

מסמך ג' – המפרט הטכני המיוחד

SOUTH NETANYA MARINE GROUND INVESTIGATION

SPECIFICATION FOR GROUND INVESTIGATION

Specification The specification shall be the UK Specification for Ground Investigation, Second edition published by ICE Publishing in 2012, with information, amendments and additions as described in the Schedules.

SCHEDULE 1: INFORMATION

S1.1 NAME OF CONTRACT

South Netanya Marine Ground Investigation.

S1.2 PROJECT OVERVIEW

MCCP has initiated a coastal/cliff stabilization project for the Netanya south frontage, extending from the centre of Netanya some 3000 metres to the south, as illustrated below. The project focuses on a combination of offshore breakwater elements and beach nourishment to create a protected marine environment to minimise wave action on the toe of the cliffs along the frontage. The measures are required to safeguard the cliff line, allowing further development along the coastline between Netanya and Herzliya. A number of options have been evaluated during concept design and modelling analysis, with a detached breakwater scheme comprising 10 small breakwaters and 2 large breakwaters along the 5m depth contour selected as the preferred configuration. The concept design also includes a sand nourishment of 570,000m³ behind the breakwaters. Details of the approved plan for the project can be found at <https://tinyurl.com/h8lh6j>

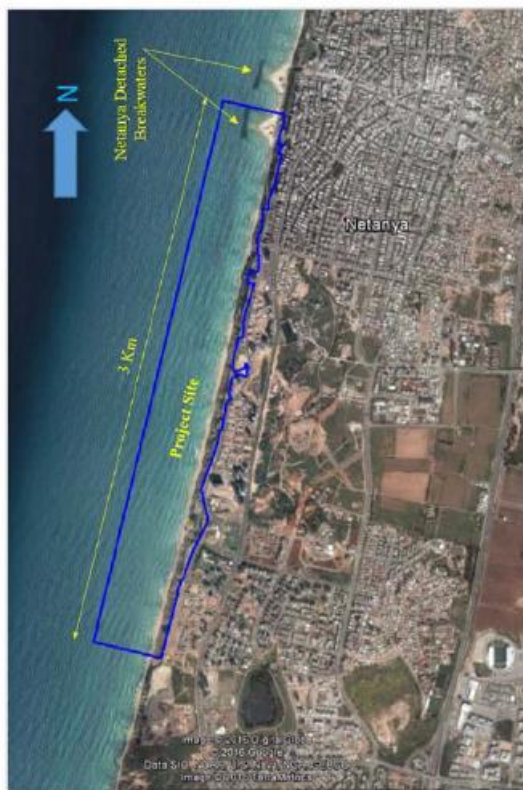


Figure 1: Netanya study frontage

To advance the project, and conclude design and permitting, MCCP is now commissioning a geotechnical investigation (GI) survey to assist the detail design stage, which will be tendered shortly.

S1.3 DESCRIPTION OF SITE

The site location is shown on Exhibit 1 within Appendix A.

The project is located on the Mediterranean coastline of Israel (Figure 2). Netanya is some 60km south of Haifa and 30km north of Tel Aviv. The site is located to the south of the existing breakwaters in Netanya.

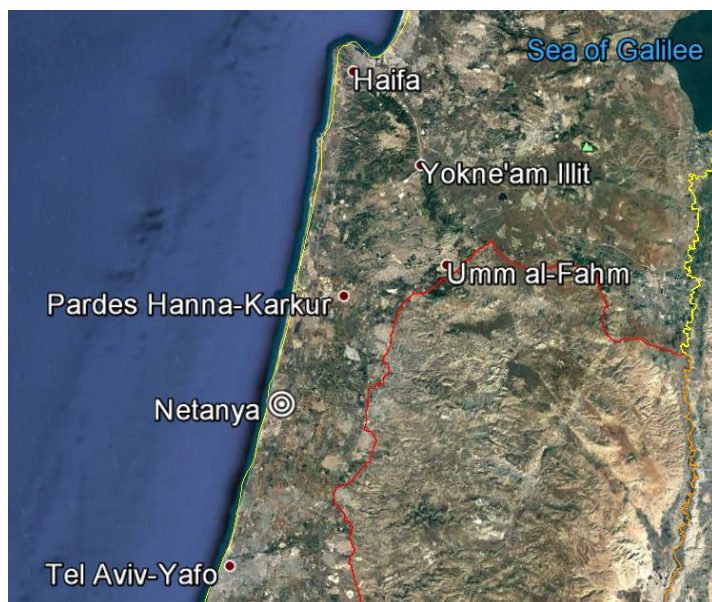


Figure 2: Location map (from Google Earth)

S1.4 MAIN WORKS PROPOSED AND PURPOSE OF THE CONTRACT

A range of services, including a marine ground investigation as described in this document, are required in support of the commercial development of a part of south Netanya. The nature of this development is, as yet, to be confirmed.

For the purpose of progressing studies to inform the design and construction of offshore shore protection structures and beach nourishment in the area, the marine ground investigation defined in this document is required.

The purpose of the site investigation is to determine the offshore ground conditions within the South Netanya in relation to the design of the proposed facility. This would enable a ground model for the site to be established and geotechnical parameters to be determined for the design of the breakwaters including the estimation of settlements and of scour potential. The ground investigation shall comprise inter alia, drilling of boreholes and drill-holes, soil sampling and testing and an optional scope of work for geophysical survey of the study area.

For this purpose, the Contractor is obligated to hire on his own expense an accredited authorized Laboratory services (accredited by the Israeli Laboratory Accreditation Authority) including experienced chartered geologist as a well-sitter. The Laboratory shall

be responsible for the analysis of the tests results, production of geological and geotechnical reports as detailed below.

