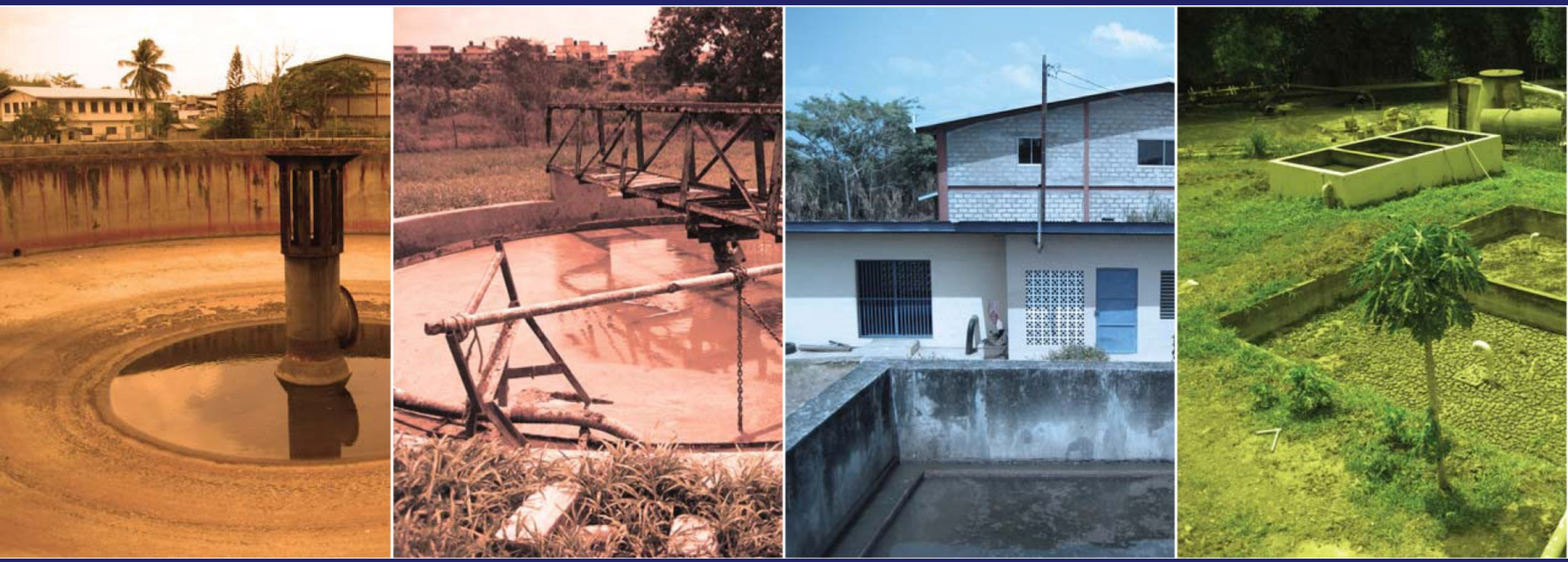
WATER AND SEWERAGE AUTHORITY
OF TRINIDAD AND TOBAGO

Environmental Impact Assessment

Establishment of a Regional Wastewater Collection System and Treatment Plant for San Fernando and Environs



Volume 2 of 2
Appendices

CEC 1597/2006

July 2010

AECOM

AECOM

CEC 1597/2006

EIA for a Wastewater Collection System and Treatment Plant in San Fernando and Environs

Prepared by:

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Project Number:

60118683

Date:

July, 2010

Appendices

Appendix A. Application and Terms of Reference for Certificate of Environmental Clearance
Appendix B. Legislative and Regulatory Framework
Appendix C. Project Description
Appendix D. Biophysical Baseline Data
Appendix E. Socio-Economic Baseline Data
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Appendix G. Impact Assessment and Mitigation Measures
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Appendix A

Certificate of Environmental Clearance

Appendix A

Certificate of Environmental Clearance

Application

(3)

SCHEDULE

FORM A (Rule 3(1))

THE CERTIFICATE OF ENVIRONMENTAL CLEARANCE RULES 2001

APPLICATION FOR A CERTIFICATE OF ENVIRONMENTAL CLEARANCE

This form must be completed in **triplicate** for any proposed activity identified in the Schedule of the Certificate of Environmental Clearance (Designated Activities) Order, 2001. **Essential additional information such as plans, maps, diagrams, photographs or text may be included in the application as an appropriately referenced attachment.**

To: The Environmental Management Authority,

I/We hereby apply for a Certificate of Environmental Clearance (CEC).

Signed...
Applicant/Applicant's agent/ Applicant's Attorney

DENISE LEE SING-PEREIRA
....
(PRINT NAME)

Signed...
Company Director/CEO/ Corporate Secretary
(Company Stamp)

WATER AND SEWERAGE AUTHORITY ST. JOSEPH

DAVID BOYCE
....
(PRINT NAME)

Date......2001 Aug 22......

FOR OFFICIAL USE ONLY

Application Received.......................... (Date) Received by: .... (Signature)

Ref. No. | | | | | | | | | | | | | | | | | | | | |

Acknowledgment Sent.............................. (Date)

Category of intended activity: (please tick appropriate box) (i) New ☐ (ii) Modification ☐

(iii) Abandonment/ Decommissioning ☐

PROJECT CLASSIFICATION

Activity ☐☐ Definition ☐☐

Application requires CEC: Y ☐ N ☐ Application requires EIA: Y ☐ N ☐

EMA: CEC 1

CERTIFICATE OF ENVIRONMENTAL CLEARANCE

APPLICATION FORM

A. GENERAL INFORMATION

1. Name of applicant **WATER AND SEWERAGE AUTHORITY (WASA)**

2. Postal Address **FARM ROAD, ST. JOSEPH**

Electronic mailing address (e-mail address) pere9127@wasa.gov.tt

3. Telephone no. **662-2302-7 ext. 2402** 4. Fax No. **663-9117**

5. Location of proposed activity:

(a) District/Village **SAN FERNANDO AND ENVIRONS**

(b) Street (Name and Lot or LP No.) See attached Map

6. Do you own the property on which the activity is intended to be carried out?
Y☐ N☒

If Yes, please attach certified copies of Proof of ownership.

If No, what is the nature of your interest in this property? Please attach supporting documents, justifying your claim (e.g. lease).

7. Names and addresses of adjoining property owners: See Map Attached

8. (a) Previous Application for CEC for this site? Y ☐ N ☒

(b) If yes, Reference No of most recent application ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

9. Activity for which CEC required (state the activity and definition categories under which you are applying -refer to CEC Order) as well as the purpose of the project.

Activity **42** ☐☐ Definition ☐☐

Purpose: <u>The establishment of a regional wastewater treatment plant for the above mentioned areas, inclusive of associated works; laying of sewage mains and decommissioning of existing treatment plants where applicable.</u>

10. Site Description (physical setting of the proposal, both developed and undeveloped areas)

Give an outline description of the physical features of the site to include information on:

(a) Topography and gradient i.e. generally flat ☐ rolling/undulating terrain ☒ or hilly ☐

(b) Are there any springs or aquifers in or adjacent to the site? Y ☐ N ☒

(c) Are there any rivers, streams or drainage within or adjacent to the project site? Y☒ N☐

(d) Are there any ponds, reservoirs or wetland areas within or contiguous to the project site? Y ☐ N ☒

(e) What is the predominant soil type? Clay based ☒ Sand ☐ Loam ☐ Alluvial ☐

(f) Is the project located within 5km from the coast ☒ or further inland ☐?

(g) Present site land use: Residential ☒ Agricultural ☐ Commercial ☒ Industrial ☒ Forestry ☐

11. Estimated project capital (TT dollars) **See claim for confidentiality**

B. DESCRIPTION OF INTENDED ACTIVITY

12. Description of the Intended Activity, which must include information on:

(a) Total area intended for the activity (ha or m^2): **To be determined**

(b) Percentage of the total surface area allocated to covered space and paved areas (%)

To be determined

(c) Potable water consumption rate (m^3/day) **To be determined**

(d) Process water consumption rate (m^3/day) **N/A**

(e) Project's intended operating capacity (metric tons per annum) **N/A**

(f) Production output rate, if different from above (metric tons per annum) **N/A**

(g) Intended commencement date **January 2008**

Site Preparation and Construction Phase

13. Does the project site require major earthworks such as clearing ☒ cutting ☐ excavation ☒ grading ☒ blasting ☐ dredging ☐?

If yes, state the method of disposal (and disposal site) of material generated as a result

Disposal to the landfill site with dump trucks; reuse as fill where possible

(a) Does the site require filling ☐ reclamation ☐ coastline stabilisation/alteration ☐ ?

If yes, state the source and quantity (metric tons) of material required. **N/A**

(b) Would the project require major waterworks such as abstraction ☐ diversion of water courses ☐ creation of standing water bodies ☐?

If yes, give an estimate of the volume of water to be impounded (m^3) or the rate of abstraction (m^3/day) and the source of this water **N/A**

(c) Would the site require infrastructure and utility development:
access roads and/or bridges ☐ power generating or transmission facilities ☐
telecommunications ☒ installation or modification of a drainage system ☒
sewage system ☐?

If yes, give details **N/A**

14. Will the project require relocation of people ☐ houses ☐ facilities ☐ from the site?
If yes, give details: **NO**

15. What percentage of the intended project area would be cleared of vegetation?

To be determined, however the majority of network expansion will be done along existing roads and ROWs as well as the plant will be upgraded within existing site boundaries.

16. State mitigation measures for adverse impacts resulting during site preparation and the construction phase.

- **Wetting of Site**
- **Shoring of Trenches**
- **Traffic Management; Alternate routes and detours**
- **Public Awareness Programme**
- **Construction Best Practices**

Operational Phase

17. State the required raw/input materials and the quantities/volumes (kg or metric tons/m^3) to be kept in stock for the project as well as their respective rates of consumption (kg or metric tons per day/m^3 per day).

(a) Would the activity require any ancillary process related chemicals (e.g. catalysts, pesticides)?

If yes, state the quantity (kg or metric tonnes/ m^3) and rate of consumption.

To be determined

(b) State the final products to be derived and the rate of production (metric tons/m^3 per year)

To be determined

(c) State any intermediate products resulting from this activity indicating the rate of production (metric tons/m^3 per year) and their fate.

To be determined

(d) State the rate of production (metric tons per year) and method of disposal of domestic solid waste generated during the operational phase.

To be determined

(e) List, characterise and quantify (metric tons per year) process related solid waste. State the method(s) and location intended for their disposal.

Sludge will be dried on enlarged sludge drying beds and then landfilled.

(f) Provide respective estimates for the rate of generation (m^3per day) of domestic wastewater and sewage. State the respective treatment methods intended for domestic wastewater and sewage as well as their ultimate effluent points.

All domestic wastewater from office staff will be treated at the plant

(g) State the source and process water consumption rate (m^3 per day) **N/A**

(h) Would the activity discharge process related liquid effluent? Y ☒ N ☐

If yes, state the source, composition, discharge rate (m^3 per day) and the ultimate effluent points.

To be determined

(i) Would this activity utilise any hazardous (i.e. toxic, flammable, explosive, radioactive etc.) substances? Y ☐ N ☒

If yes, provide a listing of the substances and the quantities to be used or stored.

18. Would the project require storage of input and/or waste material on site? Y ☐ N ☐
If yes, give estimates of the quantities (kg or metric tons) for the storage of:

Waste **Sludge** Input material **Appurtenances & Fill**

(a) Describe briefly the facilities allocated for this purpose
On-site sludge drying beds
Designated lay-down years for pipes & backfill

19. Indicate the mode(s) of transport intended for materials and equipment necessary for the operational phase. **N/A**

20. Will the activity generate air emissions (i.e. particulate emissions such as dust or pollutant gaseous emissions) during the operational phases? Y ☐ N ☒

If yes, describe types and sources and provide an estimated emission rate or loading

21. Will the activity routinely produce odours (i.e. for more than 1 hour per day)? Y ☐ N ☒

22. Will the activity generate significant levels of noise (i.e. for more than 1 hour per day at levels exceeding 60 dB) during its operational phase? Y ☐ N ☒

23. Will the project have adverse effects on the aesthetics of the area where it is located (i.e. result in radical changes of the landscape, such as scarring/mass vegetation removal)? Y ☐ N ☒

24. State mitigation measures for adverse impacts resulting during the operational phase.

Plants will be designed to meet effluent standards outlined in TTS 417:1993, TTS 547:1998 and Draft Water Pollution Rules. Sludge will be treated in accordance with USEPA Standard (40 CFR Part 503)

24. State the expected lifespan of this activity

Plant network will be designed for 2036

C. CONFIDENTIALITY

26. (a) Do you consider any information provided here to be a trade secret or other confidential business information and that such information be omitted from the Register?

Y ☒ N ☐

(b) Give details:

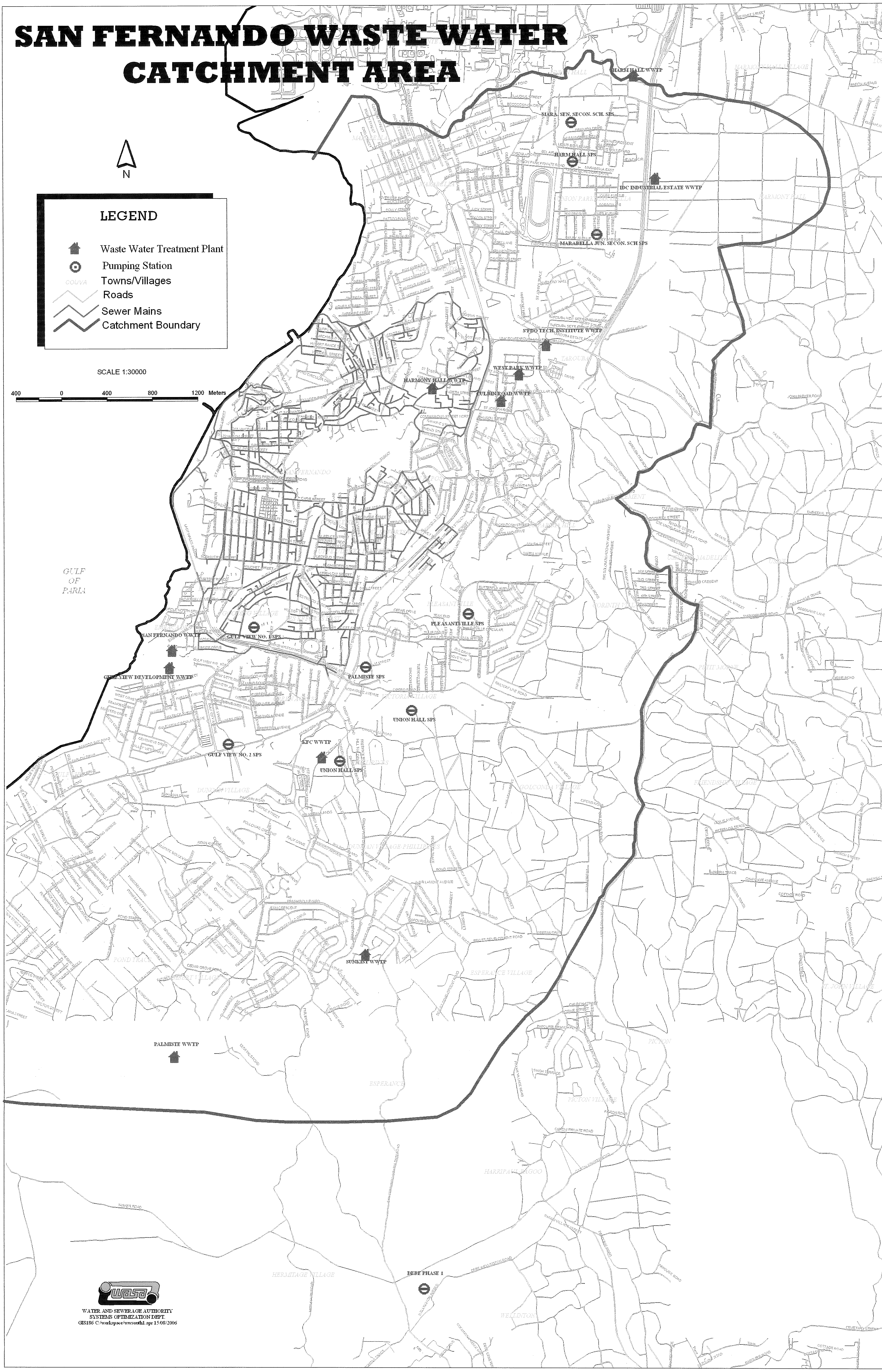
i. All GIS Database and files if requested.
ii. Estimated Project Capital

