



Bheriganga Municipality
Office of the Municipal Executive
Chhinchu, Surkhet
Karnali Province, Nepal
Sustainable WASH for All (SUSWA) Project

Soil Test, Structural Analysis and Design Estimation Review of 30Cu.M. Overhead Tank
Terms of Reference (ToR)
April, 2024

Summary Table

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|------------------------------|---|
| Intervention Name | Soil Test, Structural Analysis and Design & Estimation Review of 30 Cu.M. Overhead Tank (Elevated Water Tank) |
| Location | Bheriganga Municipality, Ward No. - 11, Surkhet, Karnali Province, Nepal |
| Sector | WASH |
| Timeframe | First-April to Last-April 2024 |
| Reports to | WASH Unit focal Person, Bheriganga |
| Intervention Language | English |


1. BACKGROUND AND INTERVENTION LOGIC

Bheriganga Municipality, Surkhet is implementing Sustainable WASH for All (SUSWA) project within the municipality in support of the Government of Nepal (GoN), Government of Finland (GoF) and the European Union. The project's focus is more on the functionality of existing water supply and sanitation services including WASH governance systems. The Project targets to support the establishment of an efficient and transparent WASH governance at a municipal level that would be capable to ensure safe, sustainable, inclusive WASH services and conditions for all.

SUSWA has three outcome areas and outcome area 2 is fully focused on 'Climate resilient, safe and functional water supply'. SUSWA will focus on rehabilitation or reconstruction of existing non-functional water supply schemes to make it functional and also targets to extend it where applicable to cover the unserved/unreached people. Apart from this, the project also aims to implement new water supply schemes targeting to cover the unserved or underserved populations with the idea of Leave No One Behind (LNOB). The project will focus on rehabilitation/reconstruction to make functional water schemes.

One of the schemes of Bherignaga named Keureni water supply scheme of ward No. 11 has to be designed an overhead tank (OHT) of 30 cu.m to serve 69 households. WASH unit of Bheriganga municipality has refereed the DWSSM reference design and cost estimation. However, it is always safer side to have a soil test of the site where OHT is going to be constructed with its structural analysis to propose foundation type, designs, estimate, and construction of the proposed Overhead Tank.

2. OBJECTIVE AND PURPOSE OF THE ASSIGNMENT


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The overall objective of this task is to ensure the soil type, structural requirement and confirm the design estimate of the overhead water tank.

The specific objectives are:

- ✓ To test the sub-soil profile
- ✓ To conduct the structural analysis of 30 cu.m RCC overhead water reservoir tank
- ✓ To ensure the design standard and cost estimate of 30 Cu.m RCC overhead tank

3. SCOPE OF WORK

The scope of the work is to explore the sub-soil profile of the site where the overhead tank has been proposed. Similarly, another aspect is to conduct a structural analysis of the proposed 30 cu.m RCC overhead water reservoir tank and review the design and cost estimation of the reservoir tanks. The scope of subsurface exploration shall be as follows:

- ✓ Borehole advancement to 15 meter at 3 locations;
- ✓ Standard penetration tests (for Dynamic Cone penetration; if required) at 1.5 m interval;
- ✓ Collection of disturbed and undisturbed samples at regular intervals or as and when required;
- ✓ Ground water table observation;
- ✓ Laboratory test and analysis of data to determine the engineering properties;
- ✓ Technical report of the investigation work;
- ✓ Predict Liquefaction of soil strata and recommend necessary preventive measures against liquefaction;
- ✓ Conduct a conductivity test of the soil strata.

The above-mentioned depths, numbers and process for analysis and design review are indicative. The Consultant shall decide the actual required depth of soil investigation according to the field condition and design parameters.

4. METHODOLOGY

The consultant should follow the standard procedure to complete the work. The work shall be carried out following the relevant standard code of practice. The method of boring should be rotary drilling. The method adopted for boring shall be according to IS 1892-1979. Boring of pits at the site should be done in the presence of the Engineer from the Client. Ground water table shall be observed and noted every morning and evening during the investigation period.

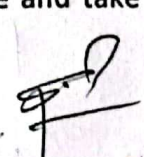
Method of Sampling in Boreholes

Undisturbed soil samples shall be collected from regular intervals in case of Uniform soil formation. Additional undisturbed samples shall be collected at every change of formation. The collected sample shall be sealed and transported carefully. Disturbed samples may be taken by any method approved by the Engineer and must be stored in air-tight double plastic bags. Collection of the sample shall be according to IS: 1892-1979.

Drilling, Sampling & Field Testing

i. Rotary Drilling:

The rotary drilling method shall be used to develop the borehole and take samples from the subsurface layers.