The Laboratory and the geologist shall be approved by the Project Manager in advance prior to commencement of the work.

The Contractor shall submit all the required data in soft copy (as an open file such as Word, Excel, DWG, txt etc..) and as PDF files. The PDF shall be readable and searchable i.e. scanned documents shall not be accepted. Additionally, all the data shall be submitted in two (2) hard copies. The required data submissions shall include inter alia and not limited to the following:

- 1) Raw data from sampling & measurements.
- 2) Lab results and certificates.
- 3) Boreholes logs (well logs)
- 4) CPT raw data and interpretation.
- 5) Factual report as a preliminary data analysis.
- 6) Interpretive report. The report shall summarize all the above including Lab results charts describing the results scattering and statistical analysis. In addition, the report shall include a longitudinal geological section along the borehole's axis showing the different soil/rock strata.

S1.5 SCOPE OF INVESTIGATION

S1.5.1 Proposed investigation work

A ground investigation is required, as shown on Exhibit 1 within Appendix A.

The ground investigation comprises the following:

- Geophysical survey of project site (optional).
- Bathymetry Survey.
- Overwater cable percussion boreholes extended by rotary core drilling.
- In-situ testing, including Cone Penetration Tests (CPTs), Standard Penetration Tests (SPTs) and borehole vane tests.
- Sampling using piston sampling.
- Undisturbed and disturbed sampling of soils.
- Standard Core-Boxes for cores and samples storing.
- Geotechnical and contamination testing.
- Accredited Laboratory services (including well-sitter), lab tests and certifications.

- Preparation of the Factual Report
- Preparation of the Interpretive Report.

S1.5.2 Plant to be used for the investigation work

The Contractor shall use a “jack-up” or similar floating type of platform for carrying out the offshore investigation work. The Tenderer may propose an alternative type of platform, but must demonstrate in his Tender that the use of the alternative platform can meet the requirements of the Specification. The Tenderer shall demonstrate that the alternative type of platform can be maintained in position and that sufficient elevation control can be provided to ensure that there is no deterioration in the quality of the investigation work, from that specified, throughout the full tidal range. The Contractor shall demonstrate that anchors and any other part of the alternative type of platform will not cause disruption to the normal marine activities within the area. The Contractor shall demonstrate that the vessel is in conformity with relevant regulations for operation in coastal waters and is fully insured for the activities set out in this specification.

The Contractor shall be aware to the limitations of the Site and that all the works shall be done offshore. Land access is not an option.

In addition, the Contractor shall provide to the Project Manager and all of his representatives a free access to the "jack-up". The vessel/boat shall be safe and available for the Project Manager at any time.

S1.6 GEOLOGY AND GROUND CONDITIONS

The following assessment of the site geology and ground conditions has been inferred from available information. No assurance is given to its accuracy.

S1.6.1 Geology

45 kilometres out of a total 190 kilometres of the Israel Mediterranean shoreline, between Hadera and Ashkelon, consist of coastal cliffs of 10 metres or more in height. The coastal zone comprises a sequence of coast parallel, Nilotic, late Pleistocene to early Holocene eolianite ridges, exposed in the cliff line. The cliffs are unstable and are in a process of continued retreat eastward, a rate estimated between 100mm and 500mm per year, as a result of the weakness of the strata and the combination of three main processes: undercutting by waves at the base of the cliff, unstable cliff slopes and the infiltration of groundwater at the cliff top. Cliff instability is a natural process which is influenced by the height of sea level in relation to the cliff base, wave action and the presence of sand at the cliff base.

The cliffs consist of alternating late Pleistocene–Holocene quartz-dominated, carbonate-cemented eolianites and clay-bearing paleosols. These are considered to be mechanically weak, characterised as weakly to moderately cemented sands.

It is anticipated that the geology at the marine investigation site, on the minus 5 metre contour, is represented by a wave-cut shelf of similar rock typology (weakly to moderately cemented sands) as encountered in the exposed cliff line, overlain by marine sand and silt deposits.

S1.6.2 Previous site investigations

Currently, the Project has access to bathymetric and topographic data, but no GI data has been undertaken. Bathymetric surveys have been undertaken in 1996, 2011 and in 2017. Figure 3 shows the extent of bathymetric surveys undertaken in 2011 and 2017.

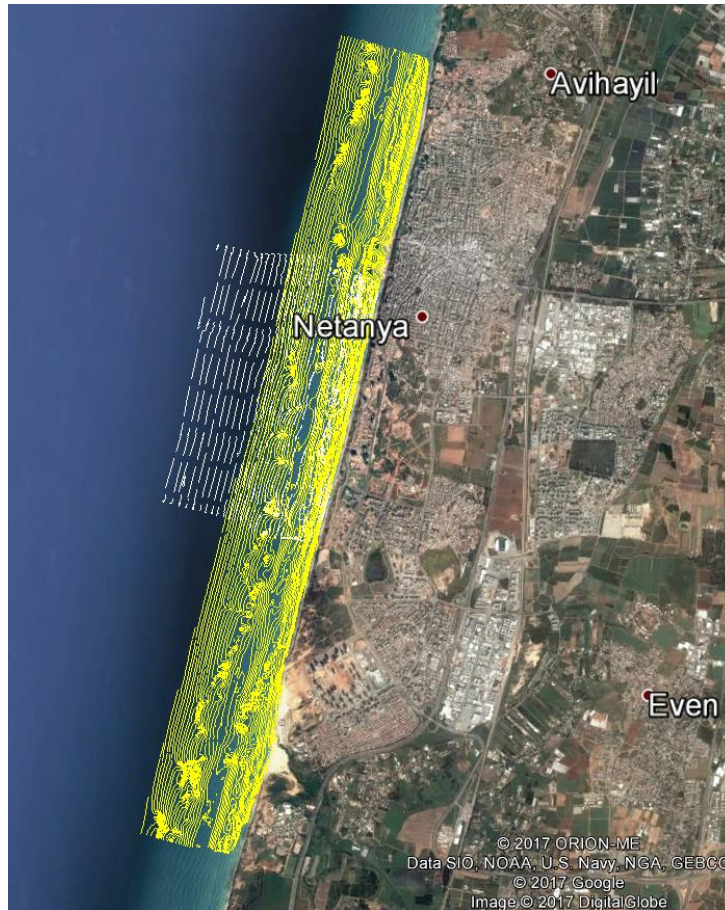


Figure 3: Netanya surveyed areas; 2011 (yellow) and 2017 (white)