27. Other relevant information

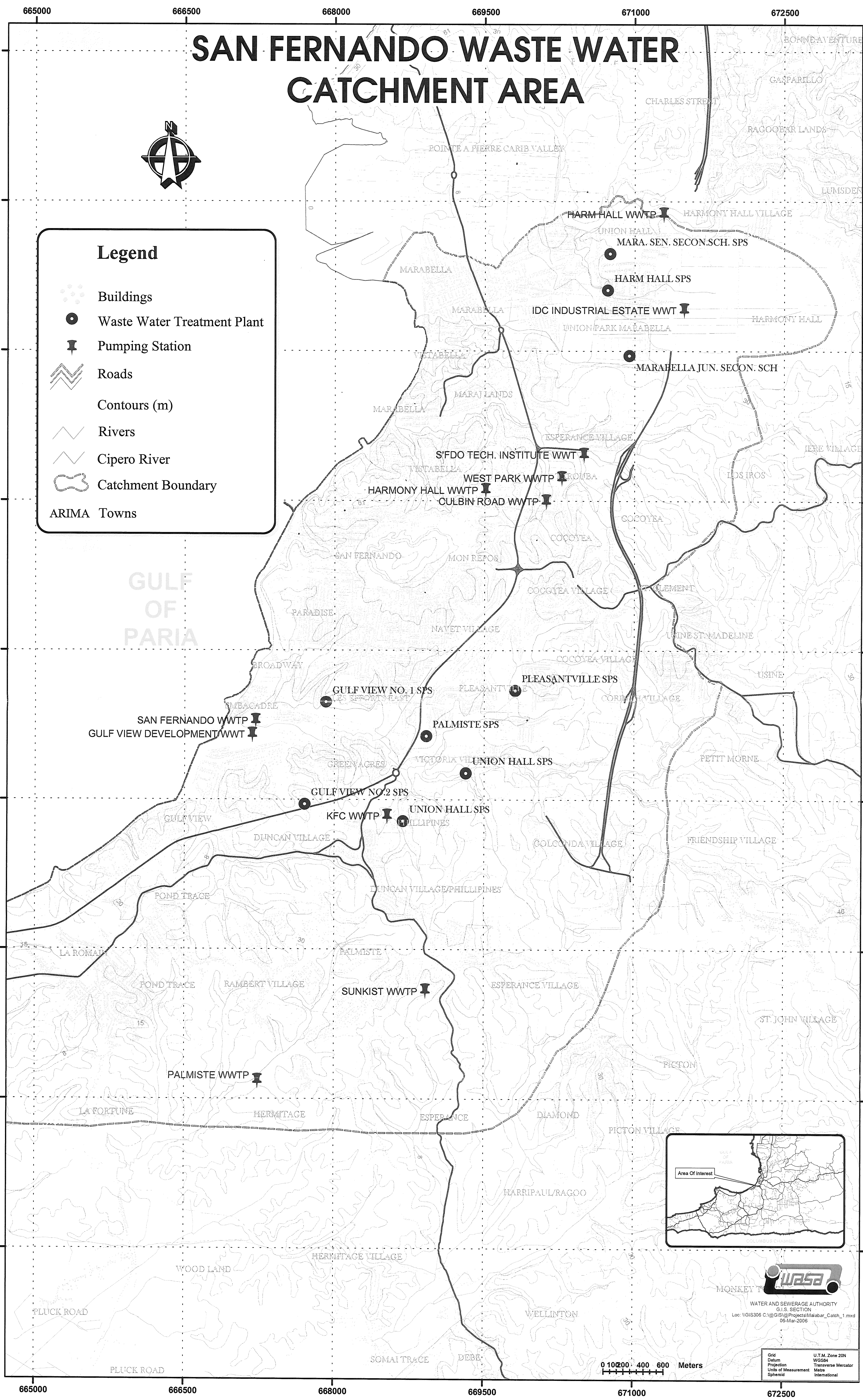
28. Please list any attachments included in the application

- **Maps of Project Area and Site**
- **Payment for CEC Application**
- **Claim for Confidentiality Letter**
- **Project Scope**

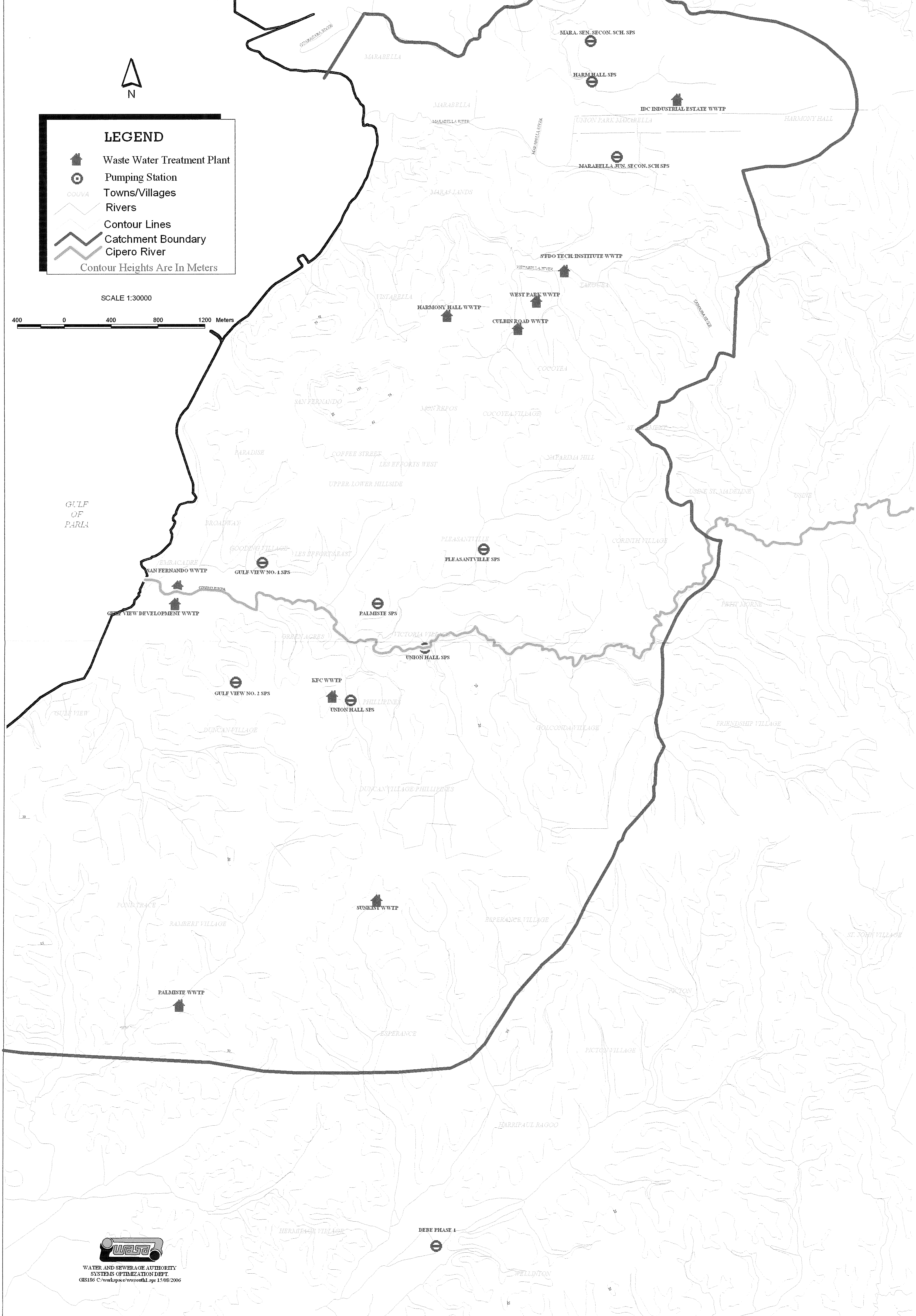
SAN FERNANDO WASTE WATER CATCHMENT AREA



SAN FERNANDO WASTE WATER CATCHMENT AREA



SAN FERNANDO WASTE WATER CATCHMENT AREA



PROJECT SCOPE FOR THE INTEGRATION, EXPANSION AND UPGRADE OF EXISTING INDEPENDENT WASTEWATER SYSTEMS IN THE CITY OF SAN FERNANDO AND ENVIRONS

Background Information

The Water and Sewerage Authority (WASA) desires to embark on the integration, expansion and upgrade of existing independent wastewater systems in the city of San Fernando and environs; and redirect the wastewater flows to the San Fernando Wastewater Treatment Plant. The Authority also intends to upgrade and expand this treatment plant to accommodate flows to design horizon 2036. WASA recommends that this advancement will ensure the long-term sustainability of the wastewater sector and would provide a more cost effective solution for the operation and maintenance of wastewater treatment plants.

Presently, the wastewater generated in San Fernando is treated at the San Fernando wastewater treatment plant. The existing sewerage system utilizes the conventional twin Trickle Filter Process (see Fig. 1) which dates back to the Island Wide Sewerage Scheme of the early sixties, following which (in 1965) WASA was established.

The Solid Waste Management Company Limited added a faecal station in 1985. This facility was intended to receive sludge collected from septic tanks daily, from the Borough of San Fernando and the counties of Victoria and St. Patrick.

The plant has a design capacity of 17,032 m^3/day for a population of 50,000 persons. The estimated population served within the catchment is 29,000 persons. Recent developments in Union Hall and Tarouba Village have contributed to an increase in the population, hence placing greater stress on the existing system.

There are several smaller wastewater systems contained in the study area such as:

- Palmiste
- Gulf View
- Sunkist
- Harmony Hall
- Harm Hall
- IDC Industrial Est.
- San Fernando Institute
- West Park
- Culbin Road
- KFC

In addition, also there are various lift stations within the San Fernando catchment namely:

- Pleasantville
- Union Hall (2)
- Marabella Sen. Sec. School
- Harm Hall
- Marabella Jun. Sec. School
- Palmiste
- Gulf View #1
- Gulf View #2

(See attached map)

The wastewater source is primarily domestic with some commercial and industrial customer contributions. The point of discharge of the effluent is into the Cipero River.

As such, some of the main objectives of the project are:

1. Establishing the catchment area to be served by the San Fernando wastewater treatment plant.
2. Identifying unsewered areas within the catchment area.
3. Identifying all wastewater facilities within the study area.
4. Preparing a methodology and schedule for decommissioning all wastewater treatment plants other than the San Fernando wastewater treatment plant.
5. Preparing as-built drawings of existing wastewater collection systems within the study area.
6. Determining future projections for wastewater flows and loads within the study area.
7. Evaluating options to upgrade the San Fernando wastewater treatment plant to treat the projected flows and loads to the year 2036 and meet effluent standards.
8. Undertaking an economic analysis of the alternatives.

The upgraded facility will also be equipped with staff housing and a modern laboratory. It's envisaged that this project will have many beneficial impacts both environmental and operational. Integration and expansion of the collection network ensures that entreated sewage will not flow directly into the environment, thereby improving pubic health conditions.

Integration also reduces the operational and maintenance costs as well as standardizes material and equipment specifications. Concomitant with improvement to the collection system upgrade of the San Fernando Wastewater Treatment Plant is necessary to ensure that future effluent standards are met. It is anticipated that some negative impacts will occur during the civil/construction works. These relate primarily to traffic, noise and dust.

The Authority recognizes that a Certificate of Environmental Clearance (CEC) is required since the project is consistent with Activity 42 of the CEC (Designated Activities) Order, 2001 and hereby submits the application in accordance with the CEC Rules, 2001.

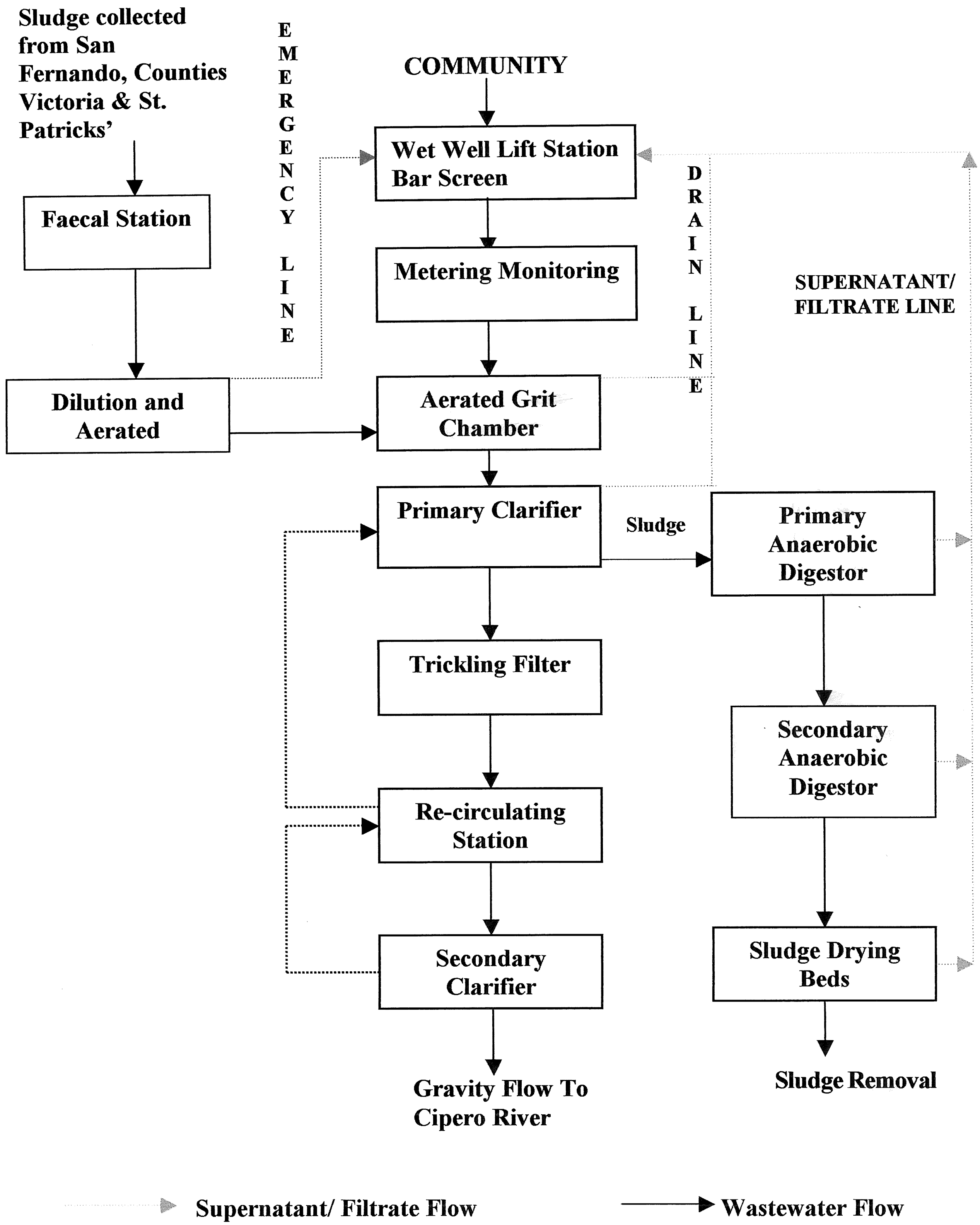


FIG. 1: EXISTING SAN FERNANDO WASTEWATER TREATMENT PLANT PROCESS FLOW

SAN FERNANDO WASTEWATER SYSTEM FACTS SHEET

Address:	Riverside Road, San Fernando
Treatment Type:	Physical & Biological- Twin Trickling Filter
Year Commissioned:	1965
Design Capacity:	17,032 m^3/day
Wastewater Source:	Residential/ Commercial/ Industrial
Catchment- Area Served:	Borough of San Fernando, Pleasantville, Cocoyea, Union Hall and Tarouba North
Satellite Pump Stations:	Pleasantville, Union Hall, Cocoyea
Design Population:	50,000
Estimated Population Served:	29,000
Area of San Fernando	18.64km^2
No. of Household (in 2000):	15,694
Present Estimated Flow:	2mgd (dry flow)
Discharge Point:	Cipero River
Sludge Disposal Method:	Drying Beds (2)
Effluent Quality:	Normally good

Appendix A

Certificate of Environmental Clearance

Final Terms of Reference

CERTIFICATE OF ENVIRONMENTAL CLEARANCE RULES, 2001

Final Terms of Reference for the Environmental Impact Assessment in respect of:

CEC1597/2006 – Application for a Certificate of Environmental Clearance (CEC) by Water and Sewerage Authority (WASA) for the establishment of a regional wastewater plant at San Fernando.

1.0 Introduction

The Environmental Management Authority (EMA) received an application for a CEC from the **Water and Sewerage Authority (WASA)**, for the establishment of a regional wastewater plant, inclusive of associated works, laying of sewage mains and decommissioning of existing treatment plants, where applicable. This project entails the establishment of drainage network, pipeline (sewerage) network. This application was made in accordance with the CEC Rules, 2001 and Activity 42 of the CEC (Designated Activities) Order, 2001.

Cognisant of the potential benefits of this proposed activity, the EMA has determined that there are potential significant environmental impacts that could arise from this activity and that the application requires a CEC and an Environmental Impact Assessment (EIA) in compliance with a Terms of Reference (TOR). The TOR will serve as a guide for the conduct of the EIA and the preparation of an EIA Report in an effort to understand the scope of the project, the potential impacts and the measures that should be taken to mitigate these impacts.

Every attempt has been made to ensure that this TOR addresses all the major issues associated with this proposed development. However, the contents are not exhaustive and should not be interpreted as excluding issues deemed to be significant or issues (currently unforeseen) that may emerge as significant or important from environmental studies, or otherwise, during the preparation of the EIA document. It should be noted that the preparation of the Terms of Reference for this Environmental Impact Assessment does not indicate approval or support in any way, nor does it indicate approval in principle for the proposed development.

