295000

297500

380000

330000

Distance through car park: 1.8 km

Google earth

TP07

TP06

TP05

TP04

Legend

- Trial Pit
- MHWS

Proposed access to trial pits

- Access through the private path
- Access through car park

0 100 200 m

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Kinmel Bay to Llanddulas Beach

Access to the trial pits 5/7

Distance through car park: 810 m

TP08

TP07

Legend

- Trial Pit
- MHWS

Proposed access to trial pits

- Access through the private path
- Access through the slip road
- Access through the car park

0 50 100 m

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Distance through the beach: 450 m

TP09

Google earth

Google Street View

4.00 m

Access point

Kinmel Bay to Llanddulas Beach

Access to the trial pits 6/7

Legend

- Trial Pit
- MHWS

Proposed access to trial pits

- Access though the car park

0 50 100

N

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Distance through car park: 230 m

Distance through the private path: 850 m

Kinmel Bay to Llanddulas Beach

Access to the trial pits 7/7/h3>

TP11

TP10

TP09

2.50 m width

Legend

- Trial Pit
- MHWS

Proposed access to trial pits

- Access through the car park
- Access through the private path (width limitation)

0 50 100 m

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Distance through car park: 230 m

Distance through the private path: 850 m

Kinmel Bay to Llanddulas Beach

Access to the trial pits 7/7/h3>

TP11

TP10

TP09

2.50 m width

Legend

- Trial Pit
- MHWS

Proposed access to trial pits

- Access through the car park
- Access through the private path (width limitation)

0 50 100 m

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Google earth

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