S1.6.3 Tidal Information

A summary of tidal data for the area based on the Admiralty Tide Tables is given below:

Tidal level	Elevation	
	mCD	m ILSD
Highest Astronomical Tide (HAT)	0.8	0.581
Mean High Water Springs (MHWS)	0.6	0.381
Mean High Water Neaps (MHWN)	0.4	0.181
Mean Sea Level (MSL)	0.3	0.081
Mean Low Water Neaps (MLWN)	0.2	-0.019
Mean Low Water Springs (MLWS)	0.1	-0.119

Actual water levels may vary due to meteorological conditions. The vertical datum for the site should be Israel Land Survey Datum (ILSD)

S1.6.4 Codes and Standards

The Contractor shall use the latest edition of the following codes, regulations and standards, unless otherwise noted. In cases where more than one code, regulation or standard apply to the same condition, the most stringent shall be followed. In the event of a conflict, MCCP shall be consulted and a ruling, in writing, shall be obtained before any work is started. Any deviation must be approved, in writing, by MCCP. Such written approval must be obtained prior to the commencement of any work, which would constitute such a deviation. Work shall be carried out in accordance with code requirements and industry best practices for geotechnical investigations, associated surveys, and laboratory testing.

Primary Standards

All work will be carried out to the relevant ASTM Standards or equivalent Israeli Standards if applicable, with particular reference to D2113 – 14, D3213 – 13, D3441 – 16, D6519 – 15 and procedures for storing and testing materials, together with other international standards as appropriate. Tenderers must define the relevant ASTM or other standards in describing their methodology within their proposal. The Contractor must seek approval for the methodology from MCCP prior to commencing works.

Replacing ASTM Standard by Israeli Standard shall be approved by the Project Manager in advance.

Other Relevant Standards

ICE Spec for GI IMO	ICE UK Specification for Ground Investigation (2nd Edition) ISM code and guidelines for implementation International Convention for the Safety of Life at Sea (SOLAS) International Convention for the Prevention of Pollution from Ships (MARPOL)
ISO 9000 ISO 19901-4	Quality Management and Quality Assurance Standards Petroleum and natural gas industries – Specific requirements for offshore structures Part 4: Geotechnical and foundation design considerations
Subsea Working Group Of The Offshore Soil Investigation Forum	Guidance Notes On Geotechnical Investigations For Subsea Structures, Revision 02, 31/08/00

S1.7 SCHEDULE OF DRAWINGS

Drawing within.	Title
Appendix A	Exhibit 1 - Proposed Borehole Locations

S1.8 PARTICULAR CONTRACT RESTRICTIONS

S1.8.1 Programme and reporting dates

- (i) The Contractor shall agree a programme and sequence of drilling exploratory holes with the Project Manager.
- (ii) To minimise the risk of injury or damage due to encountering unexploded ordnance during the intrusive portion of the siteworks, the Contractor shall complete Section A of the works (as defined in the Appendix to the Form of Tender), prior to commencing Section B of the works.
- (iii) Preliminary engineering logs of the exploratory holes shall be submitted to the MCCP or its representative within 3 days of completion of each exploratory hole, along with in situ test records and blank laboratory testing schedules.

S1.8.2 Consents

The Contractor shall adhere to all restrictions imposed by bodies giving consent to perform the works.

The Contractor is responsible for ensuring that all required consents are in place.

S1.9 PARTICULAR GENERAL REQUIREMENTS

S1.9.1 Programme of Work

The Contractor shall submit a detailed breakdown of the work to be carried out, the intended progress for each individual exploratory hole and the intended progress of laboratory testing.

Programmes submitted shall be in the form of a bar chart showing the earliest and latest start and finish dates for each activity, and the critical path.

S1.9.2 Professional attendance on site

The Contractor shall provide full time control of the investigation by A qualified “Well Sitter” and “Project Manager” as per Contract requirements. In addition, the Contractor is fully responsible to comply with all the Ministry of Labor Regulations with respect to health, safety and environment.

The Contractor shall also provide a Marine Operations Supervisor, who shall be responsible for the operation of marine craft. The Marine Operations Supervisor shall have appropriate qualifications

The description of soils and logging of rock cores from boring and drilling operations shall be carried out by a Geotechnical Engineer or geologist that meets minimum requirements described in the examination and logging of soil and rock cores in accordance with ASTM D5434 tender documents. Soil samples for geotechnical testing shall be taken under the direction of the above personnel.

The Contractor shall give written instructions to his site staff on all relevant aspects in the Specification and sampling requirements.

S1.9.3 Location and elevation of exploratory holes

The default horizontal projection used for the local models will be the Israel-TM and the default vertical datum will be the Israel Land Survey Datum (ISLD)

The location of the exploratory holes is shown on Exhibit 1 within Appendix A. The Project Manager may, after consultation with the Contractor, vary the location and depth of any exploratory hole and the sequence or quantity of in-situ testing depending upon the actual site or ground conditions encountered.