1.1 Background information

The aims of these regional wastewater treatment plants would be to maximise the integration of existing independent wastewater systems and gravity flows to the proposed regional plant, the upgraded and expanded San Fernando Wastewater Treatment Plant. WASA proposes that this approach will ensure the long-term sustainability of the wastewater sector and would provide a more cost-effective solution for the operation and maintenance of wastewater treatment plant. The proposed wastewater treatment plant will be designed to accommodate the capacity requirements of 2036.

The proposed catchment area spans from Esperance Village in the south to Harm Hall in the north, Corinth Village in the east and the Gulf of Paria to the west. The existing wastewater treatment plant will be refurbished and expanded to facilitate the needs of a forecasted population in year 2036. The final point of discharge for the treated effluent from the upgraded San Fernando wastewater treatment plant will be the Cipero River. Proposed works in the catchment area will also entail the installation of service connections to service customers and the decommissioning of approximately ten (10) wastewater treatment plants located at Palmiste, Gulf View, Sunkist, Harmony Hall, Harm Hall, IDC Industrial Estate, the San Fernando Institute, West Park, Culbin Road and KFC Gulf View. It is proposed that the decommissioned wastewater treatment plants may be replaced with sewerage pumping stations in the areas where gravity flow cannot be obtained.

There are some environmental concerns associated with a development of this nature. Potential impacts of this development may be of a physical, social and biological nature such that activities from this project can potentially have short-term and long-term impacts on the environment. These potential impacts entail the discharge of suspended solids, nutrients, oil and grease and pathogenic micro-organisms to the existing environment in the event of improper collection, management and treatment of the wastewater. This can lead to public health hazards at the point of collection for routing and point of discharge. There can also be potential impacts on the aquatic environment of the receiving body, such as oxygen depletion, bioaccumulation. Additionally during the construction phase of the development there is potential for increased traffic due to the site works, increased noise, increased surface runoff, erosion and sedimentation of any drains or nearby watercourses due to excavation and filling works proposed for the sites.

1.2 Objectives

The scope of the environmental assessment will be to determine the extent of environmental and social impacts arising from the proposed development, the management of identified significant negative impacts through mitigation, in addition to monitoring plans to gauge the effectiveness of the adopted mitigation measures. At the same time, the environmental assessment should quantitatively and qualitatively evaluate the cumulative impacts from this proposed development and, ongoing and other proposed activities within the respective catchment area. This assessment should also consider the impacts of the proposed excavation and filling works proposed for the site.

1.3 Environmental Assessment Requirements

The CEC Rules, 2001 were made under section 26(h) of the Environmental Management (EM) Act, 2000 and came into effect on July 7, 2001. The CEC (Designated Activities) Order, 2001 outlines a list of activities that require a CEC from the EMA before such activities can commence. The **proposed regional wastewater treatment plant** is consistent with the following activity:

Activity 42 - The establishment, modification, expansion, decommissioning or abandonment (inclusive of associated works) of a wastewater or sewage treatment facility.

The CEC Rules describe the process to apply for, and obtain a CEC. Rule 5(1) of the CEC Rules describes the process for preparation of the TOR for an EIA while Rule 10 outlines the standards of preparation of the EIA.

This environmental assessment is requested in accordance with the relevant sections and rules of the EM Act and CEC Rules, respectively.

In order to be environmentally acceptable, the design and operation must be in compliance with local standards, policies or guidelines. Internationally accepted standards or guidelines should be used in situations where they have not been formalized locally for specific circumstances. Local Standards or Guidelines which may be referenced as appropriate in the EIA include the following:

- TTS 417:1993 (Specification for the Liquid Effluent from Domestic Wastewater Treatment Plants into the Environment);
- TTS 547:1998 (Specification for the Effluent from Industrial Processes Discharged into the Environment);
- Water Quality Guidelines (Draft Water Pollution Rules, 2001);
- Air Quality Guidelines (Draft Air Pollution Rules, 2005);
- Noise Pollution Control Rules, 2001;
- Environmentally Sensitive Areas Rules, 2001;
- Environmentally Sensitive Species Rules, 2001;
- National Environmental Policy;
- Health and Safety Standards e.g. OSHA;
- Trinidad and Tobago Occupational Safety and Health Act, 2004
- Trinidad and Tobago Occupational Safety and Health (Amendment) Act, 2006:

Internationally accepted standards or guidelines can be sourced from the United States Environmental Protection Agency (USEPA), World Bank, World Health Organization (WHO), Multilateral Environmental Agreements or other appropriately referenced and available material.

2.0 Requirements for Environmental Impact Assessment and EIA Report

2.1 Study Area

The study area should be determined by the extent of direct and indirect impacts on the physical, biological and social environments.

This should include the entire catchment area that will be serviced by the proposed treatment plant, inclusive of the drainage area that will be serviced by the wastewater collection system, rivers/streams that may be influenced by the discharge of effluent from the wastewater treatment plant, sites or areas that may be used for the disposal of solid waste generated from the treatment process, surrounding communities that can be affected by the proposed site preparation and construction works such as the transport of materials, laying of sewage mains and other associated infrastructure such as lift stations and pumping stations, etc. Any biological environment that could be affected by the activities for the proposed development needs to be considered in defining the study area. This study area should also consider adjacent development, as well as proposed developments that are planned within the range of influence of the project. This should include any commercial or recreational activities that could potentially be affected by the proposed project.

The study area should be properly identified and described with accompanying photographs, maps and diagrams at easily understood and consistent scales to illustrate the spatial extent of the project and the impact area.

2.1.1 Mapping

Mapping as referred to in this TOR shall be considered to be spatial data to scale, as represented in digital or printed format. All spatial data shall as far as possible be presented using a Geographical Information System (GIS). The use of GIS would not otherwise exclude the use of photographs, map sheets and diagrams at easily understood and appropriate scales to illustrate the spatial extent of the project and the impact area. Printed maps of the site area should indicate the layout of the proposed area in the context of the immediate site as well as with respect to the wider study area. Each printed map should be at an appropriate/easily-understood scale for the view being illustrated (e.g. 1:5 000 minimum for site plans) and be included/inserted at the point of reference in the text in the document.

2.1.2 Use of GIS

Due to the scale and nature of this intended project and the study area, the use of GIS to represent spatial data shall be required wherever practicable. Submitted data should be on a CD Rom and in a format compatible with ArcView GIS and be presented in jpeg format. Data themes should illustrate but not necessarily be limited to the following features/attributes:

- Roads (all classes);
- Built development (e.g. commercial, residential, industrial, institutions – schools, hospitals etc.);
- Non-built land uses (e.g. open spaces, forested areas, agricultural areas, parks, etc.);
- Water resources – rivers/streams, standing water bodies, aquifers/groundwater resources, etc;
- Topography (contour lines at appropriate intervals, preferably in metres);
- Sampling points for baseline data;
- Proposed monitoring stations/points;
- Intended effluent discharge points;

- Discharge points for the existing and proposed drainage systems;
- Geological data.

For features in themes to which particular emphasis is to be placed, consideration should be given to linking to photographs wherever they are available. Themes should be clearly labelled/annotated as necessary. Map units and distance should be set in metres and kilometres respectively, while the Universal Transverse Mercator (UTM) projection should be utilised. Please note that although spatial data would be presented using GIS, hard copies of maps should be included in the report.

2.2 Description of Project

The purpose of the project, as well as a justification for its conceptualisation and implementation should be described. This should also include a justification for the size of the proposed plant. This should incorporate consideration of the existing land use, proposed development and Land Use Planning Policy for the area.

Site plans should be provided showing the general layout of the specific sites for the proposed wastewater treatment plants and the associated discharge pipe(s), car-parking facilities and associated buildings. These plans should be at a minimum scale of 1: 5,000 to facilitate easy comprehension of location, design and operational processes.

An updated aerial survey photograph, **from 2003 or later**, delineating the site should also be provided.

Comprehensive information on the project should be provided and should include the following:

- Location – map showing the overall positioning of the project, with an indication of the proposed components in relation to one another and surrounding areas. This should show shapes, boundaries and areas of roads, rivers/streams, agricultural areas, residential and commercial settlements, recreational areas, industrial areas, existing sanitary sewerage treatment systems, existing wastewater treatment plants and outfall locations, existing pipelines or networks, existing pump stations and building. This map (s) should be at a minimum scale of 1: 10,000 to facilitate easy comprehension;

- Description of all the existing sewage treatment services within the catchment area;

- Description of the present wastewater volume and strength, projections of the wastewater volume for the future taking into account an estimation of the design population equivalent for the plant;

- A detailed description of the proposed design of the wastewater treatment plant, an indication of the acceptability of the chosen design and the ability of the system to meet the effluent water quality standards;

- Conceptual designs (i.e. scaled plans and elevations) of the proposed plant. The construction methods shall be described in outline to facilitate understanding of the use of materials, equipment and the design standards of all the constructs (resistance to seismic events, storms, etc.);

- Description of the proposed plans and methodology for the proposed decommissioning of all the abandoned and existing wastewater treatment plants;

- Description of the proposed plans for the management, operation and maintenance of the proposed plant;

- Description of the requirements for earthworks for site preparation, including the nature and extent of excavation, filling and grading works to be conducted. This description should include the following:

  - Illustrations with scaled pre- and post-development plan and section diagrams, showing the nature and extent of excavation, filling and grading works;
  - Description of the methods, equipment proposed for the site;

- Description of the infrastructural activities proposed for the site. This should include the following:

  - Scaled site plans showing internal roads, car parks, access arrangements and proposed infrastructure associated with the proposed plant;
  - Description of the construction procedure/methodology, infrastructure development, drainage, access to the site, source and estimated quantity of aggregate to be utilised, equipment, machinery and vehicles to be used and the daily traffic that will be generated; and measures for containment or disposal of any construction spoil;

- Description of the stormwater management plans for the proposed development during the site preparation and construction phase of the development. This should include the following:

  - A description of existing and proposed on-site drainage and drainage of adjoining properties;
  - Description of both soft and hard engineering techniques that may be used for the development of the project area;
  - Scaled site plans showing the proposed measures for the management of stormwater on the site during both site preparation and construction;
  - Details of expected volumes and velocity discharge and proposed point(s) of discharge into receiving waters;

- Please provide an outline of a waste management plan for the proposed project area from pre-construction to the operational phase. The operational phase should emphasise the proposed plans for disposal of sludge material and other solid waste from any grit or grease screenings;

- A description of likely transport methods should provide an outline on the routing, staging and the intended means to bring the materials on/to the site (i.e. choice of mode of transport);

- Please provide in outline, a proposed traffic management plan to be implemented for the proposed area, particularly during the construction phase;

- Description of utility requirement in terms of requirements, availability and sources for all aspects of the development (i.e. electricity, potable water, telecommunications, etc.);

- Description of chemicals and the associated volumes; that will be used in the operation of the proposed wastewater treatment plant. This should include copies of the Material Safety Data Sheets (MSDS) for each of the chemicals proposed for use, if applicable;

- Criteria used for the location of the proposed treatment plant and associated constraints;

- Details of land tenure for areas directly affected by the proposed works at the present time and the intended tenure when the development is commissioned, including management arrangements and responsibilities;

- Details of the scheduling of each phase of the development including proposed commencement times and duration for each phase of the development;

- Identification of the expected workforce, support, facilities and services that would be required during the different phases of activity;

- An estimation of the quantity and concentration of expected emissions, effluents, sanitary wastewater, hazardous and non-hazardous wastes and noise during the site preparation and construction phase of the development.

2.3 Description of the Environment

Conduct studies to determine the baseline characteristics of the study area **during the entire annual cycle**, as they relate to the physical, biological and socio-cultural environments. Methodologies should be detailed for all sampling stations, sampling regions and analyses, and included in an appendix of the EIA document. Standard methods should be utilised where applicable. **Data shall clearly show coordinates of sample points, in relation to the entire project, as shown on a map.**

The applicant can make use of existing data sets; both published and unpublished, with confirmed field tests, as applicable. However, the applicant should exercise discretion in the use of this information, baseline information and the need to conduct, as well as the duration of, field studies. In the event that the information supplied is deemed to be inadequate for decision-making purposes by the EMA, the applicant will be required to conduct further studies etc;

Details of the study area should include the following:

2.3.1 Physical environment

Information gathered for this section should identify and reference all relevant baseline data from other studies in a reference list as an appendix.

- Geology, topography and soil characteristics of the proposed site, especially as they relate to the seismic history of these areas and erosion. This should include an assessment of the soil characteristics and the ability to support the expected structures;

- Surface and groundwater hydrology of the area identifying watercourses, groundwater locations/aquifers, as well as, the flow rates of any rivers during within or adjacent to the site during the wet and dry season;

- Meteorological data specific to the site;

- Infrastructure and amenities (roads, bridges, transport, health and emergency services) – the present capacity of the area and the potential to accommodate the proposed project during the construction phase;

- Utilities (i.e. water, electricity, telephones etc.);

- Traffic in relation to ongoing and future activities;

- Ambient water quality – water quality of the freshwater environments during both the wet and dry seasons; analysis of water quality parameters should include pH, temperature, dissolved oxygen, total suspended solids, chemical oxygen demand, biochemical oxygen demand, nitrates, phosphates, contaminants (e.g. heavy metals, hydrocarbons), and coliforms. An assessment of annual and seasonal variations (especially at discharge locations for effluent and comparison with applicable water quality standards and any historical data for the area to be affected) should be included;

- Measurement of Sound Pressure Level (Noise) and Vibration – data should indicate make and model of instrument, frequency weighting, time weighting, exchange rate (dB) and the logging interval. Measurements should cover daily and seasonal normal activities at the site;

- Ambient air quality of the area around the sites proposed for the wastewater treatment plant;

2.3.2 Biological environment

- Flora and fauna:

  - Definition, characterization and spatial illustration of the vegetation types and any associated habitats within the development site. This should include the identification and description of any flora of the area that may be of crucial importance to fauna for food, habitat, etc;

  - Qualitative/quantitative determinations of any fauna, including aquatic and avifauna present, or estimate what is likely to be present in the area. This should include an identification of any species of commercial importance, the identification and description of any sensitive habitats; rare, endangered or sensitive species, as well as an assessment of their local, sub-regional and regional, national and international significance, using published and unpublished data;

2.3.3 Socio-cultural environment

- Description of the socio-demographic characteristics of communities within the study area. This description should include but not be limited to the following:

  - Present and projected population size in the study area including population growth rates;

  - Socio-economic characteristics of the resident population in the study area (e.g. age, sex, income etc);

- Employment and labour market – indicate opportunities for employment generation and the availability of such employment both locally and within the nearby communities;

- Customs, aspiration and attitudes – indicate the acceptability of the proposed project to users of the area, government stakeholders and environmental non-governmental organizations (NGO's);

- Archaeological, cultural and historic value of the area and the acceptability to local residents of the use of historic sites (if applicable);

- Traditional uses of the study area and possible displacements of such uses.

2.4 Legislative and Regulatory Considerations

Describe the relevant section(s) of the local regulations, standards, policies and guidelines governing environmental quality, health and safety that would apply to the proposed project. Some of these are identified in section 1.3 above and should be expanded as appropriate.

2.5 Determination of the Potential Effects (positive and negative impacts) of the Proposed Project

Identify all effects on the physical, biological and social environments that could arise during the different phases of the activity. Quantify or rate the negative impacts **both before and after** the application of mitigation measures and consider those that can occur under upset conditions, according to the following: nature (direct, indirect), significance (negative, positive), scope (local, regional, international), duration (short term, medium term, long-term) and severity (negligible, low, moderate, high), likelihood/potential (negligible, low, medium, high). A rating of positive effects is also encouraged. Areas of potential effects should be illustrated in map form and those that are unavoidable or irreversible must be specifically identified. Significant changes to baseline conditions should also be quantified. A matrix of the physical and biological characteristics of the site in relation to the described impacts should be developed.

The method of impact rating should be explained and details of methods referenced in the appendices. Impacts should be qualitatively described to indicate the maximum area over which both direct and indirect impacts from this activity will be experienced and linked to the rating system. This must also be illustrated on maps to show the variation of distance and the level or degree of impacts from this activity.

The potential effects to be determined include, but are not limited to the following:

- Human beings:
  - Conduct a Social Impact Assessment taking into consideration the following:
    - Disruption or loss of the traditional and current uses of the area by stakeholders for the duration of the activity;
    - Labour force (short and long term);
    - Archaeological and cultural resources (if applicable);
    - Impact of increased traffic during site preparation, construction and operational/occupation within the area;
  - Potential to restrict or alter access to traditional users of the area;
  - Impact of dust and noise due to site activities;
- Flora and fauna:
  - Impact of clearing of vegetation within the area;
  - Impact due to soil erosion;
  - Impact of stormwater and effluent discharges to the receiving bodies;
- Physical environment:
  - Impact of land clearing activities and sedimentation/erosion of material;

- Drainage capacities - the potential to manage increases in volume that could arise from land clearing activities and paving activities;

- Impact of the laying of sewerage networks on public roads and thoroughfares;

- The change in the aesthetics of the concerned area;

- Receiving water quality:

  - Impact on water quality from the site preparation activities i.e. the excavation, filling and grading of land;

  - Impacts due to expected discharge streams and surface runoff from the development during the construction and operational phase;

- Air:

  - Impact of vehicular and equipment emissions to ambient air quality during all site activities;

- Noise and vibration:

  - The impact of noise and vibration on fauna within the study area; this should include both short and long term effects. The fauna considered should include those mentioned previously, as well as any endangered/protected species;

  - The impact of noise and vibration on humans, human activity and buildings;

- Infrastructure and utilities:

  Changes in the availability or service of infrastructure and utilities (e.g. roads, bridges, water, electricity, services, waste disposal);

- Other nearby activities both existing and proposed;

2.5.2 Cumulative impacts

The cumulative impacts associated with other existing or proposed activities within the study area to be determined include, but are not limited to the following:

- Relate potential impacts from proposed activity with existing impacts from other activities such as roads works and other infrastructural works within the study area, in terms of effects to the socio-economic climate and civil amenities/infrastructure;

An account must be given of the assessment methods used for all the impacts identified and the level of uncertainty of any predictions.

