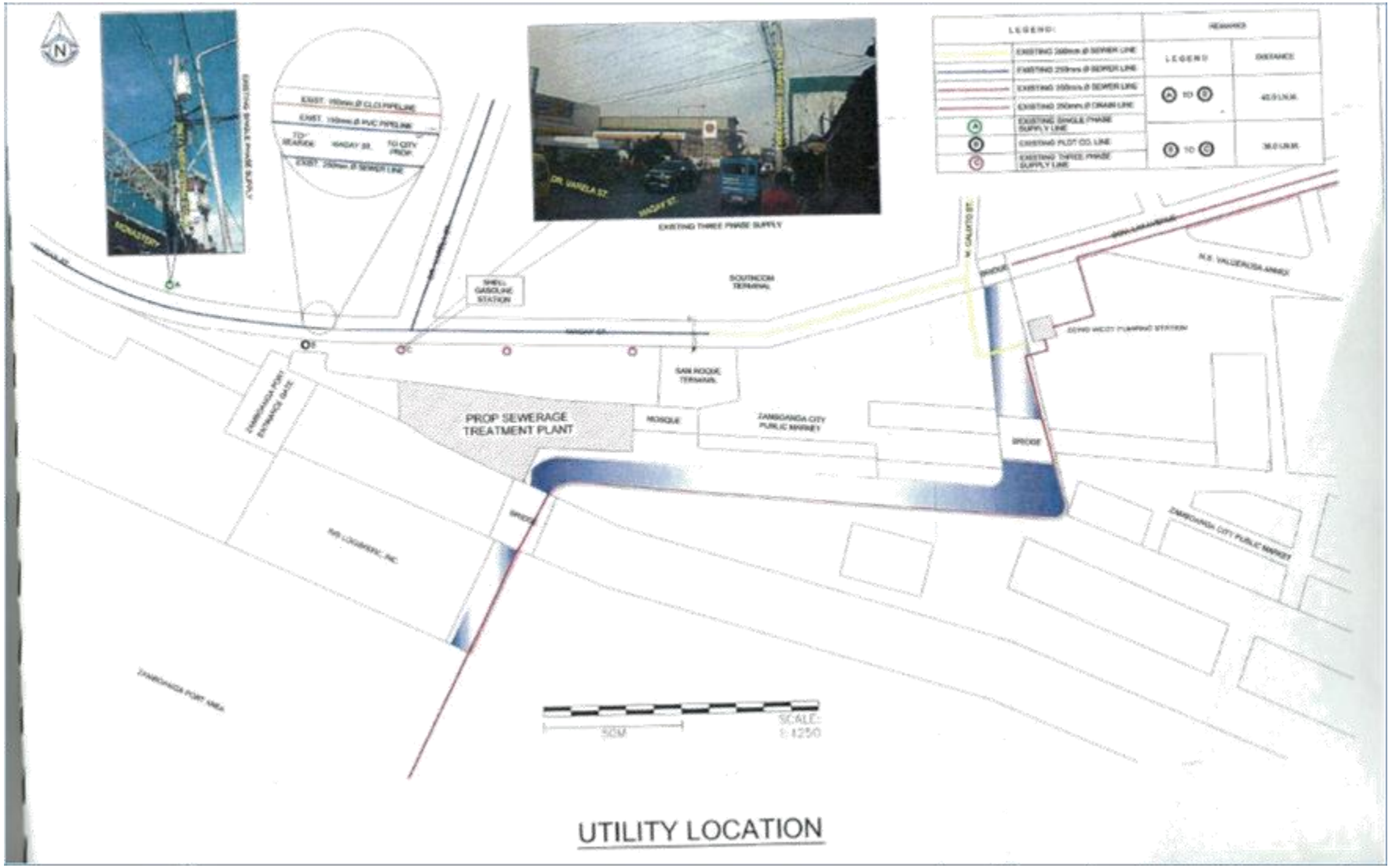
## 10. UTILITY LOCATIONS



## 11. GEOTECHNICAL INVESTIGATION



### 1. INTRODUCTION

This Final Geotechnical Report is in accordance with the contract Agreement entered into between AECOM International Development, Inc.– herein referred to as the "Client"; and Advanced Geotechnical Engineering Services (AGES) with main office address at 103 Dunhill Street, East Fairview, Quezon City, for the latter to conduct the geotechnical investigation work, in connection with the proposed Sewage Treatment Plant for Zamboanga Water District located at Magay St., Barangay Zone IV, Zamboanga City.