The Contractor shall be responsible for locating the exploratory holes in the positions indicated on the drawing. The as-drilled position shall be within 3.0m of the scheduled location. The position of all exploratory holes with respect to Israel-TM shall be determined to an accuracy of ± 0.1 m. The as-drilled locations shall be shown on the logs and on a plan to be included in the Factual Report.

The Contractor shall be responsible for recording ground elevations of all exploratory holes to an accuracy of ± 0.1 metre. Ground elevations shall be based on Israel Land Survey Datum (ISLD).

The Contractor shall submit details of his proposed surveying and levelling method to the Project Manager for approval prior to the commencement of the site works.

S1.9.4 Equipment

All boring, excavation, sampling and testing equipment shall be delivered to site in good working condition and shall be maintained in good working order to the satisfaction of the Project Manager. The major items of plant and equipment shall not be varied from those stated in the Contractor's Tender without prior written authorisation by the Project Manager.

All offshore boreholes shall be undertaken from a jack-up platform. The jack-up platform shall be of sufficient size to allow all boring, sampling and in-situ testing operations to be carried out safely, under all anticipated weather conditions.

In-situ testing equipment shall have been calibrated prior to the commencement of the site works, in accordance with the manufacturer's recommendations. The Contractor shall submit all calibration certificates to the Project Manager prior to the commencement of the site works. The calibration of the SPT shall include the efficiency of the machine.

S1.9.5 Quality Management

Work shall be carried out in accordance with a quality management system established in accordance with ISO 9001:2015. Records to indicate compliance with the quality management system shall be made available to the Project Manager on request.

S1.9.6 Emergency Arrangements

The Contractor shall provide the Project Manager with at least two telephone numbers at which responsible representatives of the Contractor can be contacted at all times outside normal working hours.

The Contractors Health and Safety procedures should consider how emergency first aid could be administered in the event that a person working on the jack up platform becomes seriously injured. The Contractors Health and Safety procedures should consider how the emergency services can safely get on to and off the jack up platform with all necessary medical equipment and the injured person. The procedures should also include the address and location of the nearest Accident and Emergency Hospital.

S1.9.7 Services

The Contractor shall make all necessary checks for buried services. The Contractor shall also take all reasonable precautions to avoid damage to ducts, pipes or cables which are present on site in carrying out the Works and shall protect and support them adequately during the contract and reinstate them on completion of the Site Operations to the satisfaction of the Project Manager.

The Contractor shall be responsible for determining the presence of any utility services or other potential man-made obstructions within the study area prior to the commencement of the works. The supply of this information shall not relieve the Contractor of his obligations under the Contract with respect to the location and protection of buried services.

S1.9.8 Environmental Best Practice

The Contractor shall plan and order all his activities to ensure that the environmental principles of stewardship and sustainability are achieved.

Particular areas for action are:

- Avoidance of pollution of any waters (surface or underground);
- Avoidance of pollution of any land;
- Avoidance of excessive noise, vibrations, mud, dust and fumes.

The Contractor shall demonstrate in his written Method Statement his proposals to minimise environmental impact and satisfy the above requirements.

The following should be addressed in the Method Statement:

- Plant which leaks any fuel, lubricant or hydraulic fluid shall not be used;
- Bio-degradable hydraulic fluid is preferred;
- Plant shall be maintained to ensure efficiency and to minimise emissions;
- Fuel and oil shall be stored away from watercourses. Fuel and oil storage areas shall be fully bunded to 110% of the volume stored and maintained in a secure and clean manner. Delivery and vent pipes shall terminate within the bund;

- Refuelling or servicing of plant shall be carried out in designated locations away from watercourses;
- Refuelling shall be supervised and shall be carried out by pumping through a trigger type delivery nozzle;
- An adequate supply of oil absorbent materials shall be readily available on site at all times;
- Any spillage shall be immediately contained, removed from site and disposed of to a licensed tip;
- Plant shall be effectively silenced, and shall comply with any stated requirements of the local Municipality.

Upon completion of the site work, any excess soil resulting from the investigation work shall be disposed of off-site to a licensed landfill, approved by the Project Manager. The Contractor shall be responsible for obtaining all necessary consents for disposal.

S1.9.9 Care in Executing the Investigation

The Contractor shall take care in executing the investigation and shall avoid damaging existing assets such as tracks, fences, bridges, roads, verges, hedges, private roads, property etc. The Contractor shall take all necessary precautions to avoid endangering the public and to restrict their entry into the Site.

Upon completion of the site work the Contractor shall remove all plant, equipment, rubbish, debris and surplus material from the site and shall reinstate the site and working areas to their previous condition.

Any damage caused through the fault or neglect of the Contractor or sub-contractors or suppliers shall be made good by the Contractor, at his own expense, to the satisfaction of the Project Manager.

Existing drains, gullies, manholes etc must not be contaminated or obstructed by materials excavated from or used in the site investigation work. Any drain found to be so contaminated shall be thoroughly cleaned and flushed out to the satisfaction of the Project Manager. No effluent or washings resulting from this work shall contaminate any controlled waters.

Permanent damage resulting from the obstruction of any drain shall be made good by removing and replacing the damaged parts.

S1.10 PARTICULAR BOREHOLE REQUIREMENTS

S1.10.1 General

All boreholes shall be commenced using cable percussion techniques. The diameter of the borehole shall allow for completion of the borehole to the scheduled depth, or the continuation of the borehole by rotary coring.

The surging of casing to assist with penetration of the cable percussive equipment shall not be permitted. Where the borehole can no longer be advanced in soil using cable

percussion techniques the use of chiselling techniques will be permitted. The Project Manager shall be informed immediately if chiselling techniques are employed.