2.6 Analysis of Alternatives to the Proposed Project

Describe reasonable alternatives to the proposed projects that would achieve similar objectives. This extends to, but is not limited to the following:

- Siting – possible alternative locations for this activity;
- Type of collection system;
- Type of treatment system;
- Conceptual design and layout of the proposed wastewater treatment plant;
- Construction techniques and phasing;
- Alternatives to proposed land use;
- Treatment and disposal of sludge;

Compare the alternatives in terms of potential environmental impacts and costs, suitability under local conditions and reasons for selecting the chosen alternative. Furthermore, alternatives should be discussed in sufficient detail to make clear the reasons for preferring certain options and rejecting others. The reasons for choice of the preferred option should be explained, including a comparison of the adverse and beneficial effects (both to the environment and community) used as the basis for selection, compliance with government policy and with the principles (and objectives) of sustainable development. The impact of significant delay or abandonment of the project before all of the proposed phases are completed should also be considered. The 'no action' alternative must also be considered to demonstrate potential changes in environmental baseline conditions without the project.

2.7 Development of a Management Plan to Mitigate Negative Impacts

In consideration of significant adverse environmental impacts that were identified in relation to 2.5 above, you are required to propose realistic, feasible and prescriptive measures to avoid, reduce, mitigate or remedy such impacts to acceptable levels. These measures should satisfy local environmental, health and safety standards/guidelines/policies and where these are not available, internationally accepted standards/guidelines should be used.

Impacts must be categorized and illustrated in matrix form and a Mitigation Management Plan (MMP) should be formulated. This should be a framework management plan for the development to manage existing health, safety and environmental issues as well as expected impacts as a result of the proposed project.

The plan must be formulated so that mitigation measures are implemented during relevant phases of the activity (pre-construction, construction and operation (use)). It is necessary to describe the impacts of the project prior to the application of mitigation measures as well as the residual impacts after mitigation.

Mitigation measures shall be detailed to reflect the different phases of the activity (pre-construction, construction, operation (use)). The estimated effectiveness (i.e. residual impact) of listed mitigation measures shall be detailed in a quantitative and/or qualitative manner (as applicable).

Where potential impacts are deemed to be irreversible, unavoidable and significant in scope, the MMP shall indicate provisions to be made for substitutes/compensation for lost amenities or resources to be conferred to relevant stakeholders. It shall be documented where such arrangements are made in consultation with the identified stakeholder groups as appropriate.

Mitigation measures should outline in broad terms operational procedures needed to minimise environmental liability during daily and maintenance operations, as well as emergency and contingency plans in case of accidents, where applicable. The MMP shall include, where applicable, schematics and/or plans to illustrate procedures/processes, layout of facilities and buffer zones.

On a detailed level, description of mitigation measures shall include but not necessarily be limited to:

- A listing of necessary equipment;
- Specifications/design criteria;
- Schedule(s) indicating how mitigation measures are to be deployed in a timely fashion;
- Contingency/alternatives in the event of failure of first choice mitigation measures.

2.8 Development of a Monitoring Plan

A detailed monitoring plan should be provided for the different phases of the project to observe performance indicators for the project and its mitigation measures. Monitoring programmes should address the physical, biological and social impacts as well as the parameters to be monitored (and the respective frequencies of measurement). Impact indicators should be identified and qualitatively and quantitatively assessed to aid in evaluation of impacts. Monitoring locations/stations should be mapped appropriately.

The monitoring plan should also include a table, which summarises the potential impacts, lists the corresponding mitigation measures, identifies the parameters to be used to gauge the effectiveness of the measures and the frequency at which these parameters would be monitored. Outline the measures proposed to monitor the impacts on the environment throughout the duration of laying of the sewage mains, decommissioning of existing treatment plants and the establishment of the proposed treatment plant. The monitoring programs should ensure safeguards are being effectively applied, allow the identification of any unpredicted impacts requiring remedial measures and measure any differences between predicted and actual impacts.

2.9 Consultation and Public Participation

Consultation and public participation can assist in the identification and mitigation of impacts while preventing environmentally unacceptable development, controversy, confrontation and delay.

You should determine the stakeholders that can assist in the provision of information relevant to the project and seek their input into its feasibility as it relates to the impact assessment process. These stakeholders would include, but not limited to, the following:

- Government Ministries/Departments/Statutory Authorities:
  - Ministry of Public Utilities and the Environment;
  - Trinidad and Tobago Electricity Commission;
  - Telecommunication Services of Trinidad and Tobago;
  - Town and Country Planning Division;
  - Ministry of Agriculture, Land and Marine Resources;
  - Trinidad and Tobago Fire Services;
  - Ministry of Works and Transport;
  - San Fernando City Corporation;
  - Princes Town Regional Corporation;
  - Penal/Debe Regional Corporation;
  - Ministry of Labour, Small and Micro Enterprise Development;
  - Central Statistical Office;
  - Archaeological Committee;
- People living in the vicinity of the project;
- People affected by the project;
- Environmental and other non-governmental organizations;
- Other business interests that can be affected by the project.

There should be mechanisms to provide meaningful information to these stakeholders and to allow proper consultation and participation. The public consultation should be geared towards the understanding of the general public on the nature of the project, time frame involved and all relevant issues.

An appropriate number of consultations (minimum 2) must be held with the determined stakeholders at a time and day of the week appropriate for the community given consideration for religious observances and public holidays. All relevant information, including description of activities, all associated impacts and mitigation measures should be presented. Stakeholder consultations should address concerns that will be largely related to the impacts that the project is likely to have on their lives. Information should be graphic, concise, clear and designed in a manner to elicit participation.

NB. *The first meeting should be held within in one month of the issuance of the final ToR. There WASA should provide information about project design and its plans for conducting the EIA, respond to questions about the project and comments from participants. All subsequent meetings should include discussions about alternatives chosen, impacts identified and mitigation measures, assessments of impacts etc.*

The following guidelines shall be followed for the public consultations:

Location

- The public consultations shall be hosted at a location that is easily accessible to the communities that can be directly affected by the project with the capacity for at least one hundred attendees.

Advertising

- The public meeting/s shall be advertised in at least one daily newspaper at least one week from the date of the meeting. The advertisement should occupy at least one quarter of a page in the newspaper and should be bold and noticeable;

- Flyers of at least 8 ½" by 11" in size should be placed at popular stops within the communities such as gas stations, supermarkets, banks and drugstores or within daily newspapers circulated within the communities (this service can be accessed via the newspaper houses). Fonts on the flyers shall be bold and noticeable;

- Other means of advertising may be used, such as radio and television announcements.

Invitees

- The proponent shall extend official invitations to the following Officials:
  - The Member(s) of Parliament/ Elected Representative for the Area(s);
  - The Mayor or other representative(s) of the relevant Regional Corporation(s);
  - Representative/s of the Environmental Management Authority and other relevant; Government Authorities;
  - Community Leader(s);

- The proponent may choose to invite members of various non-governmental organisations including those who may provide supporting reasons for the Certification of the proposed project;

- Members of the media may be invited;

- Any other invitees.

Meeting Format

- The proponent or representatives of the proponent shall inform attendees of who they are and the purpose of the meeting, specifically that a Certificate of Environmental Clearance is being sought from the EMA to proceed with the project;

- The proponent or representatives of the proponent shall give a clear and concise synopsis of the findings of the Environmental Impact Assessment including:

- The precise location of the project;

- The activities to be undertaken by the proponent;

- All logistics associated with the activities, including use of resources, infrastructure, scheduling and duration of activities;
- All possible impacts associated with the project;

- All mitigation measures proposed;

- The floor shall be opened for comments by attendees. (Comments may be managed in the interest of time and in an effort to extract the salient points);

- All comments from the meeting/s shall be noted and submitted in an appendix of the Environmental Impact Assessment Report;

The information gathered should be representative of the stakeholders and should address the concerns raised during the consultation process. The EIA report should demonstrate that public concerns have been adequately considered by suggesting possible modifications to the project proposal or by clarification of items within the document. This should be appropriately documented and included in the EIA Report. The EIA report should also contain details on

- The manner in which the public was notified, the groups targeted, the number of meetings held, location of the meetings, days held, minutes of all meetings and results of the public surveys;

- The type of information provided during the consultations and the issues discussed, differentiating between those which have been resolved and any outstanding issues;

- The key alternatives which have been identified by WASA and stakeholders in the consideration of resolved issues;

- Any plans for ongoing consultations.

Public involvement in the process should be accessible, transparent, accountable, flexible and provide for certainty and should be conducted with integrity. A tabular format is a recommended way of summarizing the results of this process. The table is not to replace specific reference to public involvement throughout the impact assessment report. Rather with specific cross-reference to page numbers or section numbers of the report, the table becomes a useful reference tool.

3.0 The EIA Report

The EIA Report should be concise and limited to significant environmental issues and should provide all the relevant information needed by the regulatory agencies to consider fully any adverse or beneficial impacts of the proposal. It is envisaged that the EIA will be based on the results of available research (including any preliminary results from research through consultation with research organizations), studies and data as appropriate, with further studies being conducted where necessary and practicable. The extent to which the limitations, if any, of available information may influence the conclusions of the environmental assessment should be discussed.

The main text should focus on findings, conclusions and recommended actions, supported by summaries and analyses of the data collected, as well as citations for any references used in their interpretation. Unpublished documents and detailed data should be presented in appendices. Where the EIA utilizes the results of previously conducted research, appropriate references and a listing of individuals and organisations consulted should be included. The public availability of data and studies utilized should also be indicated.

Methodologies for all data collection and analyses (including quality control measures) should be included in relevant appendices. Wherever practical, maps, flow diagrams, charts and photographs directly referred to in the main text shall be included in the relevant section of the main body of the document.

The introduction to the EIA should provide an explanation of the scope of the proposal and the issues and decisions which led to the proposal at this time and in this context - including a history of events leading up to project formulation and alternatives considered; envisaged time scale for implementation and project life; anticipated establishment costs; and actions already taken at the project site. The introduction should also briefly describe the study area and regional setting for the proposal (with reference to any maps as appropriate), including land use and tenure, and describe the studies/surveys/consultations that have been conducted in developing the proposal and preparing the EIA. The complete studies and detailed comments resulting from consultations should be included as appendices. The EIA should provide a listing and description of the approvals needed for the proposal to proceed.

A suggested format is outlined below.

- Table of contents
- Glossary of terms/abbreviations/acronyms
- Non-Technical Summary
- Legislative and Regulatory Framework
- Description of the Proposed Project
- Description of the Environment
- Significant Environmental Impacts
- Analysis of Alternatives
- Mitigation Measures
- Monitoring Plan

- Inter-Agency and Public/NGO Involvement
- List of References
- Appendices
  - Application Form and Terms of Reference;
  - List of those having prepared the Environmental Assessment Records and their qualifications;
  - List of Inter-Agency and Public/NGO Communications;
  - Summary of the outcome of consultations;
  - Methodologies, Data and Unpublished Documents;
  - Site plans, elevations, schematics;
  - Data sets.

Note: All pages are to be numbered and one convention of units are to be used consistently, preferably the metric system

4.0 Other information

Environmental assessment requires interdisciplinary analysis. Experts in their relevant fields should interpret information obtained and where necessary, appropriate references and technical/scientific analyses should be provided to support such interpretations. This should also apply to social issues, especially when dealing with sensitive matters.

The applicant may assert a claim that information provided in support of the EIA is a trade secret or confidential business information. Such information, if any, should be excluded from the EIA Report and submitted under separate cover to the EMA. . The EMA will then determine the validity of this claim and where this is rejected in accordance with rule 3(8) of the CEC Rules, 2001, the applicant shall be notified accordingly.

Under Section 35(5) of the EM Act any application, which requires the preparation of an environmental impact assessment shall be submitted for public comment in accordance with Section 28. Section 28(3) stipulates a period of not less than thirty days to receive public comments and this Report would be made available for such comments as part of an administrative record

In order to aid the review process, the following information should be submitted to the EMA:

- Twenty- five (25) hard copies of the EIA Report;
- Three (3) digital copies of the EIA Report in PDF format and the Executive Summary in MS Word. Each chapter of the EIA Report and each appendix must be individual PDF files;
- All spatial and mapped data required must be provided digitally in a GIS format compatible with ArcView 3.0;
- Format main text of the report using the Size 12 Font, Times New Roman;

These will be copied and used for the public comment process, as well as being made available to other departments/agencies that would have a critical role in the evaluation of the report.

Dated this ..21st....... day of ...November......, 2006.

Dave McIntosh
Managing Director/CEO
Environmental Management Authority

Appendix B

Legislative and Regulatory Framework

Appendix B

Legislative and Regulatory Framework

B.1: EMA Noise Pollution Control Rules (2001), Excerpts

SECOND SCHEDULE

[Rules 6(3) and 8(2)]

MEASUREMENT OF SOUND PRESSURE LEVELS

1.0 INSTRUMENTATION

For the purposes of determining compliance with the prescribed standards, the instrumentation used shall comply with the following requirements:

(a) the instrumentation used shall be an integrating-averaging sound level meter (also known as an integrating sound level meter or an averaging sound level meter) with a measurement capability of the range of 30 dB to 140 dB, and which complies with the specifications for integrating-averaging sound level meters Type 1 or 2 respectively, as specified in International Electrotechnical Commission Standard IEC 804:1985 Integrating-averaging sound level meters and applicable requirements of IEC 651:1979 sound level meters, or with other standards as approved by the Authority;

(b) the integrating-averaging sound level meter shall also possess the capability to measure unweighted sound pressure levels (linear response) and the peak time weighted characteristic as specified in IEC 651:1979;

(c) the integrating-averaging sound level meter shall also possess the capability to log the acoustic data in the memory of the meter, over the measurement period(s).

2.0 CALIBRATION

For the purposes of determining compliance with the prescribed standards, the integrating-averaging sound level meter shall be appropriately calibrated for the acoustical environment in which it shall be used.

NOTE: Generally, for measurement of community (environmental) sound, the instrument shall be calibrated for diffuse field.

3.0 PERSONNEL

The determination of sound pressure levels shall be conducted by competent officers so designated by the Authority or by persons appropriately trained in sound level measurement techniques.

4.0 GENERAL PROCEDURES

4.1 The following general procedures shall be followed in measuring sound pressure levels:

(a) as far as possible, standard sound measurement practice and the manufacturer's instructions for the calibration and method and manner of use of the integrating-averaging sound level meter should be observed;

(b) the calibration of the integrating-averaging sound level meter should be checked in the field in accordance with the manufacturer's instructions prior to taking the sound pressure level measurements of the source under investigation;

(c) to prevent measuring errors caused by wind blowing across the microphone, a windscreen as recommended by the manufacturer of the integrating-averaging sound level meter should be used.

4.2 Settings on Instrument

In determining compliance with the prescribed standards, measurements shall be taken with the integrating-averaging sound level meter on the following settings:

(a) the integrating-averaging sound level meter shall be set at the 3 dB exchange rate;

(b) in determining equivalent continuous sound pressure level, the meter shall be set on the "Fast" response and "A-weighted" frequency characteristic;

(c) in determining instantaneous unweighted peak sound pressure level, the meter shall be set on the "Peak" response and "Linear" frequency (unweighted) characteristic.

4.3 Location of Measurement Points

In determining compliance with the prescribed standards, the background sound pressure level shall be measured at or beyond the boundary of the property in which the source of the sound under investigation is located, or at the boundary of a receptor.

The following guidelines should be observed in positioning the integrating-averaging sound level meter when taking measurements:

(a) for outdoor measurements, the preferred measurement height is 1.2 to 1.5 metres above the ground. For outdoor measurements near buildings, the preferred measurement positions are, at least, 1 metre to 2 metres horizontally from the façade and at least, 1.2 metres to 1.5 metres above each floor level of interest;

(b) where sound pressure levels are to be determined inside buildings, the measurements shall be carried out in enclosures where the sound is of interest. The preferred measurement positions are at least 1 metre horizontally from the walls or other major reflecting surfaces, 1.2 metres to 1.5 metres above the floor and about 1.5 metres from windows.

4.4 Meteorological Conditions

For the purposes of determining compliance with the prescribed standards, sound pressure levels may be taken under any prevailing meteorological conditions provided that there is the absence of precipitation, thunder and distinctly audible winds. Further, meteorological conditions prevailing at one time period shall be deemed to be similar to those at another time period if both time periods fall within the same time of day, i.e., "daytime" or "night-time" as defined by the respective intervals for the relevant type of noise zone, and if during the period of measurement, there is no precipitation, thunder or distinctly audible winds blowing in the immediate vicinity. (For guidance, the immediate vicinity may be interpreted as within a radius of 10 metres of the microphone of the integrating-averaging sound level meter).