This Final Report contains the borehole location plan, idealized soil profile, final boring logs, laboratory test results, and photographs taken during the actual field work, and the final evaluation and recommendations for foundation design of the proposed project.

### 2. OBJECTIVE AND SCOPE OF WORK

The main objective of the investigation is to assess the general subsurface condition of the project site, and to provide recommendations relevant to the foundation design of the above-mentioned project.

The Client's authorized Scope of Work calls for the drilling of two (2) boreholes to target depth of thirty (30) meters, the conduct of the necessary laboratory testing on selected soil samples, and the submission of this final geotechnical report.

The specifications, as set forth in the Contract, were adhered to in the conduct of the investigation.

## 3. THE PROJECT SITE

The proposed site, located at Magay St., Barangay Zone IV, Zamboanga City, is situated inside the compound of Material Recovery Facility near the Philippine Ports Authority (PPA) and main public market. The proposed site is currently surrounded by existing low-rise residential and commercial structures, and is near a creek.


Figure 3-1. Project Site Location from Google Earth

The perspective of the proposed sewage treatment plant provided by the client is shown in Figure 3-2 below.

Figure 3-2. Perspective of the Proposed Sewage Treatment Plant

The proposed sewage treatment plant will be constructed about 6m below the existing ground surface within the compound of the existing Material Recovery Facility (MRF). Some of the low-rise structures within the project site will be demolished to give way for the construction of the proposed sewage treatment plant.

Photographs of the actual borehole location and drilling activity are shown below.

Figure 3-3. Actual Borehole Location & Drilling Activity

## 4. FIELDWORK

One set of hydraulically powered drilling equipment, complete with crew were mobilized for this project. Actual drilling work was started on September 18, 2015 and was completed on September 21, 2015.

The approximate location of the boreholes is shown in Appendix A entitled "Borehole Location Plan".

The duration of work and the final depth of boreholes are tabulated as follows:

Table 4-1. Summary of drilling activities

| Borehole I.D. | Work Started | Work Completed | Final Depth (meter) |
|---|---|---|---|
| BH-1 | Sept. 18, 2015 | Sept. 19, 2015 | 30.45 |
| BH-2 | Sept. 20, 2015 | Sept. 21, 2015 | 30.45 |
| **TOTAL** | | | **60.90** |

### 4.1. DRILLING OF BOREHOLES

The drilling work was conducted using rotary, hydraulically-powered TDC-2 drilling machine.

#### 4.1.1. Wash Boring Procedure

Drilling through ordinary soils was advanced using the Wash Boring Procedure. This is accomplished by first driving short pieces of casings into the ground to start the borehole. The casing is normally cleaned out by means of chopping bit attached to the lower end of the drill rods, with water exiting at high pressure at the side holes of the chopping bit, carrying the cuttings or loosened soil particles out of the borehole through the space between the casings and the drill rods.

NW size casings (76 mm inside diameter) were added to prevent the borehole from caving-in.

4.1.2. Standard Penetration Tests (ASTM D1586)

Standard Penetration Tests were conducted at 1.0 meter intervals for the first 3.0 meters and 1.5 meters thereafter.

Standard Penetration Tests (SPT) was performed using the Automatic Trip Hammer Mechanism with the Standard 50 mm outside-diameter split-spoon sampler, coupled to the end of a string of drill rods, and driven by a 63.5-kg hammer with a free-fall of 75 cm. The trip-hammer mechanism minimizes errors due to human intervention during the testing. The number of blows for the three successive 15-cm penetrations was then recorded.