Overwater boreholes shall be fully cased with conductor casing between the drilling platform and seabed level. Boring shall not take place when, in the judgement of the Project Manager or Contractor, the effect of adverse weather conditions on the drilling platform and/or casing is reducing the quality of boring, drilling or in-situ testing.

S1.10.2 Water Level inside Borehole

The Contractor shall ensure that the soil or rock at the bottom of the exploratory hole is not disturbed by water entering or leaving the hole, or by stress relief. To this end, the water level in all exploratory holes shall be kept at least 1m above the sea level at all times during the ground investigation, unless otherwise instructed by the Project Manager. The removal of water from the casing by too rapid a withdrawal of rods and close fitting sampling equipment shall be avoided.

S1.10.3 Disposal of Arisings

All arisings from the boreholes shall be bagged and stockpiled before being disposed of at a licensed facility. This includes arisings from offshore boreholes, which must not be disposed of into the sea. Any material which appears to be contaminated shall be double bagged and clearly labelled, and stored separately from the other material.

Apparently contaminated material shall not be disposed of until relevant chemical testing is completed and the quality of the arisings is known. Arisings shall only be disposed of at a licensed landfill.

S1.11 PARTICULAR ROTARY DRILLING REQUIREMENTS

S1.11.1 Rotary coring

Rotary coring using a wireline triple tube system (such as Geobor S) shall be used to retrieve continuous cores in the rock. Rotary coring using a double tube system shall not be acceptable.

The diameter of the recovered core shall be at least 96mm outside diameter of core liner).

Where directed by the Project Manager, SPTs shall be taken at the base of every other core run (i.e. if core runs are 1.5m long, SPTs shall be taken every 3m, and so on). Small disturbed samples taken from the split spoon after testing shall be placed into suitable containers and clearly labelled.

The Contractor shall take particular care to retrieve good quality core, and must be prepared to vary his drilling equipment in order to maximise recovery, for example, by changing the flushing medium, adjusting the rate of drilling or changing the drill bit.

S1.11.2 Core preparation

In order to minimise disturbance to the recovered cores, immediately upon recovery the core liner shall be split carefully, taking care not to damage the core within. Soil that has been disturbed or softened due to the passage of the flush medium shall be carefully scraped off using a sharp tool. The remaining core shall then be wrapped in at least two layers of clinging plastic film and sealed with low temperature wax, before the core is

transferred to core boxes for storage and transport. The temperature of the molten wax shall be checked with a suitable thermometer prior to use: wax at a temperature of more than 60°C shall not be used.

All cores must be wrapped and sealed immediately after retrieval so as to preserve the moisture content for later testing.

A dedicated core preparation area shall be provided on the drilling platform which shall be adequately screened from adverse weather conditions. The core storage area shall be protected from extremes of temperature and weather, and cores shall be transferred from the platform at regular intervals to the Contractor's premises for logging, photographing and sampling. The Contractor must provide a storage location area for the maintaining of all samples retrieved for ten years for further tests.

S1.11.3 Logging and photographing rotary core

After transportation to the Contractor's premises, the cores shall be unwrapped in a sheltered, well-lit environment. The core shall be logged by an Geologist or Geotechnical Engineer that meets minimum requirements described in the tender documents. The description shall be in accordance with the guidance given in ASTM D5434 - 12, with particular care given to identifying strata boundaries and soil thicknesses.

Cores shall be photographed in accordance with clauses 3.25 and 5.6 of the Specification for ground Investigation. A standard film or high resolution digital camera shall be used to take photographs of the core.

S1.11.4 Sub-sampling for testing

Soil shall be sub-sampled from the recovered core after being unwrapped for photographing and logging. Samples shall be cut from the core using a sharp tool or cutting wire to minimise disturbance, and tested as soon as possible after sub-sampling. To minimise loss of moisture between unwrapping the cores and testing, the sub-sample shall be removed immediately and the core photographed with a labelled spacer taking the place of the missing sub-sample. The core should then be re wrapped.

S1.12 PARTICULAR PIT AND TRENCH REQUIREMENTS

Trial pits and trenches are not required.

S1.13 PARTICULAR SAMPLING REQUIREMENTS

S1.13.1 Sampling Frequency

The frequency and type of sampling shall depend on the type of exploratory hole and nature of the ground encountered as detailed below:-

Small disturbed samples

Small disturbed samples shall be recovered at each change of stratum and every metre of penetration in all materials throughout each borehole. A small disturbed sample shall also be taken over the depth of each borehole shear vane test.

Piston sampling

In boreholes in very soft and soft cohesive material, an in-situ vane shear strength test shall be carried out at 0.5m below the top of the very soft or soft cohesive material. Then, piston samples shall be taken at 1.5m below the top of the very soft or soft cohesive material and thereafter at 2.0m intervals, alternating with the in-situ shear vane tests as described in S1.13 of this Specification.

Where there is no recovery from two successive piston samples, an open tube sample with a core catcher shall be taken. Thereafter, in the same stratum and borehole, open tube samples shall be taken in lieu of the piston samples, alternating with vane tests as before.

Open tube samples

In boreholes in firm, stiff, very stiff or hard cohesive material, an open tube (U100 or Thin wall Shelby tube) sample shall be taken at 0.5m below the top of the firm, stiff, very stiff or hard material. Thereafter, open tube samples shall be taken at 2.0m intervals. The U100 tube used shall be steel or aluminium. The open tube samples shall alternate with standard penetration tests (SPTs) as described in Schedule S1.13 of this specification, to give an SPT or an open tube sample every 1.0m depth.

Bulk samples

In boreholes in non-cohesive material, a bulk disturbed sample shall be taken at a depth of 0.5 m below the top of the non-cohesive material. Thereafter, bulk disturbed samples shall be taken at 1.0m intervals. The bulk disturbed samples shall alternate with standard penetration tests (SPTs) such that a sample is taken and an SPT is carried out every 1.0m depth.