4.5 Background sound pressure level

The background sound pressure level at a specific site shall be determined by measuring both the equivalent continuous sound pressure level in dBA, and, the maximum instantaneous unweighted peak sound pressure level over any measurement period (which shall be reported in the report as required in the Third Schedule). These measurements shall be taken during the same time of day as defined for the respective prescribed standards with which compliance is being determined.

NOTE: The point at which measurements for determining the background sound pressure level are taken, should be preferably in the immediate vicinity of the point at which the background sound pressure level with the source in operation would be taken; however, such measurements for determining background sound pressure level should not be taken at points outside a radius of 100 metres from the source under investigation.

Appendix B

Legislative and Regulatory Framework

B.2: EMA Draft Air Pollution Rules, (2005) Excerpts

THIRD SCHEDULE

[Rules 6(3) and 8(2)]

REPORTING OF SOUND PRESSURE LEVEL MEASUREMENT DATA

1.0 For the purposes of reporting the sound pressure level measurement data obtained in accordance with the Second Schedule, a report containing the following information shall be prepared:

1.1 ACOUSTIC DATA

(a) general location(s), including address if possible, where the measurements were taken;

(b) general description of the type of sound being measured (i.e., steady, fluctuating, etc.);

(c) height(s) of the measurement position(s), and microphone orientations;

(d) the sound pressure level(s) obtained, expressed as the equivalent continuous sound pressure level, in dBA;

(e) the maximum instantaneous unweighted peak sound pressure level, in dB (peak), recorded over a period of measurement which shall also be stated;

(f) the frequency weighting used in obtaining—

(i) the equivalent continuous sound pressure level; and

(ii) the maximum instantaneous unweighted peak sound pressure level;

(g) the time-weighting characteristic used in obtaining—

(i) the equivalent continuous sound pressure level; and

(ii) the maximum instantaneous unweighted peak sound pressure level;

(h) the exchange rate at which the integrating-averaging sound level meter was set during the measuring exercise;

(i) the date(s) and time period(s) when the sound pressure level measurements were taken; and

(j) whether or not the measured sound pressure level(s) in terms of—

(i) the equivalent continuous sound pressure level; and

(ii) the maximum instantaneous unweighted peak sound pressure levels are in compliance with the applicable prescribed maximum permissible sound pressure levels as specified in the First Schedule.

1.2 DESCRIPTION OF SOURCE AND SURROUNDINGS

(a) general description of the sound source(s), which may include nature of sound and activity generating it, character of the sound, and its appropriateness for the particular noise zone;

(b) general location of source(s), including address if possible; and

(c) general description and, optionally, sketch (not necessarily drawn to scale) of the physical environment in the immediate vicinity of the sound source(s) or in the area of concern or in the receptor locations; (This description and sketch may include location of walls, ceilings, and rooms, or if outdoors, trees, structures, reflecting objects, and topographic features).

1.3 Meteorological Conditions

Description of the meteorological conditions in the vicinity of the location of the microphone of the integrating-averaging sound level meter during the measurement period(s), in terms of

(a) whether or not precipitation was present;

(b) whether or not thunder was present; and

(c) whether or not there were distinctly audible winds blowing.

1.4 Instrumentation

(a) identification of the instrument(s) used, such as brand name, manufacturer, type, serial number of instrument, serial number of microphone, if removable;

(b) most recent report of calibration conducted by manufacturer or other recognised authority;

(c) record of calibration checks conducted for the particular measurement exercise; and

(d) accessories used in measuring the sound pressure levels, if applicable, such as microphone corrector, windscreen, tripod.

1.5 Personnel

(a) name of person(s) taking the measurements;

(b) respective job designation; and

(c) name and job designation of person(s) who checked the calibration of the instrument, if different from *(a)* and *(b)* above.

1.6 Miscellaneous

Any other data and information that the person taking the measurements or the Authority may deem necessary.

NOTE: The required data and information may be completed in a form to be determined by the Authority.

Appendix B

Legislative and Regulatory Framework

B.3: EMA Environmentally Sensitive Area Rules (2001), Schedule III Excerpt

SCHEDULE III

Rule 3(1)*(d)*

AREAS REFERRED TO IN OTHER WRITTEN LAWS

(a) The territorial sea of Trinidad and Tobago and the internal waters of Trinidad and Tobago referred to in sections 3 and 4 respectively of the Territorial Sea Act. Chap. 1:51

(b) A restricted area referred to in section 2 of the Continental Shelf Act. Chap. 1:52

(c) A restricted area referred to in section 2 of the Marine Areas (Preservation and Enhancement) Act. Chap. 37:02

(d) A Forest Reserve and a prohibited area referred to in section 2, and a declared district referred to in section 7 (3), of the Forests Act. Chap. 66:01

(e) A Game Sanctuary referred to in section 2 of the Conservation of Wildlife Act. Chap. 67:01

(f) An infected area and an infected place referred to in section 2 of the Animal (Diseases and Importation) Act. Chap. 67:02

(g) A prohibited area referred to in section 2 of the Fisheries Act. Chap. 67:51

(h) The archipelagic waters referred to in section 2, and the exclusive economic zone established under section 14, of the Archipelagic Waters and Exclusive Zones Act, 1986. Act No. 24 of 1986

Appendix B

Legislative and Regulatory Framework

B.4: WASA Design Guideline Manual (2009) Excerpt

Storage Tanks

Welded Steel Tank	ANSI/AWWA D100-84
Painting for Welded Steel Tanks	ANSI/AWWA D102-78
Factory Coated Tanks	ANSI/AWWA D103-80
Disinfection	ANSI/AWWA D652-86
Concrete Structures for Retaining Liquids	AS 3735 1991

Pipelines

Polybutylene (PB)	AWWA C-902-78
Polyethylene (PET)	AWWA C-901-78
Poly Vinyl Chloride (PVC)	AWWA C-900-75
Fabricated Steel Pipe and Fittings	AWWA C-208-83
Steel Pipe Flanges Class D	AWWA C-207-86
Coal tar protection coatings and linings for steel water pipelines	AWWA C-203-86
Flanged Ductile Iron Pipelines	AWWA C-115/A21
Rubber Gasket	AWWA C-111/A21
Disinfection	AWWA C-651-86
Pressure Test	AWWA C-600-82
Grey Iron Casting	BS 1452:1977
GRP	AWWA C 950 - ASTM D 3754
Elastometrix Joint Rings for pipework and pipelines	BS 2494:1986
Flanges and bolting for pipes valves and fittings metric series (copper alloy and composite flanges)	BS 4504: Part 2 1974
Metal Washers for General Engineering Purposes Metric Series	BS 4320:1968
Specifications for Poly Vinyl Chloride (PVC) Solvent Cement for use with unplasticized PVC Pipes and fittings for cold water applications	TTS 413-1992
Cast Iron Non-pressure pipes and pipe fittings metric units	AS 1631-1974

Valves

Ball Valves	AWWA C-507-85
Rubber Sealed Butterfly Valves	ANSI/AWWA C-50
Sluice Valves	AWWA C-501-86
Predominantly key Operated Cast Iron Valves for Waterworks purposes	BS1 5163:1986
Butterfly Valves	BS 5155:1984
Copper Alloy Gate Valve and Non-Return Valves for use in water supply and hot water services	AS 1628:1977
Float Operated Valves	BS 1212
Specifications for Piston Type Float Operated valves (Copper Ally Body) (Excluding Floats)	PT 1 1990
Specifications for Diaphragm type float operated valve (copper Alloy Body) (Excluding Floats)	PT 2 1990
Specifications for Diaphragm type operated valves plastic bodies, for cold water services only excluding floats	PT 3 1990
Draw off taps and stop valves for water services (screw down pattern)	BS 1010 PT 2 1973

Safety Valves

Safety Valves	BS 6759
Specification for safety valves for steam and hot water	PT 1 1984

Mixing Valves

Mixing Valves	BS 1415
Non-Thermostatic, Non-Compensating mixing valves	PT 1 1976
Specification for Thermostatic mixing valves	PT 2 1986

Various standards

Glass Filament reinforced thermosetting plastics (GRP) Pipes Polyester Based-Water Supply. Sewerage and Drainage Applications	AS 3571 1989
Water Supply Metal Bodied Taps – Specified by performance	AS 3718 – 1990
Water Well Casing	BS 879
Specification for steel tubes for casing	PT 1 – 1985
Specification for thermoplastics tubes for casing and slotted casing	PT Z – 1988
Stationary circulation pumps for heating and hot water service system	BS 1394
Specification for Cold Water Storage and combined feed and expansion cisterns (polyolefin or olefin copolymer) up to 500L capacity used for domestic purposes	BS 4213 – 1991
Multi Standard Measurement of flow of cold potable water in closed conduits	BS 5728
Safety and control Devices for use in hot water systems	BS 6283
Code of Practice for test pumping of Water Well	BS 6316 – 1992
Storage Cisterns up to 500L Actual Capacity for water supply for domestic purposes	BS 7181 – 1989
Bitumen – based coatings for cold application, suitable for use in contact with potable water	BS 3416 – 1980
Bitumen based hot applied coating materials for protecting iron and steel including suitable primers were required	BS1 4147 – 1980
Water Quality (Multi Standards) Physical, Chemical and Biochemical methods	BS 6008 PT 2

Wastewater systems

Cement	ASTM C-150 -60
Aggregate	ASTM C-33-59
Steel (Reinforcer)	ASTM A-15-58T
Structural Steel	ASA-ASA A57 1-1952
Manhole Bricks	ASTM C-32-58 Grade MA
Precast Sections	ASTM C-478-61T usina Type II cement
Manhole Frames Cones	ASTM A48-60T
Reinforced Concrete Pipes	ASTM C76-60T
Non reinforced Concrete Pipes	ASTM C14-59, 1
Welded Steel Pipe	AWWA C 202-59
Steel Fitting Couplings	AWWA (Same as Water)
Gate Valves	ASA B16 10-1957
Sluice Valves	AWWA C 501-41T
Drain Pipes and Fittings	BS 4660
Sewer	BS 4660, BS 5481 or Class B, BS 3505
Grey iron	BS 4622
Ductile Iron	BS 4772
Thermoplastic Pipe for Sewers	ASTM D 2321, F-894
Thermoplastics waste pipes and fittings	BS 5255 – 1989
Polypropylene Waste pipe and fittings (external Diameter 34.6 mm 41.0 mm 54.1mm)	BS 5254 – 1976
Unplasticized PVC (UPVC) Pipes and Fittings for storm and surface water applications	AS 1254
Unplasticized PVC (UPVC) Pipes and Fittings for soil waste and vent (SWV) applications	AS 1415 PT 1-4
Design charts for water supply and sewerage	AS 2200-1978
Water supply – Mechanical backflow prevention devices	AS 2845-1986
Plastics Waste Fittings	AS 2887 – 1986
Specifications for compact type float operated valves for WC Flushing Cisterns (including floats)	PT 4 -1991
	BS 417
Specification for Galvanized low Carbon Steel, Cisterns, lid tanks and Cylinders	TTS 414-1992
Specification for unplasticized PVC Drain, Waste and vent pipes	TTS 31 85 006
Technical Drawing Installation, Graphical symbols for supply water and drainage systems	PT 6 – 1998
Recommendations for the Design of buildings, plumbing and drainage systems	TTS 16 90 400 PT 4 - 1985

Appendix B

Legislative and Regulatory Framework

B.5: Forest Act (as amended) Second Schedule Excerpt

SECOND SCHEDULE

Local Name	Botanical Name
Cedar	Cedrela odorata, L.
Poui	Tecoma serratifolia, Don.
Balata	Mimusops globosa, Gaertn
Locust	Hymenoea courbaril, L.
Cyp	Cordia gerascanthus, Jacq.
Balsam	Copaifera officinalis, L.
Teak	Tactona grandis, L.
Ryania	Ryania Speciosa

Appendix B

Legislative and Regulatory Framework

B.6: Fisheries Act Excerpt

2. (1) The nets to be employed in the territorial waters of Trinidad and Tobago shall be the following and no others:

(a) *Drift or Fillet Nets for catching Mackerel, King Fish and other large fishes.*—Length of net not to exceed nine hundred feet. Width at centre not to exceed fifteen feet. Mesh not to be less than one and three-quarter inches square.

(b) *Fillet Nets for catching Mullets.*—Length not to exceed nine hundred feet. Width at centre not to exceed twelve feet. Mesh not to be less than one and one-quarter inches square.

(c) *Pocket Seines for catching mixed white fish.*—Length not to exceed nine hundred feet. Width of pocket not to exceed fifteen feet, tapering to two feet. Mesh in the pocket not less than three-quarter inch square at end of pocket.

(d) *Pocket Seines for catching Prawns.*—Length not to exceed one hundred and twenty feet. Width not to exceed twelve feet. Mesh not to be less than half an inch square.

(e) *Seines for catching Bait.*—Length not to exceed one hundred and twenty feet. Width not to exceed nine feet. Mesh not to be less than half an inch square.

(f) *Cast Nets for catching Bait.*—Length not to exceed six feet. Mesh not to be less than half an inch square.

(g) *Gar Seines for catching fish other than Cavalli or Jack fish.*—Length not to exceed five hundred and forty feet. Width not to exceed twelve feet at centre. Mesh not to be less than half an inch square.

(h) *Seines for catching Cavalli.*—Length not to exceed seven hundred and fifty feet. Width not to exceed thirty-six feet in centre. Mesh not to be less than one and seven-eighth inches square.

(i) *Seines for catching Jack fish.*—Length not to exceed six hundred feet. Width not to exceed twenty-four feet at centre. Mesh to be not less than half an inch square.

(j) *Seines known as Italian Seines.*—Length not to exceed nine hundred feet. Mesh to be not less than half an inch square.

Appendix B

Legislative and Regulatory Framework

B.7: Wildlife Conservation Act, Second and Third Schedule

SECOND SCHEDULE

Part I

Animals –

Alligator or Cayman

Lizards

Agouti

Armadillo (Tattoo)

Deer (in Trinidad only)

Lappe

Quenk (Peccary or Wild Hog)

Part II

Birds –

Ammazona Amazonica Amazonica, Lim or Common Amazon Parrot

Charadriidae – All birds belonging to the Family *Charadriidae* or Plovers (including Petit Collier, Gros Collier, Pluviers)

Corbeau, Common Town (*Coragyps*)

Cormorants (*Phalacrocoraz olivaceus olivaceus* and *Phalacrocorax auritus*)

Cranes, (*Ardea heredias* and *Ardea cocoi*)

Ducks, Ouikiki (*Dendrocygna autumnalis*)

Ducks, Wild (except Bahama Pintails) (*Poecilonetta bahamensis, Anas Bahamensis, Dafila acuta, Dafila bahamensis*), Muscovy (*Cairina moschata*)

Heron, Blackcrowned Night or Crabier Batali (*Nycticorax nycticorax*)

Heron, Boatbilled or Crabier Bec Plat (*Cochlearius*)

Heron, Yellowcrowned Night or Crabier a Croissant (*Nyctanassa violacea*)

Ibis, Scarlet – (Flamant or Flamingo) (*Guara rubra)*

Rallidae – All birds belonging to the Family *Rallidae* (Coots, Rails, Waterfowl and their allies)

Ramier or pigeon (all kinds)

Scolopacidae – All birds belonging to the Family *Scolopacidae* or Snipes and Sand Pipers (Snipes, Curlews, Sand Pipers, White-wings, Yellow-legs, Godwits, Sanderlings)

Part III

Cage Birds –

Cage birds which may be captured or kept captive by cage

Chicki-Chong or Bullfinch (*Oryzoborous angloensis)*

Cravat (*Tanagra trinitatis*)

Finch, Yellow-bellied

Parakeet (*Ferpus passerinus*)

Picoplat (*Spermophila intermedia*)

Semp (*Tanagra violacea*)

Ring Neck

Chat or Nun (*Spermophila bouvronides*)

THIRD SCHEDULE

List of animals declared as vermin

1. Bats
2. Mapipire Balson or Fer de Lance (*Bothrops atrox*)
3. Mapipire Zanana or Bushmaster (*Lanchesis muta*)
4. Mice
5. Mongoose
6. Rats
7. Snakes, Coral (*Micrurus spp.*)
8. Squirrels
9. Yellow-tails (*Ostinops decumanus*)
10. Manicou (*Opossum*)
11. Green Parrot
12. Cocrico (*Ortalis ruficanda ruficanda*)

