Annexure – II

TECHNICAL SPECIFICATION

1.0 OBJECT

This specification covers soil investigation work to be carried out at the site of overhead tank. The object of the investigation is of ascertain the nature and properties of sub soil available at site at various depths and to determine sequence of strata, chemical properties of sub-soil and groundwater are to be determined to assess their effects on foundations and to evaluate safe bearing capacity of soil for the structural design of overhead tanks.

2.0 General

2.1 Visit to Site

The contractor before submission of his tender shall visit the site and ascertain nature of soil, local, site and traffic conditions, the accommodation he may require for his staff and labour, obstructions in the area etc and allow for any extras likely to be any such condition in his quoted rates, no claim on this account shall be admissible under any circumstances.

2.2 Setting Out and Surveying

The contractor shall carry out necessary survey work to set out and take levels of all locations for soil investigation work and shall be responsible for the accuracy of the same. He is to provide all instruments and proper qualified staff and labour for getting his work checked by the Engineer In charge or his representative.

2.3 Safety Code

The contractor shall take adequate safety precautions and ensure complete safety and prevention of accidents at site and shall be entirely responsible for the complete safety of his workmen working at site.

2.4 Keeping works free from Water and Obstructions
The contractor shall provide and maintain at his own cost, pumps and other equipment to keep the work areas free from water, other obstructions and continue to do so till the completion of the work.

2.5 Removal of Vegetation etc

The contractor shall clear all vegetation and rubbish etc from the site as may be required to carry out the soil investigation work and disposes then suitably in areas.

2.6 Standards

Unless otherwise specified herein, all latest applicable codes and standards of the bureau of Indian Standards shall grown the work in respect of design, workmanship, quality and properties and materials and method of testing a list is furnished in the end of this specification.

3.0 SCOPE OF WORK

The work covered under soil investigation includes setting out, field investigations, laboratory tests and submission of soil investigation reports incorporating the observations made during the field investigation and the results of laboratory tests, analysis of field and laboratory test results, foundation recommendations and other related information like bearing capacity etc along with all charts, curves, drawings, tables etc.

The field investigation shall consist of sinking boreholes by boring, chiseling and drilling, conducting standard penetration tests, collection of disturbed and undisturbed soil sample, collection of blocks sample of solid / disintegrated rock and core samples of rock, collection of water samples etc.

All samples collected at field shall be properly preserved and transported by the contractor to recognized and approved soil testing laboratory for conducting necessary laboratory tests.

All field information and test result shall be collected, collated and presented in the form of soil investigation report with necessary drawings, curves, charts, tables, calculations etc.

The contractor shall provide all materials, surveying instruments,
plants, instruments, equipments, knowledge and labour required for carrying out the soil investigation work complete in all respects.

The contractor shall perform soil investigation work at the location of overhead tanks or as per priority decided by the In charge during the course of field and laboratory work.

4.0 BORING

Boring shall be done generally in accordance with IS 1892, employing mechanically operated equipment, Boreholes of normal diameter 150/200 mm, shall be sunk employing shell and auger equipment or other approved method, to the envisaged depth. Wash boring shall not be permitted above the level of Ground Water Table (GWT). In case of boring through hard slag and heterogeneous fill, the boreholes may have to be advanced by using equipment of larger diameter.

Before commencement of boring, at each borehole location at 10 m x 1.0 pit upto a depth of 2.0 m shall be excavated to identify any possible underground obstructions like electrical, water, sewage or other service / utility lines.

Records of borings shall be maintained by the contractor in accordance with Appendix – C of IS 1892, the boring records shall indicate borehole number, time and date of start and completion of boring, type of boring and / or drilling, diameter of boreholes at different depths, depth of casing, existing ground level, level of standing subsoil water including loss or gain of water in borehole, description and thickness of various strata including their depth below existing ground level, ‘N’ values from standard penetration tests, number and type of soil samples collected and the depths at which samples were taken and all other relevant data. All boring records shall be incorporated by the contractor in the soil investigation report.

5.0 STANDARD PENETRATION TEST

Standard penetration tests in boreholes shall be carried out in accordance with IS 2131 at intervals of 1.5 m, at every change of strata or at depths as directed by the Engineer. Samples collected from all spilt spoon shall be preserved for concluding laboratory tests for identification and classification purpose. Results of all such penetration tests shall be included by the contractor in the bore logs and soil investigation report.
6.0 OBSERVATION OF GROUND WATER LEVEL

While sinking boreholes, the contractor shall are fully record the level at which sub-soil water is first encountered. Standing sub-soil water level shall be observed in boreholes everyday at the beginning of the boring work. On completion of each bore hole, the contractor shall allow sufficient time for the ground water to come to a steady level and record the static sub-soil water table. All such records shall be included by the contractor in the soil investigation report. Method for determination of water level in a bore hole shall be according to IS 6935.