The Contractor shall ensure that for individual strata thinner than 0.50m thick, a representative disturbed sample is taken of the thin stratum.

S1.13.2 Particular piston sampling requirements

Prior to sampling, the equipment shall be inspected and overhauled to ensure that it is capable of taking high quality samples, particular attention being given to the piston packing and locking device.

The equipment shall be of sufficient overall rigidity to prevent excessive deformation of the piston rods.

The sample tube shall conform to the following:

Area ratio:	maximum 10%
External diameter:	nominal 4 inch (100mm)
Length:	minimum 900 mm
Inside clearance:	maximum 1%
Edge taper angle:	5-10°

The inside of the tube shall be clean and smooth without protruding edges or irregularities. The difference between the maximum and minimum outside diameters at any cross section of the tube shall be 1.5 mm.

The samples shall be obtained using a single continuous motion using hydraulic pressure, at a rate compatible with causing minimum disturbance to the soil being sampled. Control of the advance length must be demonstrated by the Contractor, to ensure that unnecessary disturbance or compression of the sample does not occur. For each sample, the recovery achieved shall be recorded as follows:

$$\text{Total Recovery Ratio} = \frac{L}{H}$$

$$\text{Net Recovery Ratio} = \frac{L'}{H}$$

Where the sample has not moved downwards in the tube during withdrawal the following ratio shall be recorded:

$$\text{Gross Recovery Ratio} = \frac{L^*}{H}$$

- Where
- L = length of sample before withdrawal
 - L' = actual length of sample recovered
 - L* = distance measured from the top of the sample to the cutting edge
 - H = length of sampler penetration below the bottom of the borehole.

After measurement of the penetration, the sample can be withdrawn after a period of ten minutes in such a way that it is kept free from shock or other disturbance. Similarly, care must be taken to ensure that disturbance does not occur on disassembly. The sample shall be examined for any deposition of disturbed material and if disturbed material is present, it shall be removed. All measurements shall be taken at this time and recorded, together with the condition of both ends of the sample.

During sampling, water balance shall be maintained at a level that is sufficient to prevent disturbance at the bottom of the borehole.

The Contractor shall ensure that the sampling procedures are not negatively influenced by casing movements caused by tidal or wave variations.

Piston samples must be effectively protected from excessive heat, frost, vibration and shock during transportation and storage and care must be taken not to deform the sample tubes. The samples shall be embedded in a cushioning material that shall be placed between, on top of, and beneath the samples to a minimum thickness of 50 mm in the transportation containers. This container should normally be large enough to contain three or four samples. Piston samples shall be transported vertically. The ends of the piston samples shall be sealed with hot wax. The samples shall be stored in a room or container where the temperature and humidity are constant.

Piston samples will be sub-sampled for laboratory specimens and the majority will be extruded and described. An agreed format will be required for presentation of the detailed description of soil fabric.

Samples shall be photographed and selected prints included in the Factual report.

S1.14 PARTICULAR GEOPHYSICAL SURVEY REQUIREMENTS (OPTIONAL)

S1.14.1 Geophysical Survey

The Contractor shall carry out a geophysical survey of the soils at the site. The details and extent of the work is shown on Exhibit 2 within Appendix A.

The purpose of the survey is to determine the depths and types of soils above rockhead.

The Contractor shall propose a method which is suitable for determining this information. The method shall be approved by the Project Manager prior to the commencement of the site works.

The Contractor shall interpret the results of the survey, including calibration of the results with those from the intrusive investigation. The results of the survey shall be plotted on drawings which, as a minimum, shall show the site plan and cross sections through the site, including interpreted soil types and elevation of rockhead. The format of the drawings and position of cross sections shall be agreed with the Project Manager. Data from the survey shall be provided in digital format to allow it to be incorporated in to AutoCad drawings.

The Contractor shall agree the dates and programming of the geophysical survey with the Project Manager.

S1.14.2 Objectives of the geophysical survey

Marine geophysical survey of these areas shall provide 60-metre total coverage (30 metres each side) with 50% overlap, resulting in 30-metre survey line centers over the entire area described.

The survey operation will produce, at a minimum, the following:

- High resolution, multibeam bathymetry with 100% coverage.
- Sub-bottom profiles showing sediment depth and characteristics to a depth of 30-metres.
- Water depth profiles matching the sub-bottom profile lines
- Sidescan sonar survey with 100% coverage.
- Imagery resolution must be sufficient to detect and classify objects 0.5 metres in size minimum.

S1.14.3 Specialist Geophysicist

A Ground Specialist geophysicist shall be provided by the Contractor to advise on the types and methods of geophysics to be used.

S1.14.4 Geophysical Survey Methodology

Geophysical marine survey work shall provide a detailed assessment along the area of the breakwater construction. Resulting data shall provide details of sea bed morphology and shallow geology.

The data shall provide relevant data on the seabed materials and strength with regards to requirements for breakwater construction.

As described within the Survey Objectives, geophysical survey elements will be performed with a 30-metre survey line centre spacing over the full area described. Detailed requirements for each survey element follows.

Sub-Bottom Profiling

Continuous sub-bottom profiler data will be acquired along all survey lines. The sub-bottom profiler will be capable of penetration to a minimum of 30-metres with vertical bed separation resolution of 30-cm or better in the upper 10 to 15-metres of seabed.

Sidescan

Sidescan sonar survey of the seabed shall be collected along all geophysical survey lines with 100% overlapping coverage minimum. Backscatter data collected shall be suitable for use in determining geologic material characteristics of the surface of the seabed as well as identify objects of interest or other obstacles in the areas being surveyed.