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ii. Standard Penetration Test (SPT):

Field tests like the Standard Penetration Test (SPT) shall be conducted at each change in soil strata or 1.5 intervals as per ASTM D-1586.



iii. Dynamic Cone Penetration Test (DCPT):

The recorded number of blows required to penetrate the least 400 mm shall be taken as DCPT values. The DCPT values shall be converted to SPT values. SPT samples shall be collected in airtight plastic bags and disturbed samples shall be collected in waterproof bags.

The general sequence of sampling shall be to obtain test samples at 1.5 m intervals or as per the requirement. The material from the cutting edge of the sampler or from the split spoon tube shall be considered as a disturbed sample. Disturbed samples collected from the boreholes shall be suitably packed to get in natural condition suitably numbered and indicating job number, borehole number sample number, date of sampling, soil description, depth of sample etc. and sent for the testing of Grain size Analysis, Hydrometer Analysis, Natural Moisture Content, Moist & Dry Density, Atterberg's Limit Test, Direct Shear Test and Specific Gravity Test.

During drilling, ground water table shall be measured at the start and after 24 hrs at the end of drilling. A permanent water level shall be observed if available, which can be a deciding factor for various analysis.

Soil Testing

The Consultant shall conduct field and laboratory tests for samples collected in the field as per the standard; relevant code of ASTM, BS or IS as specified by the client. After that it shall be analyzed to measure and appraise the engineering properties of the soil. The testing program shall be directed toward the geotechnical evaluations required to develop recommendations for the structures at the site.

Test Results

The test results shall be presented as per the suggestions of the clients. The results of both lab and field tests shall be analyzed against the selected type of foundation. All design parameters shall be provided along with the recommendations of foundation type, allowable bearing capacity, settlement criteria and other. In each borehole log, the consultant shall present all the information about; stratification, soil type, field test data, water table condition and other.

Design Parameters

Based upon the analysis of the field data and lab tests, design parameters like allowable bearing capacity of soil, type and depth of foundation shall be recommended. Allowable bearing capacity for different types of foundation for different depths shall be analyzed.

Laboratory Investigation

The laboratory test methods shall be according to IS: 2720 wherever applicable. Other standard testing procedures such as BS and ASTM could also be allowed.

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Analysis of data

The field and lab data shall be analyzed by a competent geo-technical Engineer/Engineering geologist. The borehole logs shall be logged and verified. The samples shall be properly classified according to Unified Soil Classification system. The engineering parameters shall be established. Shear strength and settlement parameters shall be assessed.

Safe bearing capacity and net bearing capacity shall be calculated according to IS: 6403-1981 and IS: 8009-1976. Other codes such as USBR manuals may also be adopted. Allowable bearing capacity at the proposed site and the variation within the area shall be proposed. Allowable bearing capacity for different types of foundation for different depths shall be recommended based on suitable codes.

5. Deliverables

The following deliverables are envisioned under this assignment:

- Submit a full soil test report of the proposed site with all details of different bearing capacities of soil for different depths.
- Submit a structural analysis report of 30 Cu.m Overhead tank with the proposed foundation type based on the soil test report of the proposed site.
- Review the existing design estimation of 30 Cu.m overhead tank prepared by WASH unit and ensure the design and cost estimation as per national standards.

6. EXPERTISE & COMPETENCIES

- Consultancy should assign a team of experienced technical team with qualification of B.E. in civil or Geotechnical or structure engineering with min 3 years' experience on the relevant area of testing, analysis, designing and cost estimation of overhead tanks and such structures.
- Prior experience of accomplishing similar work and assignments.
- Strong skill on developing analytical and quality report.

7. BUDGET


The estimated budget for the assignment is NPR 300,000.00 (In words: three hundred thousands only) including tax as per government rules and regulations. All applicable taxes will be deducted at the source and resource person's fee will be disbursed upon submission all deliverables only.

8. Tentative workplan

The tentative plan of the assignment:

| S.N. | Activities | Nos. of jobs |
|------|--|--------------|
| 1 | Soil testing at the proposed site | 1 Nos |
| 2 | Structural analysis of Overhead tanks and its components | 1 Nos |
| 3 | Review existing design and cost estimation | 1 Nos |
| 4 | Submit soil test reports, structural analyses of overhead tanks with recommendations, design estimation review reports | 1 Nos |

9. TIMELINE


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The consultant is expected to conduct the proposed task within one month time in consultation with WASH Unit of Bheriganga municipality from the date of contract agreement.

10. SELECTION PROCESS AND CRITERIA

Bheriganga Municipality will review the applications based on the similar working experience of overhead tanks works.

- The consultant shall be selected based on the criteria relevant to demonstrated work experience on soil test, structural analysis and design and estimations.
- Applications must include:
 - i. Curricula Vitae (CV) of proposed resource persons
 - ii. Techniques/methods proposed for the soil testing
 - iii. Cover letter with confirmation of availability

***Note:**

This ToR can be updated to achieve aspected objectives and deliverables based on the discussion with consultant who has already a expertise on this kind of technical works.



[Signature]
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