The sum of the two 15-cm penetrations comprises the N value. These results are incorporated in the final logs in a semi-graphical form.

Disturbed and representative soil samples obtained from the split-spoon samplers were visually classified and then carefully sealed in properly labeled water-tight plastic bags. These were brought to AGES Laboratory in Quezon City for testing.

The soil consistency or in-situ relative density mentioned and shown in the attached final boring logs is based on the following:

Table 4-2. SPT N-value blow count and relative density for granular soil

| Relative Density of Sands according to the Results of Standard Penetration Test | |
|---|---|
| No. of Blows | Relative Density |
| 0 – 4 | Very Loose |
| 4 – 10 | Loose |
| 10 – 30 | Medium Dense |
| 30 – 50 | Dense |
| Over 50 | Very Dense |

Table 4-3. SPT N-value and consistency for cohesive soil

| Consistency of Cohesive Soils according to the Results of Standard Penetration Test | |
|---|---|
| No. of Blows | Consistency |
| 0 – 2 | Very Soft |
| 2 – 4 | Soft |
| 4 – 8 | Medium Stiff |
| 8 – 15 | Stiff |
| 15 – 30 | Very Stiff |
| >30 | Hard |

Disturbed and representative soil samples obtained from the split-spoon samplers were visually classified and then carefully sealed in properly labeled water-tight plastic bags. These were brought to AGES Laboratory in Quezon City for testing.

## 5. LABORATORY TESTS

Significant characteristics of the representative soil samples taken out from the fieldwork were further investigated by laboratory tests. These soil characteristics provide data used to classify and quantitatively assess the engineering properties needed in the structure's foundation.

In general, all testing procedures conform to the American Society for Testing Materials (ASTM). The Unified Soil Classification System (USCS) was used in the classification of the samples.

The following tests tabulated below were conducted on disturbed samples:

Table 5-1. Summary of laboratory tests conducted

| ASTM DESIGNATION | TITLE/ DESCRIPTION |
|---|---|
| 1. D 2487-85 | Classification of Soils for Engineering Purposes |
| 2. D 2216-80 | Water (moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures |
| 3. D 422 | Particle size Analysis of Soils |
| 4. D 4318-84 | Liquid Limit, Plastic Limit and Plasticity Index of Soils |
| 5. D 512 | Chloride Content Test on Soil |
| 6. D 516 | Sulfate Content Test on Soil |
| 7. D 2974 | Organic Content on Soil |

## 6. RESULTS AND FINDINGS

The Idealized Soil profile shown in Appendix B was drawn to graphically depict the general subsoil condition at the project site.

Based on the results of the two (2) boreholes, it may be generalized that the project site is underlain by practically uniform soil stratification, described as follows:

**Layer A**

The uppermost layer of about 12.0 meters thick consists of gray, fine to medium Sand (SM), with traces of non-plastic silt and fine gravel. Consistency of this layer is very loose to loose. SPT blow counts ranged between 3<N<13, with an average of 8.It was observed that pockets/lenses of soft, slightly plastic Clay materials were found in this layer, particularly in BH-1. Decayed wood material was also recovered in BH-1 at 2.0m depth. The lone undisturbed sample recovered at BH-1 (12.0-12.45m depth) cannot be tested for unconfined compression test because of the presence of broken corals and traces of fine gravels.

**Layer B**

This layer underlies layer A, generally described as medium to high plastic Clay (CH) with appreciable amount of limestone fragments. Thickness of this layer is about 3.0 to 4.5 meters, with recorded SPT blow counts of 5<N<14.

**Layer C**

This is the last layer encountered in the boreholes, generally classified as creamy white, gravel/sand-sized Limestone fragments with some slight to medium plastic clay.SPT blow counts ranged from a low of 9 in the uppermost stretches of the layer and linearly increased towards the bottom of the borehole (as high as 30). The two boreholes were both terminated in this layer at about 30.45 meter depths.