S1.14.5 Calibrations and conformance

All instruments shall be calibrated where appropriate and or conformance to the manufacturer's specification shall be demonstrated on site.

S1.14.6 Site log book

The Contractor shall keep a site log recording:

- a) the timing and scheduling of the survey
- b) instrument serial numbers
- c) site conditions during the survey
- d) any constraints or problems encountered during the survey
- e) any feature likely to influence the data together with details of the plan position, material type, depth and extent of the feature.

S1.14.7 Survey report

The Contractor's report shall include: copy of the site log book

S1.15 BATHYMETRY

The survey shall collect sea floor bathymetry data to provide full and continuous, 100% coverage, high resolution data of the proposed breakwater area. The information shall

be continuous and seamless from the deepest point up to above sea level using adequate overlapping between the following methods: Multibeam Echo Sounder for the marine survey, and land RTK data for above seafloor and shallow water down to the point of overlap with Multibeam data. equipment shall be used for the bathymetric survey. Marine survey shall be conducted according to the IHO standards of hydrographic surveys, Special publication No. 44, 5 th edition, Special order. All soundings and subsequent contours shall be provided in Israeli New coordinate system and shall be reduced to local chart datum the Israeli Land Survey Datum (ILSD) by observed tide..

Deliverables of combined bathymetry topography surveys:

1. All relevant raw data.
2. 0.5X0.5m xyz grid in csv format
3. DWG format of a contour map 0.5m apart
4. PDF version of the latter

S1.16 PARTICULAR IN SITU TEST REQUIREMENTS

The following in situ tests shall be carried out and reported in accordance with appropriate ASTM standards. The frequency and type of in-situ testing shall depend upon the soil encountered, as specified below.

S1.16.1 Standard Penetration Tests (SPTs)

The frequency and type of testing shall depend on the type of exploratory hole and the nature of the ground encountered as detailed below:-

In firm, stiff, very stiff or hard cohesive material, standard penetration tests (SPTs) shall be carried out at a depth of 1.5m below the top of the firm, stiff, very stiff or hard cohesive material and thereafter every 2.0m, alternating with U100 samples as specified previously in S1.12.

In non-cohesive material, standard penetration tests (SPTs) shall be carried out at a depth of 1.0m below the top of the non-cohesive material and thereafter every 1.0m.

S1.16.2 In-situ shear vane tests

In very soft and soft cohesive materials, the Contractor shall carry out borehole shear vane tests as instructed by the Project Manager.

An in-situ vane test shall be carried out at a depth of 0.5m below the top of very soft and soft cohesive material and thereafter at intervals of 2.0m. The in-situ shear vane shall alternate with piston samples, as described previously in S1.12, except where continuous piston sampling is required by the Project Manager.

Borehole shear vane tests shall be carried out in accordance with ASTM D2573 / D2573M - 15e1 or other equivalent standard to the approval of the Project Manager. Both the intact (peak) and disturbed (remoulded) undrained shear strengths shall be measured and recorded.

The equipment provided shall be such that no vertical or horizontal movement takes place during testing.

The Contractor shall supply two types of borehole shear vane, one capable of accurately measuring undrained shear strengths ranging between 0 and 50 kPa and the other one capable of accurately measuring undrained shear strengths ranging between 50 and 75 kPa. The shear vane shall have four blades, with a cutting edge at the lower end and an area ratio not exceeding 12%. The rod on which the shear vane is mounted shall not exceed 13mm in diameter and shall be enclosed in a suitably designed sleeve to exclude the effects of friction.

Extension rods of 1.0m in length shall be used and shall be fitted with a coupling which eliminates tightening or twisting one relative to another. The extension rods shall be sufficiently strong to withstand axial thrust and shall permit a certain amount of non linearity. Spacers shall be used at regular intervals (e.g. every 3-4m), to maintain the verticality of the rods inside the borehole.

The vane torque measuring equipment shall be calibrated in accordance with this Specification and a copy of the most recent certified calibration chart shall be submitted with the first set of shear vane test results and shall also be included in the factual report. The torque measuring instrument shall have been calibrated within a year of undertaking the test.

Vane testing in exploratory holes shall be carried out by lowering the vane on extension rods to the base of the hole and then pushing the vane a distance not less than 0.5 metre below the base to reach the required test depth.

Preliminary borehole shear vane test results shall be submitted to the Project Manager within 5 working days of completion of each test.

Final results of the undisturbed and remoulded undrained shear strengths, corrected by means of the torque head calibration curve, shall be submitted in the factual report. All preliminary and final record sheets shall be submitted to the approval of the Project Manager.

S1.16.3 Hand Vane Tests

Hand vane tests (set of three) shall be carried out at the top and base of each recovered U100 tube or piston sample in cohesive soil. Test results shall be reported as intact and remoulded shear strengths for each of three readings, and as an average, on a separate record sheet. The average (mean) intact and remoulded shear strength at each test depth shall be recorded on the exploratory hole log.

S1.16.4 CPT requirements

The CPTs may be carried out with down-the-hole test equipment or with equipment lowered to the seabed. For either case, the contractor shall supply complete details, including method statement, for the proposed test equipment. The method statement shall clearly discuss the measures to guarantee satisfactory (seabed) test conditions, including reaction and ballast mass, and drilling facilities to allow drilling out or drilling through obstructions which prevent penetration of the test equipment to the specified depth, whatever is applicable for the test equipment proposed.

Special attention shall be directed toward ensuring minimum disturbance of the seabed prior to the test such that accurate measurements of the material properties and elevation can be made.

The CPT's shall be carried out in accordance with Accuracy Class I with an allowable minimum accuracy of 50kPa or 3% of the measured value of the cone resistance. Reference is made to the ISSMGE Report "International Reference Test Procedure for the Cone Penetration Test and the Cone Penetration Test with pore pressure" (1999).