Appendix B

Legislative and Regulatory Framework

B.8: National Wetlands Policy, Appendix I, Preliminary List of Wetland Sites

APPENDIX 1
Preliminary List of Wetland Sites

Wetland Name	Dominant Wetland Type (some estimated)	Size (ha)
A. TRINIDAD (main island)		
Aripo Savannah	Palm swamp forest/savannahs	1800
Chin Chin	Fresh water marsh	0.5 km^2
Caroni-Arena	Reservoir	688
Caroni Swamp	Estuarine mangrove	5611
Chaguaramas Bay	Fringe mangrove	1<
Claxton Bay	Fringe mangrove	92
Couva River/Carli Bay	Est. & fringe mangrove	171
Cuesa River	Estuarine mangrove	<1
Erin Bay	Estuarine mangrove	?
Erin Savannah	Flooded savannah/forest	40
Fishing Pond	Mangrove & FW marsh	1220
Godineau	Est. mangrove and marsh	5642
Grande Riviere	Estuarine mangrove	<1
Guayaguayare	Estuarine mangrove	23
Hart's Cut	Basin mangrove	<1
Hollis Reservoir	Reservoir	550
Icacos	Est. & basin mangrove	330
Irois Bay	Estuarine mangrove	15
La Brea	Fringe/basin mangrove	<2
Las Cuevas	Fresh water swamp forest	3
Las Lomas	Ponds/flooded pasture	5
L'Ebranche River	Fringe mangrove	10
Lisas Bay	Fringe mangrove	26
Los Blanquizales	Basin mangrove and marsh	1085
Manzanilla Windbelt	Estuarine mangrove	44
Marabella	Estuarine mangrove	<1
Maracas Bay	Riverine sw. for. & marsh	25
Marianne River	Riverine/estuarine marsh	15
Matura River	Estuarine mangrove	15
Mayaro Bay	Estuarine mangrove	6
Moruga River	Fr. and basin mangrove	33
Mouville	Fringe mangrove	22
Mucurapo	Fringe mangrove	3
O'Meara/Manical	Basin/FW swamp forest	25
Nariva Swamp	FW marsh and mangrove	6234
Navet Dam	Reservoir	348
North Manzanilla	Estuarine mangrove	<1
North Oropouche	Est. & basin mangrove	850
Orange Grove	Aquaculture ponds	30
Orange Valley	Fringe mangrove	<1
Ortoire River	Fr. & basin mangrove	110

Wetland Name	Dominant Wetland Type (some estimated)	Size (ha)
Pointe-a-Pierre (WT)	Freshwater ponds	26
Point Fortin	Fringe mangrove	33
Rousillac Swamp	Fringe & basin mangrove	496
Rustville	Estuarine mangrove	102
Salibia	FW swamp forest	4
San Souci	Estuarine mangrove	<1
Scotland Bay	Fringe mangrove	<1

Sealots	Estuarine mangrove	<1
Toco Salibia	Riverine & lagoonal	60
Usine St. Madeline	Refinery cooling pond	20
Waterloo	Fringe mangrove	<1
Yarra River	Estuarine mangrove	<1

B. TRINIDAD – Offshore Islands (Chacachacare)

La Chapelle Bay	Fringe mangrove	<1
Salt Lake	Basin mangrove and pond	12

C. TOBAGO

Argyle	Two small marshes	?
Belle Gardens	Fringe mangrove	?
Betsy Hall	Small wetland	?
Bloody Bay	Estuarine mangrove	<1
Buccoo/Bon Accord	Fw ponds, fr. mang. & lagoon	50
Buccoo	Freshwater pond	15
Delafort	Marsh	<2
Diamond Estate	Riverine – 2 sites	5
Friendship	Fringe mangrove	2
Goldsborough River	Estuarine mangrove	2
Great Courland Bay (N)	Pond	2
Great Courland Bay (S)	Pond	3
Hillsborough Dam	Reservoir	50
Hillsborough River	Estuarine mangrove	2
Kilgwyn	Fr. & basin mangrove	12
Lambeau	Fringe mangrove	?
Louis d'Or	Fringe mangrove	?
Lowlands	Two man-made ponds	?
Minister Bay	Fringe mangrove	?
Parlatuvier	Fringe mangrove	?
Petit Trou	Fringe mangrove	?
Roxborough	FW marsh	?
Speyside	Small reservoir	?
Studley Park	Fringe mangrove	?
Turtle Beach River	Estuarine mangrove	2

(River & stream upper courses not included)

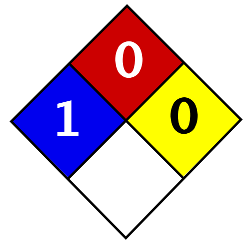
Appendix C

Project Description

Appendix C

Project Description

C.1 Sodium Hypochlorite MSDS



Health	3
Fire	0
Reactivity	0
Personal Protection	

Material Safety Data Sheet
Sodium Hypochlorite, 5% MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sodium Hypochlorite, 5%

Catalog Codes: SLS1654

CAS#: Mixture.

RTECS: Not applicable.

TSCA: TSCA 8(b) inventory: Sodium hypochlorite; Sodium hydroxide; Water

CI#: Not applicable.

Synonym: Chlorine Bleach, Bleach, Soda Bleach, Chlorox; Sodium Hypochlorite, Solution, 5% Available Chlorine

Chemical Name: Hypochlorous acid, sodium salt, solution

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Sodium hypochlorite	7681-52-9	4-7
Sodium hydroxide	1310-73-2	<1
Water	7732-18-5	>92

Toxicological Data on Ingredients: Sodium hypochlorite: ORAL (LD50): Acute: 5800 mg/kg [Mouse]. 8910 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, . Hazardous in case of skin contact (corrosive), of eye contact (corrosive). Slightly hazardous in case of inhalation (lung sensitizer). Non-corrosive for lungs. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Prolonged exposure may result in skin burns and ulcerations. Over-exposure by inhalation may cause respiratory irritation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer).
CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Sodium hypochlorite].
MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. [Sodium hypochlorite]. Mutagenic for mammalian somatic cells. [Sodium hydroxide].
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to lungs, mucous membranes, skin, eyes.
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: combustible materials, metals, organic materials

Explosion Hazards in Presence of Various Substances:
Slightly explosive in presence of open flames and sparks.

Non-explosive in presence of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
Releases chlorine when heated above 35 deg. C.
The substance itself is non-combustible and does not burn. However, when heated to decomposition it emits corrosive and/or toxic fumes.
May ignite combustibles.
Fire risk in contact with organic materials.
Contact with metals may evolve flammable hydrogen gas.

Special Remarks on Explosion Hazards:
Anydrous Sodium Hypochlorite is very explosive.
Primary amines and calcium hypochlorite or sodium hypochlorite react to form normal chloroamines, which are explosive.
Interaction of ethyleneimine with sodium (or other) hypochlorite gives the explosive N-chloro cmpd.
Removal of formic acid from industrial waste streams with sodium hypochlorite soln becomes explosive at 55 deg C.
Several explosions involving methanol and sodium hypochlorite were attributed to formation of methyl hypochlorite, especially in presence of acid or other esterification catalyst.
Use of sodium hypochlorite soln to destroy acidified benzyl cyanide residues caused a violent explosion, thought to have been due to formation of nitrogen trichloride.
(Sodium hypochlorite)

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

Large Spill:
Corrosive liquid. Oxidizing material.
Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Avoid contact with a combustible material (wood, paper, oil, clothing...). Keep substance damp using water spray. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Keep away from heat. Keep away from sources of ignition. Keep away from combustible material.. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as reducing agents, combustible materials, organic materials, metals, acids.

Storage:
Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalies, reducing agents and combustibles. See NFPA 43A, Code for the Storage of Liquid and Solid Oxidizers. Air Sensitive Sensitive to light. Store in light-resistant containers.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection:
Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
Sodium hypochlorite
TWA: 1 CEIL: 1 (ppm as Cl_2)
STEL: 1 (ppm as Cl_2) from ACGIH (TLV) [United States]
Sodium hydroxide
STEL: 2 (mg/m3) from ACGIH (TLV) [United States]
TWA: 2 CEIL: 2 (mg/m3) from OSHA (PEL) [United States]
CEIL: 2 (mg/m3) from NIOSH
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Characteristic. Chlorine-like (Slight.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light greenish yellow

pH (1% soln/water): Neutral.

Boiling Point: Decomposition temperature: 40°C (104°F)

Melting Point: Not available.

Critical Temperature: Not available.

Specific Gravity: 1.07 - 1.093 (Water = 1)

Vapor Pressure: 2.3 kPa (@ 20°C)

Vapor Density: The highest known value is 0.62 (Air = 1) (Water).

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Easily soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials. light, air, heat

Incompatibility with various substances: Reactive with reducing agents, combustible materials, organic materials, metals, acids.

Corrosivity:
Extremely corrosive in presence of aluminum.
Corrosive in presence of stainless steel(304), of stainless steel(316).
Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Decomposed by carbon dioxide from air. Slowly decomposes on contact with air. Unstable in air unless mixed with sodium hydroxide.
Incompatible with ammonium acetate, ammonium carbonate, ammonium nitrate, ammonium oxalate, and ammonium phosphate. Decompostion of sodium hypochlorite takes place within a few seconds with these salts.
Also incompatible with primary amines, phenyl acetonitrile, ethyleneimine, methanol, acidified benzyl cyanide, formic acid, urea, nitro compounds, methylscellulose, celloluse, aziridine, ether, ammonia.
Mixing this product with chemicals (e.g. ammonia, acids, detergents, etc.) or organic matter (e.g. urine, feces, etc.) will release chlorine gas.
Chloramine gas may be evolved when ammonia and bleach are mixed.
Decomposed by hot water.
Sensitive to light. Exposure to light accelerates decompositon.

Special Remarks on Corrosivity:
Sodium Hypochlorite is extremely corrosive to brass, and moderately corrosive to bronze.
There is no corrosivity information for copper.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 5800 mg/kg [Mouse]. (Sodium hypochlorite).

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Sodium hypochlorite].
MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. [Sodium hypochlorite]. Mutagenic for mammalian somatic cells. [Sodium hydroxide].
Contains material which may cause damage to the following organs: lungs, mucous membranes, skin, eyes.

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (irritant), of ingestion, .
Hazardous in case of skin contact (corrosive), of eye contact (corrosive).
Slightly hazardous in case of inhalation (lung sensitizer, lung corrosive).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: May affect genetic material (mutagenic) (Sodium hypochlorite)

Special Remarks on other Toxic Effects on Humans:
Potential Health Effects:
Can cause severe irritation and possible burns to skin and eyes.
Eye contact may also cause corneal and conjunctival edema, conjunctival hemorrhages.
Contact with skin may also cause vesicular eruptions and eczematoid dermatitis which becomes evident upon re-exposure.
Prolonged or repeated eye contact may cause conjunctivitis.
Ingestion can cause burns to the digestive tract. Symptoms may include: 1. pain and inflammation of the

mouth, pharynx, esophagus, and stomach, 2. erosion of the mucous membranes (chiefly of the stomach), nausea, vomiting, choking, coughing, hemorrhage, 3. circulatory collapse with cold and clammy skin (due to methemoglobinemia), cyanosis, and shallow respirations, 4. confusion, delirium, coma, 5. edema of the pharynx, glottis, larynx with stridor and obstruction, 6. perforation of the esophagus, or stomach, with mediastinitis or peritonitis.
Inhalation causes slight to severe respiratory tract irritation and delayed pulmonary edema. Prolonged or repeated inhalation may cause allergic respiratory reaction (asthma).

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Dilute with water and flush to sewer of local ordinances allow, otherwise, whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Hypochlorite solution UNNA: 1791 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Illinois toxic substances disclosure to employee act: Sodium hydroxide
Illinois chemical safety act: Sodium hydroxide
New York release reporting list: Sodium hydroxide
Rhode Island RTK hazardous substances: Sodium hydroxide
Pennsylvania RTK: Sodium hypochlorite; Sodium hydroxide
Florida: Sodium hypochlorite
Minnesota: Sodium hypochlorite; Sodium hydroxide
Massachusetts RTK: Sodium hypochlorite; Sodium hydroxide
New Jersey: Sodium hypochlorite; Sodium hydroxide
Louisiana spill reporting: Sodium hydroxide
TSCA 8(b) inventory: Sodium hypochlorite; Sodium hydroxide; Water
CERCLA: Hazardous substances.: Sodium hypochlorite: 100 lbs. (45.36 kg); Sodium hydroxide: 1000 lbs. (453.6 kg);

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS E: Corrosive liquid.

DSCL (EEC):
R8- Contact with combustible material may cause fire.
R31- Contact with acids liberates toxic gas.
R36/38- Irritating to eyes and skin.
S28- After contact with skin, wash immediately with plenty of water.
S36/37/39- Wear suitable protective clothing, gloves and eye/face protection.
S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 0

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Full suit.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Face shield.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 06:32 PM

Last Updated: 11/06/2008 12:00 PM

Appendix C

Project Description

C.2 Polymer PAM C-60 MSDS

CLEARTECH

MATERIAL SAFETY DATA SHEET

PAM C-60

Section 01 - Chemical And Product And Company Information

Product Identifier ……………………... PAM C-60

Product Use …………………………..... Cationic water treatment polymer.

Supplier Name……………………….…. ClearTech Industries Inc.
2302 Hanselman Avenue
Saskatoon, SK. Canada
S7L 5Z3

Prepared By.................……………..….. ClearTech Industries Inc. Technical Department
Phone: (306)664-2522

Preparation Date.........…………….….... February 18, 2009

24-Hour Emergency Phone…………... 306-664-2522

Section 02 - Composition / Information on Ingredients

Hazardous Ingredients....…………..... Contains no hazardous ingredients

CAS Number..................…………......Not available

Synonym (s)..................……………...None

Section 03 - Hazard Identification

Inhalation..................……………….... May cause sneezing, slight irritation of nose or throat.

Skin Contact / Absorption………..... Irritating to skin.

Eye Contact...............……………..... Irritating to eyes.

Ingestion...................……………… Not available

Exposure Limits……………………... Nuisance dust: 15mg/m^3

CLEARTECH

Section 04 - First Aid Measures

Inhalation.................................... Remove victim to fresh air. Give artificial respiration only if breathing has stopped. If breathing is difficult, give oxygen. Seek immediate medical attention.

Skin Contact / Absorption.............. Remove contaminated clothing. Wash affected area with soap and water. Seek medical attention if irritation occurs or persists.

Eye Contact.................................. Flush immediately with water for at least 20 minutes. Forcibly hold eyelids apart to ensure complete irrigation of eye tissue. Seek immediate medical attention.

Ingestion...................................... Do not induce vomiting. Consult a physician.

Additional Information..................... Not available

Section 05 - Fire Fighting

Conditions of Flammability.............. Not available

Means of Extinction........................... Foam, carbon dioxide, dry powder

Flash Point.. Not available

Auto-ignition Temperature............. Not available

Upper Flammable Limit .... Not available

Lower Flammable Limit.................... Not available

Hazardous Combustible Products... Nitrogen oxides, carbon monoxide and carbon dioxide.

Special Fire Fighting Procedures..... Wear NIOSH-approved self-contained breathing apparatus and protective clothing. When this product comes in contact with water, surfaces become very slippery.

Explosion Hazards.......................... Not available

CLEARTECH

Section 06 - Accidental Release Measures

Leak / Spill.................................... Wear appropriate personal protective equipment. Ventilate area. Stop or reduce leak if safe to do so. Prevent material from entering sewers. Do not flush with water. Clean up promptly by sweeping or vacuum. After cleaning, flush away traces with water.

Deactivating Materials.................... Not available

Section 07 - Handling and Storage

Handling Procedures........................ Use proper equipment for lifting and transporting all containers. Use sensible industrial hygiene and housekeeping practices. For good industrial hygiene, avoid contact with skin and eyes, avoid forming dust, and wash hands before breaks and at the end of the workday. Avoid all situations that could lead to harmful exposure.

Storage Requirements...................... Keep in a dry, cool place with the container well sealed.

Section 08 - Personal Protection and Exposure Controls

Protective Equipment

Eyes.. Chemical goggles, full-face shield, or a full-face respirator is to be worn at all times when product is handled. Contact lenses should not be worn; they may contribute to severe eye injury.

Respiratory.................................... Use dust masks where dust exceeds 15mg/m^3

Gloves... Impervious gloves of chemically resistant material (rubber or PVC) should be worn at all times. Wash contaminated clothing and dry thoroughly before reuse.

Clothing.. Body suits, aprons, and/or coveralls of chemical resistant material should be worn at all times. Wash contaminated clothing and dry thoroughly before reuse.

Footwear.. No special footwear is required other than what is mandated at place of work.

CLEARTECH

Engineering Controls

Ventilation Requirements…………...... Mechanical ventilation (dilution or local exhaust), process or personnel enclosure and control of process conditions should be provided. Supply sufficient replacement air to make up for air removed by exhaust systems.

Other………………………………….... Use exhaust if dusting occurs. Otherwise natural ventilation is adequate.

Section 09 - Physical and Chemical Properties

Physical State.......……....…………..... Granular solid

Odor and Appearance…...…………... Virtually no odor, off white

Odor Threshold....…………….......... Not available

Specific Gravity (Water=1)………….. Not available

Vapor Pressure (mm Hg, 20C)……... Not available

Vapor Density (Air=1)..……………..... Not available

Evaporation Rate.......……..………... Not available

Boiling Point...............…………….…..... Not available

Freeze/Melting Point....……………..... Not available

pH..........................…………………... 4-6 @ 5g/L

Water/Oil Distribution Coefficient.... Not available

Bulk Density.............………………..... Not available

% Volatiles by Volume……….……... Not available

Solubility in Water...…………………..... Complete

Molecular Formula......……………….... Not available

Molecular Weight........……………….... Not available

Section 10 - Stability and Reactivity

Stability................…………...…………… Product is stable

CLEARTECH

Incompatibility............……………..……….. Oxidizing agents, galvanized metals, mild steel, copper and brass.

Hazardous Products of Decomposition.. Thermal decomposition may produce nitrogen and carbon oxides.

Polymerization..........……………………… Will not occur

Section 11 - Toxicological Information

Irritancy................……..…………..… Testing on rabbits showed the material to be non-irritating to the skin.