7. SAMPLING

Disturbed samples shall be collected from boreholes at every changes stratum whichever is earlier and stored in polythene bags in accordance with IS 1892. Samples collected from the cutting shoe of the undisturbed soil sampler, spilt spoon sampler and lump samples from the auger shall be placed in suitable containers, labeled and preserved by the contractor as disturbed samples. Undisturbed soil samples shall be collected from bore holes in accordance with IS 1892 and IS 2132 by open drive thin walled tube sampler having outside and inside diameters of 106 mm and 100 mm respectively and 450 mm long, at 1.5 m intervals or at every change of stratum, whichever is earlier depth as decided by the Engineer In charge. After recovery, the tubes containing undisturbed soil samples shall be cleaned, waxed, capped and leveled according to IS 1892 and IS 2132 for onward transmission to the laboratory by the contractor, Special care shall be taken during handling and transportation of the samples.

Water samples shall be collected by the contractor in consultation with the Engineer In charge from ground water, from boreholes and from test pits for the soil investigation work or from other available source. Samples shall be collected as per IS 1892. The contractor shall take adequate care in collecting the water samples and ensure that the samples represent the true characteristics of water. The quantum of samples shall also be adequate to ensure that all specified be collected in standard sampling bottles properly sealed and labeled or onward transmission to laboratory. Each sample label shall display the source, location and depth from where the samples have been collected, data and time of collection and initials of the contractor.
Upon completion of each borehole, the contractor shall submit to the Engineer In charge one set of soil / rock samples properly preserved in polythene bags / boxes with sample labels. Each sample label shall display the source, location and (with R>L) etc from where the samples have been collected and also the description of the soil and rock as per IS classification.

8.0 LABORATORY TESTS

Samples during field investigation shall be carefully selected by the contractor so as to representative for particular types of subsoil and rock and forwarded by him to a recognized and approved soil testing laboratory for performing the laboratory tests as per relevant parts of IS 2720. The quantity of samples shall be adequate for conducting all the laboratory tests satisfactorily. The contractor shall prepare the laboratory test schedule and submit along with the bore logs to the Engineer In charge for approval. The tests shall include the following:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>NAME</th>
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<tbody>
<tr>
<td>1.</td>
<td>Moisture content</td>
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<tr>
<td>2.</td>
<td>Specific gravity</td>
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<tr>
<td>3.</td>
<td>Bulk and dry density</td>
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<tr>
<td>4.</td>
<td>Grain size analyzer</td>
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<tr>
<td>5.</td>
<td>Liquid, plastic and shrinking limits</td>
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<tr>
<td>6.</td>
<td>One dimensional consolidation</td>
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<tr>
<td>7.</td>
<td>Tri-axial comprehension :</td>
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<tr>
<td></td>
<td>Unconsolidated un-drained</td>
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<td>8.</td>
<td>Unconfined comprehension</td>
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<td>9.</td>
<td>Direct shear</td>
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<tr>
<td>10.</td>
<td>Unit weight rock</td>
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<td>11.</td>
<td>Crushing Strength rock</td>
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<tr>
<td>12.</td>
<td>Chemical strength of rock</td>
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<tr>
<td>13.</td>
<td>Chemical analyses of ground water e.g.</td>
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<tr>
<td></td>
<td>Determination of pH value, Sulphate and Cloride content etc and alothr tests as mentioned in BOQ, if any</td>
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<tr>
<td>14.</td>
<td>Safe bearing capacity</td>
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</table>

The results and interpretation of all the laboratory tests shall be corporate in the soil investigation report indicating borehole / field test number sample number, sample description and depth of collection of sample from ground level.
8.0 **SOIL INVESTIGATION REPORT**

The contractor shall submit required no. of copies (as mentioned in BOQ) of the final soil investigation report in English language. The final soil investigation report shall include complete compilation and consideration of all available data, in-situ and laboratory tests conducted, contractor’s interpretation and interference of results of in-situ and laboratory investigation. It shall include general description of site, geology of the area, soil investigation procedures and results of all in-situ and laboratory tests. The report shall include special features and their effects on foundation, for example effect of shrinking and swelling characteristics of soil and sub-grade of area in ground water or sub-soil on foundation and remedial measures to be adopted. The report shall also include drawings, showing test locations, borehole logs, sub-soil profile, load settlement and time settlement curve, tri-axial and unconfined compression test diagrams etc. The contractor shall ensure that all observation and result of all laboratory tests are incorporated in final report. The contractor shall perform adequate in-situ and laboratory tests to study and establish the properties of all sub-soil and rock layout.

The report shall specify allowable bearing capacities at various depths considering strength and settlement criteria and estimated settlement for different sizes of foundations for given intensity of loading. The report shall include assessment of ground condition and indicate types of foundations to be adopted for different sub-soil including existing fill if any and rock strata. The report shall, also include precautions and special measure, to be taken for design and construction of foundations, for example precautions to be taken for construction of foundations / substructures in existing fill if any, making keep excavations, dewatering etc. Prior to submission of final soil investigation report, the contractor shall submit draft final report comments, if any, to the Engineer Incharge.