S1.17 PARTICULAR INSTRUMENTATION AND MONITORING REQUIREMENTS

No particular requirements.

S1.18 PARTICULAR DAILY REPORT REQUIREMENTS

Daily reports shall be submitted to the Project Manager in accordance with Specification Clause 10.1.

S1.19 PARTICULAR LABORATORY TESTING REQUIREMENTS

S1.19.1 Requirements for geotechnical laboratory testing

The requirements for geotechnical laboratory testing are detailed in the Bill of Quantities. The Project Manager will prepare a schedule of tests following receipt of the typed preliminary borehole logs. The Contractor shall list all available samples per borehole on a convenient schedule for this purpose.

The laboratory or laboratories used for all geotechnical testing shall be ISO 17025 accredited.

S1.20 PARTICULAR REPORTING REQUIREMENTS

S1.20.1 Submission of Results

Drillers daily reports, preliminary exploratory hole (site engineer's hand-written) logs, monitoring records and in situ test results shall be submitted in draft to the Project Manager within 24 hours of completion of boring, drilling, monitoring and testing respectively. Typed borehole records shall be submitted to the Project Manager within three working days of completion of the borehole.

S1.20.2 Report

A Factual Report of the investigation shall be provided including Interpretation and processing of all survey data.

- All data interpreted to identify seabed obstructions, hazards, geographic relief, as well as seabed characteristics.
- Interpretation based on all available data collected, including data from geotechnical survey operation core samples collected in the area. The interpretive report should include Geotechnical characterization of all soils/rocks encountered throughout the investigation.

S1.20.3 Digital data

The checked and approved final report shall be submitted in both paper and digital format. All digital data from the ground investigation shall be submitted in ASCII type format in accordance with AGS publication *Electronic Transfer of Geotechnical and Geo-environmental Data* (3rd edition). A scanned copy of the report, including photographs, shall also be provided in Portable Document format (.pdf).

Electronic data shall be supplied on CD, clearly labelled with the contract title, Contractor, Project Manager, date of issue and version of the data.

SCHEDULE 2: EXPLORATORY HOLES

Exhibit 1 in Appendix A shows the proposed location of the marine exploratory holes. The exploratory hole locations should be regarded as "preliminary", and may be re-sited by the Project Manager if there are obstructions or access restrictions, or if the alignment and position of the proposed new works changes.

Adjacent to each Borehole (1-2 meters from the Borehole location), a CPT shall be performed to a depth of 10 meters below seabed (bsb).

The Boreholes shall be performed according to the following steps:

1. Locate the "jack-up" in the borehole location.
2. Perform CPT to a depth of 10 meters below seabed. If non penetrated layer is encountered, then drill through it and continue the CPT to the designed depth.
3. By an offset of 1-2 meters from the CPT, drill the borehole according to the Specification requirements.
4. If a clay layer encountered in the CPT, non-disturbed samples shall be taken during the borehole drilling according to the Specification requirements.

Hole No	Type (*)	Seabed Elevation [m ILSD]	Approx depth (m bsb)	EASTING	NORTHING
B	BH	-4,5	15	185060.23	689959.50
C	BH	-4,5	10	185105.65	690154.27
D	BH	-4,5	15	185151.10	690349.04
E	BH	-4,5	10	185196.54	690543.81
F	BH	-4,5	15	185242.40	690738.48
G	BH	-4,5	10	185356.87	691225.20
H	BH	-4,5	15	185401.76	691419.92
J	BH	-4,5	10	185521.90	691931.17
K	BH	-4,5	15	185575.01	692160.09
L	BH	-4,5	15	185628.41	692388.94
A1	BH	-4,5	15	185235.79	690996.52
B1	BH	-4,5	15	185394.90	691678.42
Bb	CPT	-4,5	10	1-2 meters from BH-B	
Cc	CPT	-4,5	10	1-2 meters from BH-C	
Dd	CPT	-4,5	10	1-2 meters from BH-D	
Ee	CPT	-4,5	10	1-2 meters from BH-E	
Ff	CPT	-4,5	10	1-2 meters from BH-F	
Gg	CPT	-4,5	10	1-2 meters from BH-G	

Hole No	Type (*)	Seabed Elevation [m ILSD]	Approx depth (m bsb)	EASTING	NORTHING
Hh	CPT	-4,5	10	1-2 meters from BH-H	
Jj	CPT	-4,5	10	1-2 meters from BH-J	
Kk	CPT	-4,5	10	1-2 meters from BH-K	
Ll	CPT	-4,5	10	1-2 meters from BH-L	
A1a	CPT	-4,5	10	1-2 meters from BH-A1	
B1b	CPT	-4,5	10	1-2 meters from BH-B1	

(*) BH - Borehole

The Contractor shall note that the Project Manager may vary the location, depth and number of exploratory holes in the light of initial results obtained from the investigation.

SCHEDULE 3: PROJECT MANAGERS FACILITIES

ACCOMMODATION

The Contractor shall provide all necessary attendance upon the Project Manager on-site to enable him to monitor the progress and check technical aspects of the investigation. Whilst the offshore siteworks are in progress, the Contractor shall provide a boat and boatman to transport the Project Manager and/or his representatives to and from the marine rig as he requires.

FURNISHINGS

A weatherproof area shall be provided for the Project Manager on board the jack up platform with suitable heating, lighting and water facilities for at least three people. The structure includes all other facilities that meets minimum requirements described in the tender documents.

The Contractor shall provide toilet facilities for the use of the Project Manager.

SCHEDULE 4 : SPECIFICATION AMENDMENTS

Not used

SCHEDULE 5 : SPECIFICATION ADDITIONS

Not used

Exhibit 1 – Borehole Location Plan