Sensitization.......…….......………… Testing on guinea pigs showed this material to be non-sensitizing.

Chronic/Acute Effects……...……….. Acute testing on rabbits shows the material to be non-toxic even at very high dose levels. A two-year feeding study on rats did not reveal adverse chronic health effects.

Synergistic Materials...……...……... Not available

Animal Toxicity Data.......…..……….. LD_{50}(oral, rat)= >5000mg/kg

Carcinogenicity.....……......………... Not considered to be carcinogenic by NTP, IARC, and OSHA.

Reproductive Toxicity..…...………... Not available

Teratogenicity.........…....…………... Not available

Mutagenicity.........……....………… Not available

Section 12 - Ecological Information

Fish Toxicity.................……………... LC_{50}(96 hrs, Fathead minnows)= >1000mg/L

Biodegradability............……………... Not readily biodegradable.

Environmental Effects……………… The product is not considered toxic to aquatic organisms or harmful to the aquatic environment.

Section 13 - Disposal Consideration

Waste Disposal..........…...…………...Dispose in accordance with all federal, provincial, and/or local regulations including the Canadian Environmental Protection Act.

CLEARTECH

Section 14 - Transportation Information

TDG Classification

Class……………..………………..…..... Not regulated

Group.............….………….......……... Not regulated

PIN Number...............…….…..……….... Not regulated

Other…………………………………..... Secure containers (full and/or empty) with suitable hold down devises during shipment.

Section 15 - Regulatory Information

WHMIS Classification.......…………....Not a controlled product

NOTE: THE PRODUCT LISTED ON THIS MSDS HAS BEEN CLASSIFIED IN ACCORDANCE WITH THE HAZARD CRITERIA OF THE CANADIAN CONTROLLED PRODUCTS REGULATIONS. THIS MSDS CONTAINS ALL INFORMATION REQUIRED BY THOSE REGULATIONS.

Section 16 - Other Information

Note: The responsibility to provide a safe workplace remains with the user. The user should consider the health hazards and safety information contained herein as a guide and should take those precautions required in an individual operation to instruct employees and develop work practice procedures for a safe work environment. The information contained herein is, to the best of our knowledge and belief, accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by the use of this material. It is the responsibility of the user to comply with all applicable laws and regulations.

Attention: Receiver of the chemical goods / MSDS coordinator

As part of our commitment to the Canadian Association of Chemical Distributors (CACD) Responsible Distribution® initiative, ClearTech Industries Inc. and its associated companies require, as a condition of sale, that you forward the attached Material Safety Data Sheet(s) to all affected employees, customers, and end-users. ClearTech will send any available supplementary handling, health, and safety information to you at your request.

If you have any questions or concerns please call our customer service or technical service department.

ClearTech Industries Inc. - Locations

Corporate Head Office: 2302 Hanselman Avenue, Saskatoon, SK, S7L 5Z3
Phone: 306-664-2522
Fax: 306-665-6216

www.ClearTech.ca

CLEARTECH

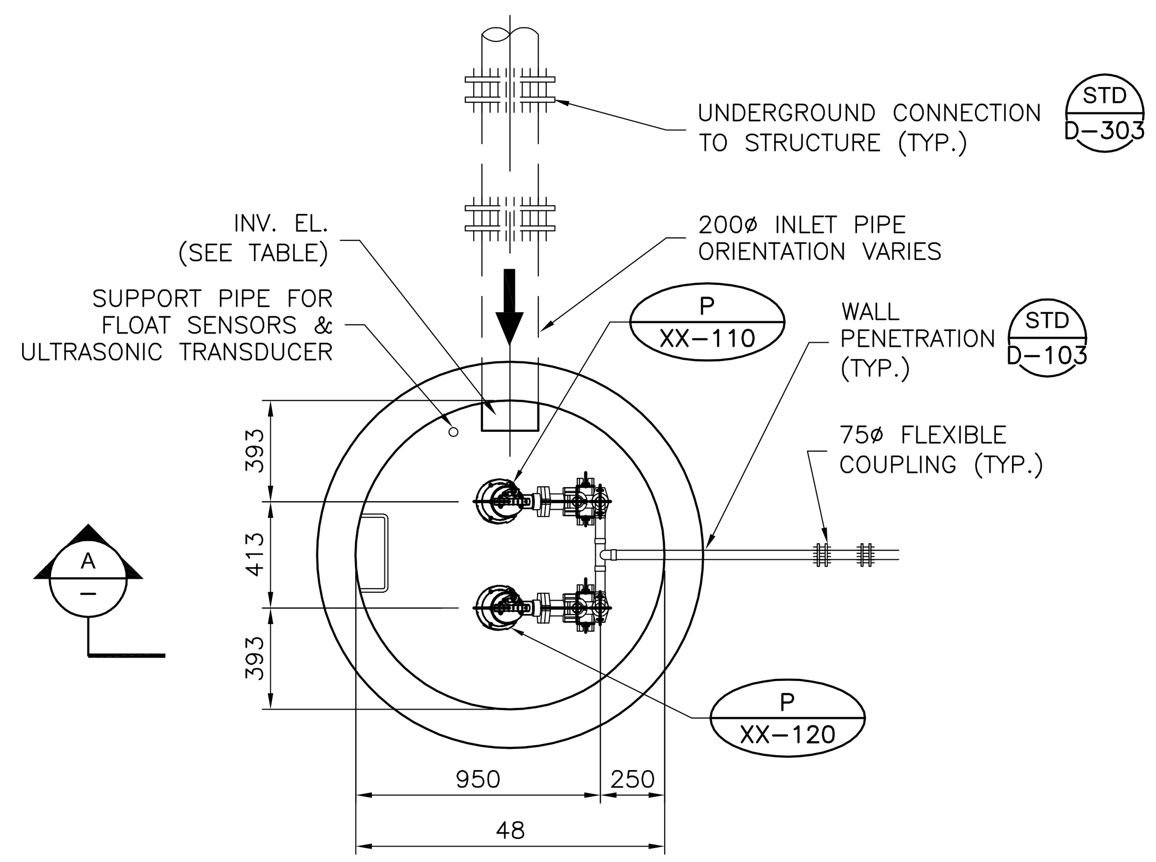
Location	Address	Postal Code	Phone Number	Fax Number
Richmond, B.C.	12431 Horseshoe Way	V7A 4X6	604-272-4000	604-272-4596
Calgary, AB.	5516E - 40th St. S.E.	T2C 2A1	403-279-1096	403-236-0989
Edmonton, AB.	11750 - 180th Street	T5S 1N7	780-452-6000	780-452-4600
Saskatoon, SK.	2302 Hanselman Avenue	S7L 5Z3	306-933-0177	306-933-3282
Regina, SK.	555 Henderson Drive	S42 5X2	306-721-7737	306-721-8611
Winnipeg, MB.	340 Saulteaux Crescent	R3J 3T2	204-987-9777	204-987-9770
Mississauga, ON.	7480 Bath Road	L4T 1L2	905-612-0566	905-612-0575

24 Hour Emergency Number - All Locations - 306-664-2522

Appendix C

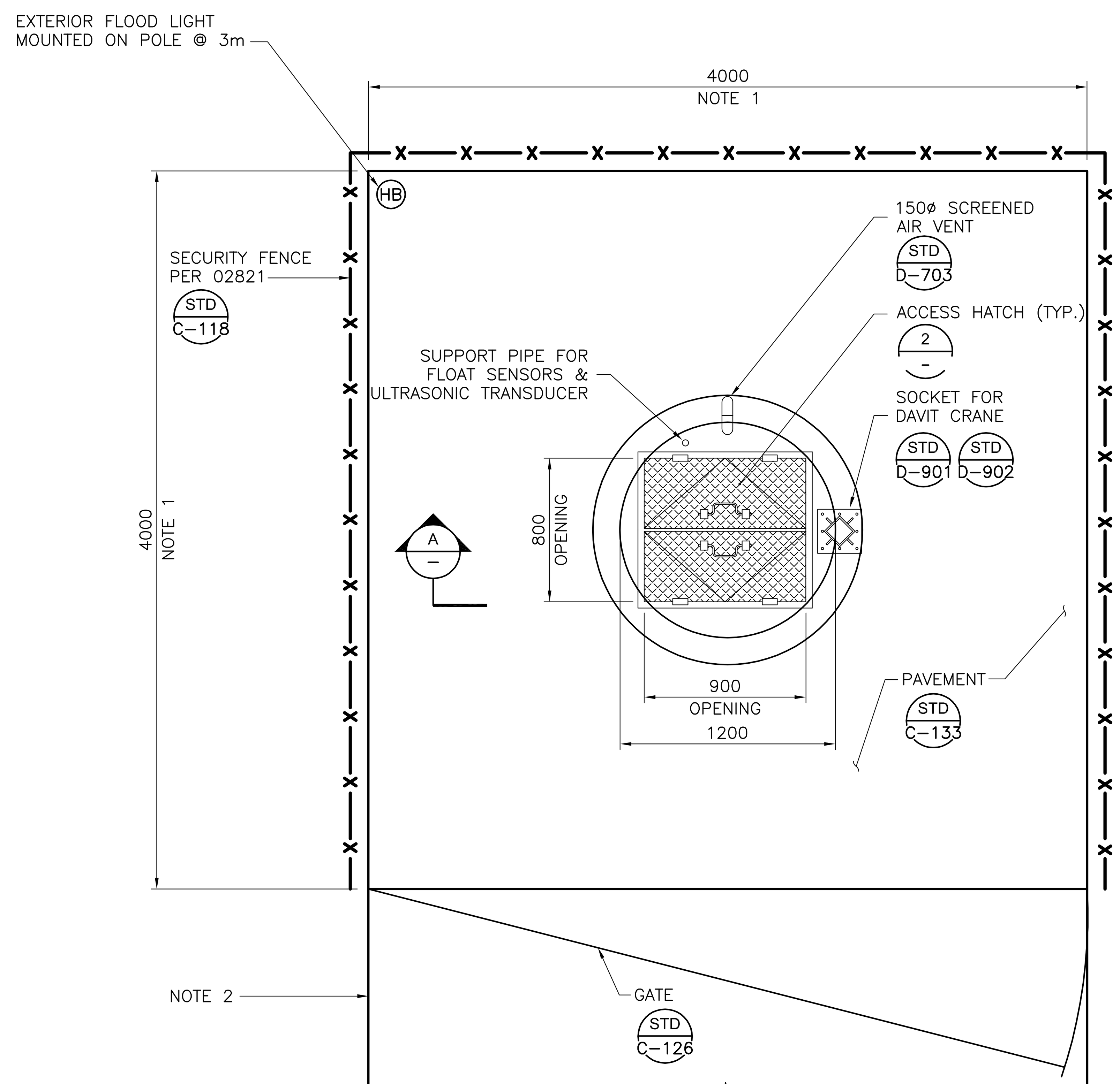
Project Description

C.3 Lift Station Example Drawings



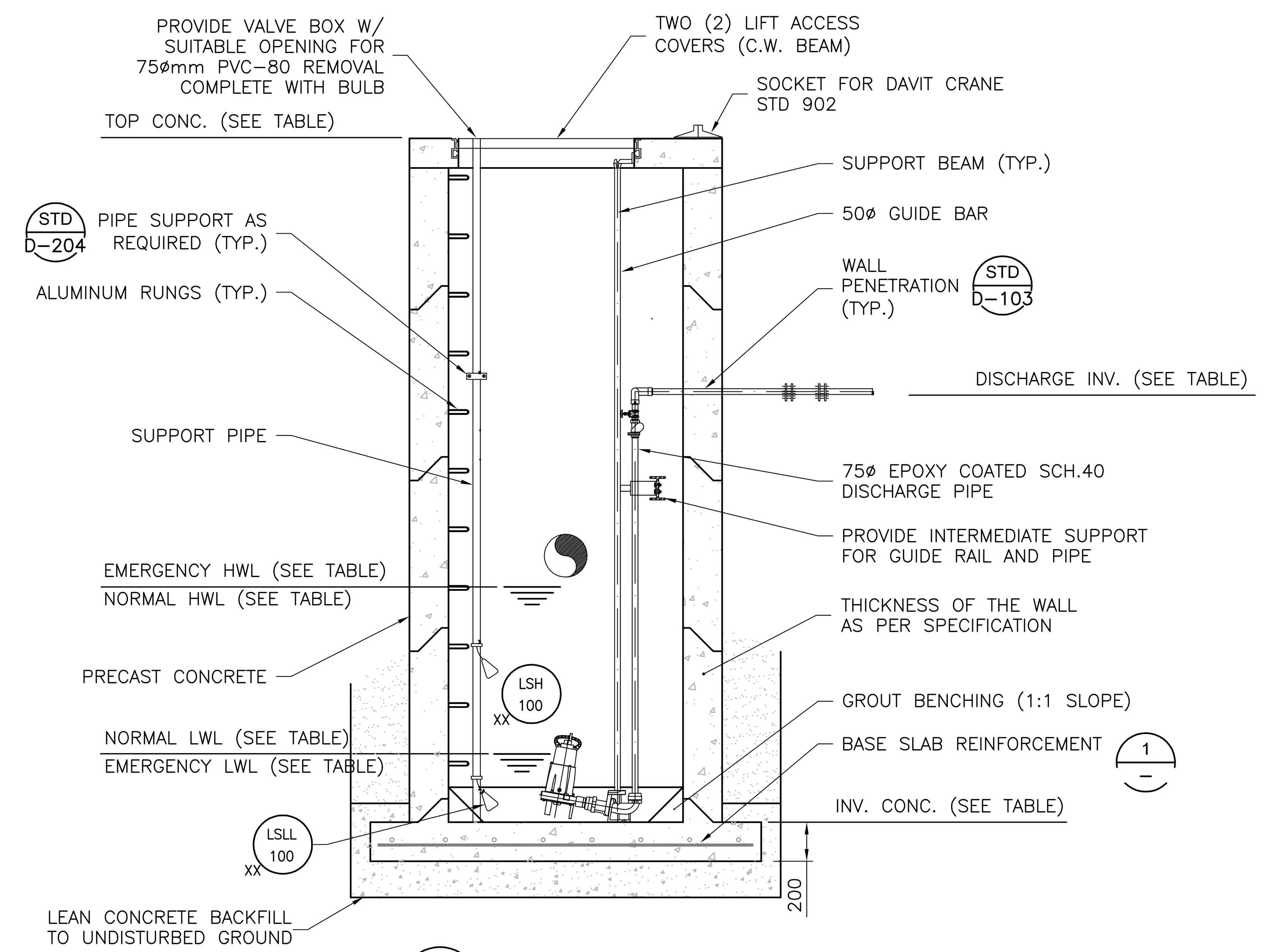
LOWER LEVEL PLAN

SCALE 1:25



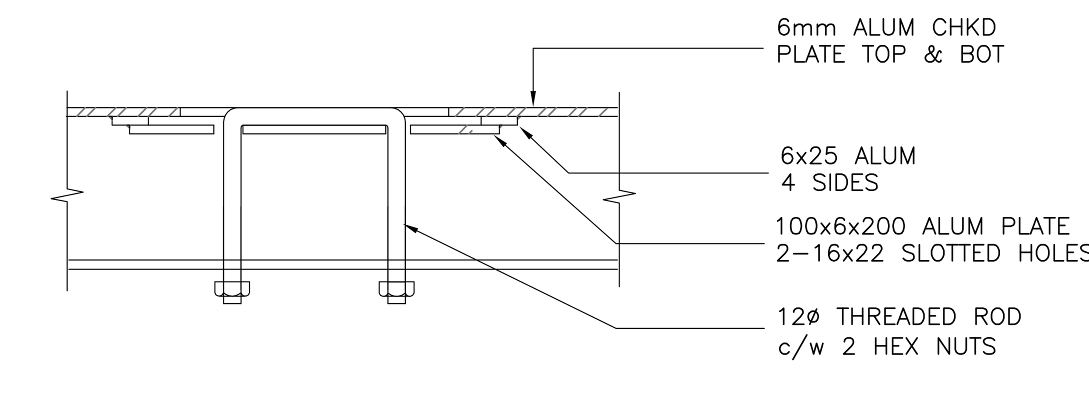
UPPER LEVEL PLAN

SCALE 1:25



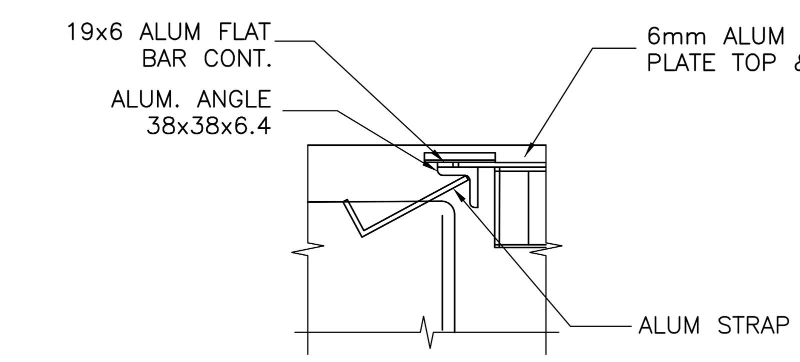
A SECTION

SCALE 1:25



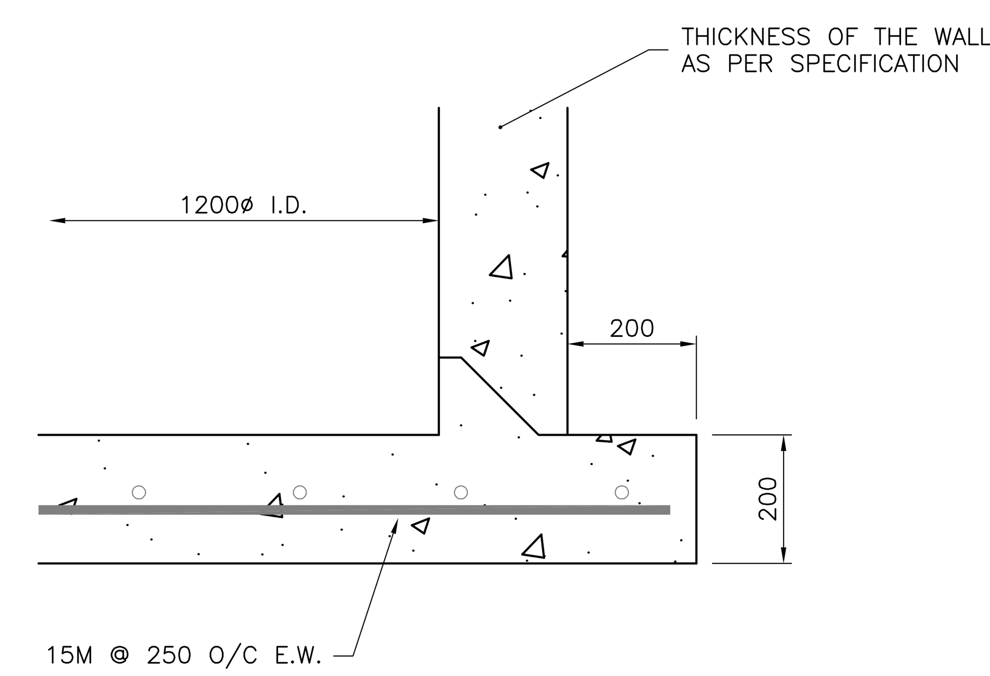
C SECTION

SCALE NTS



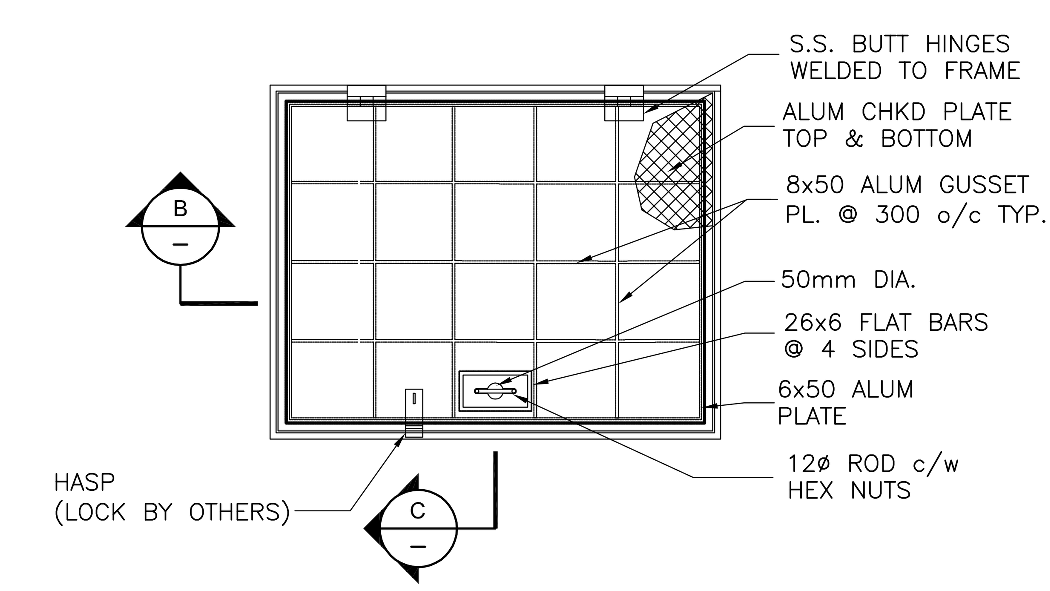
B DETAIL

SCALE NTS



2 BASE SLAB REINFORCEMENT DETAIL

SCALE NTS



1 TYP. ALUMINUM COVER & FRAME DETAIL

SCALE 1:25

DRAWING NOTES:
1. CONTRACTOR TO FIELD VERIFY FENCE AND GATE LOCATION TO PROVIDE ACCESS TO SITE. FENCED AREA MAY HAVE TO BE ADJUSTED FOR SITE CONDITIONS. FINAL SITE PLAN TO BE SUBMITTED TO ENGINEER FOR APPROVAL.
2. PAVEMENT TO EXTEND TO EDGE OF ROAD.

REV	DESCRIPTION	DRN	CHK	DATE (M/D/Y)

PREPARED FOR

WASA

TRINIDAD AND TOBAGO WATER AND SEWERAGE AUTHORITY

PREPARED BY

AECOM

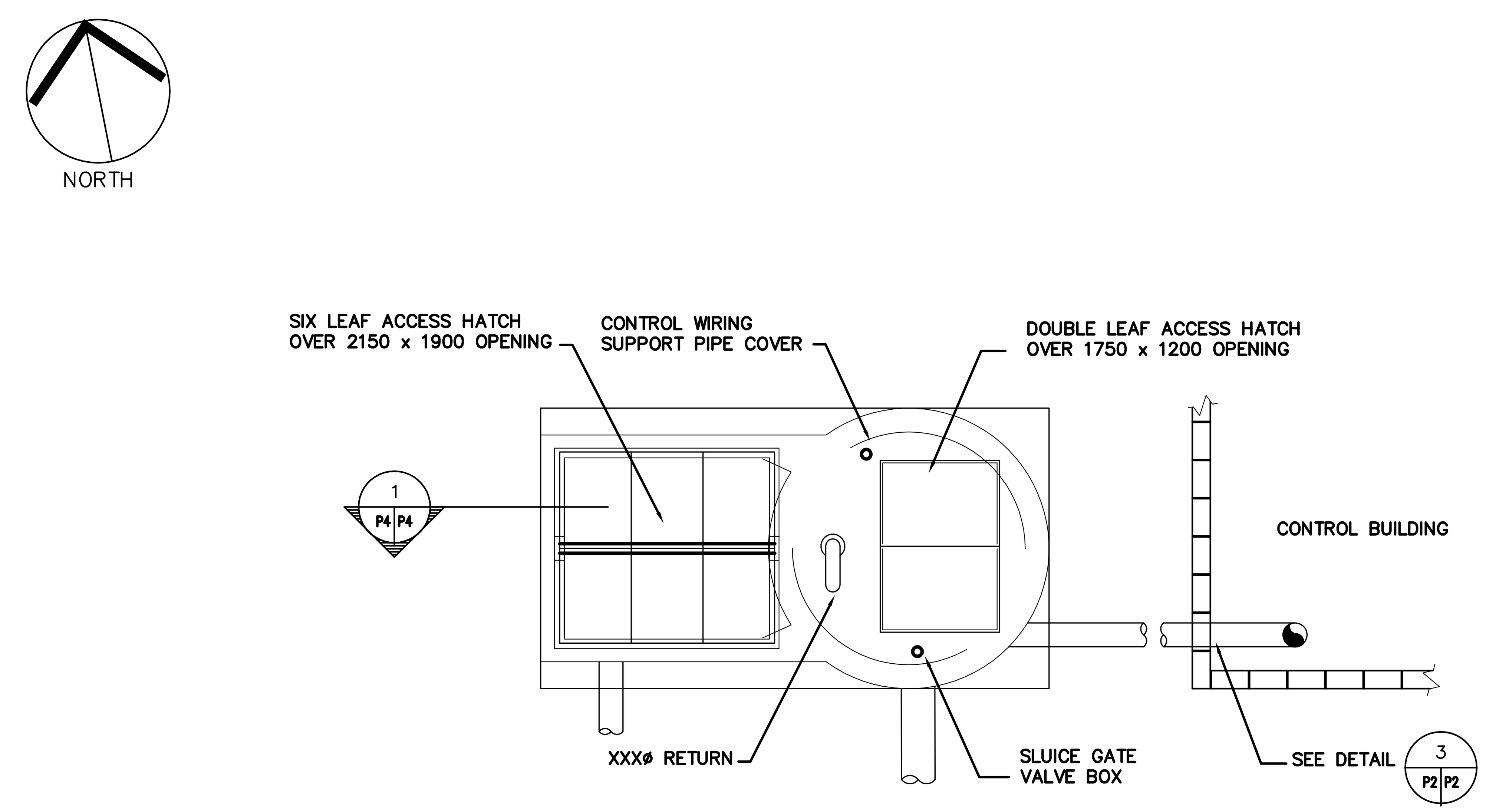
18 ALCAZAR STREET
ST. CLAIR, TRINIDAD
PHONE: 1-868-628-9710
FAX: 1-868-628-0862

DRN: SRG | CHK:
DES: NW | APP:

WATER & SEWERAGE AUTHORITY
SAN FERNANDO WASTEWATER PROJECT
WASTEWATER TREATMENT PLANT

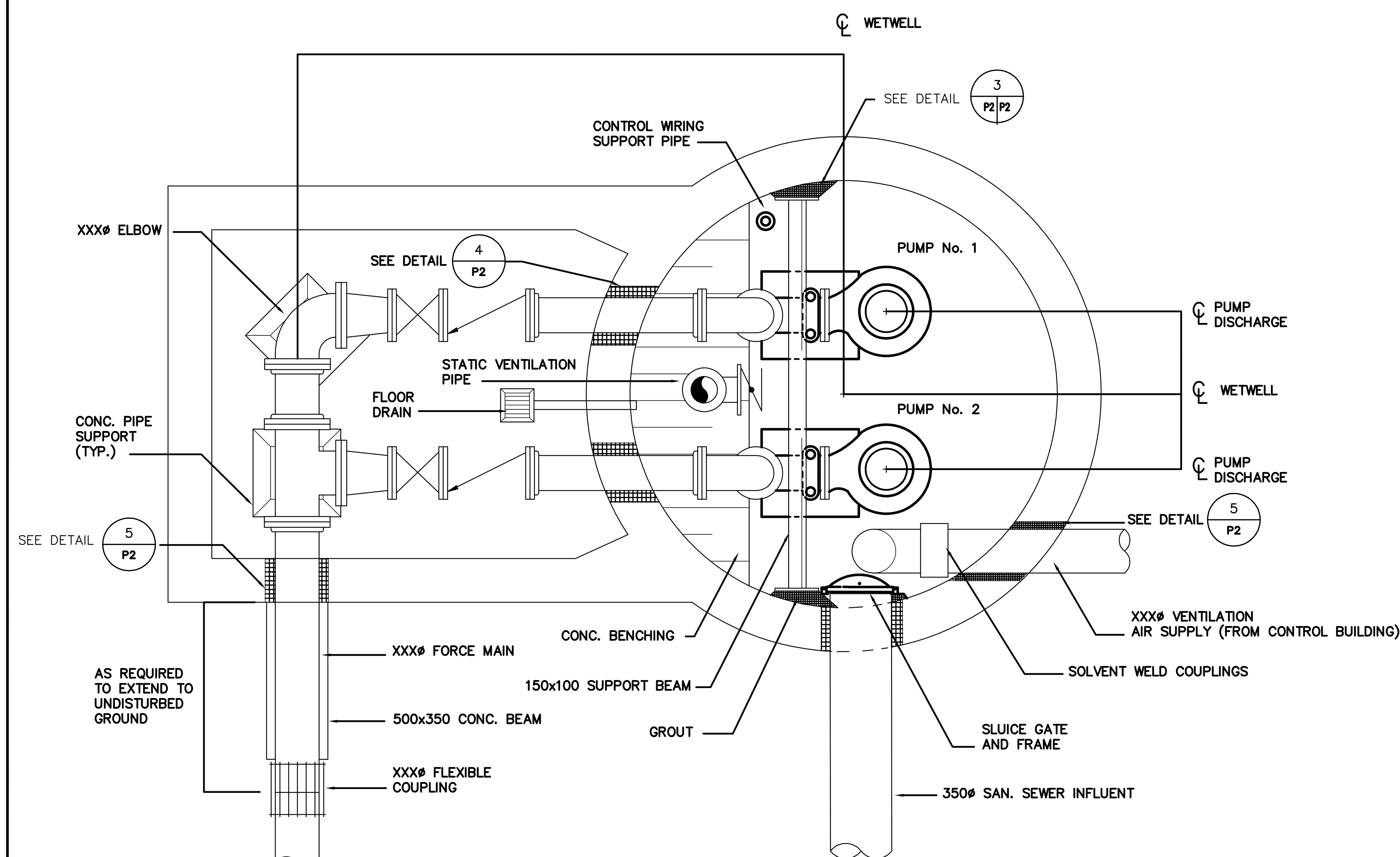
EXAMPLE OF A TYPE I LIFT STATION

PROJECT START DATE (M / Y): May 2009
PROJECT NO.: 110882
FILENAME:
SHEET NO.:
DRAWING NO.: FIGURE 3.4



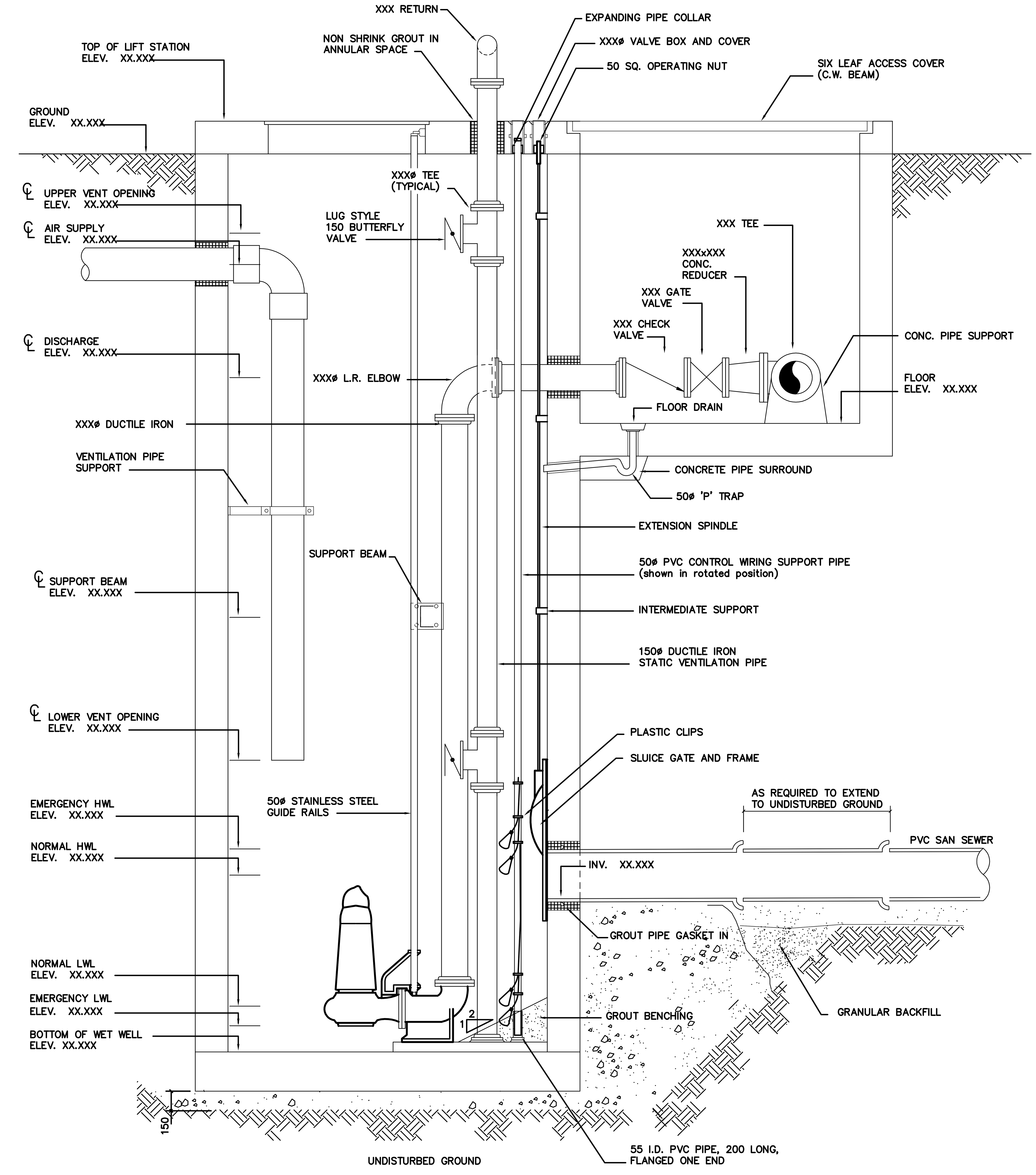
PLAN AT ELEV. 3.10m

SCALE 1:50



PLAN AT ELEV. 2.70m

SCALE 1:20



1
P4 P4
SECTION

SCALE 1:20

REV	DESCRIPTION	DRN	CHK	DATE (M/D/Y)

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DES: NW | APP:

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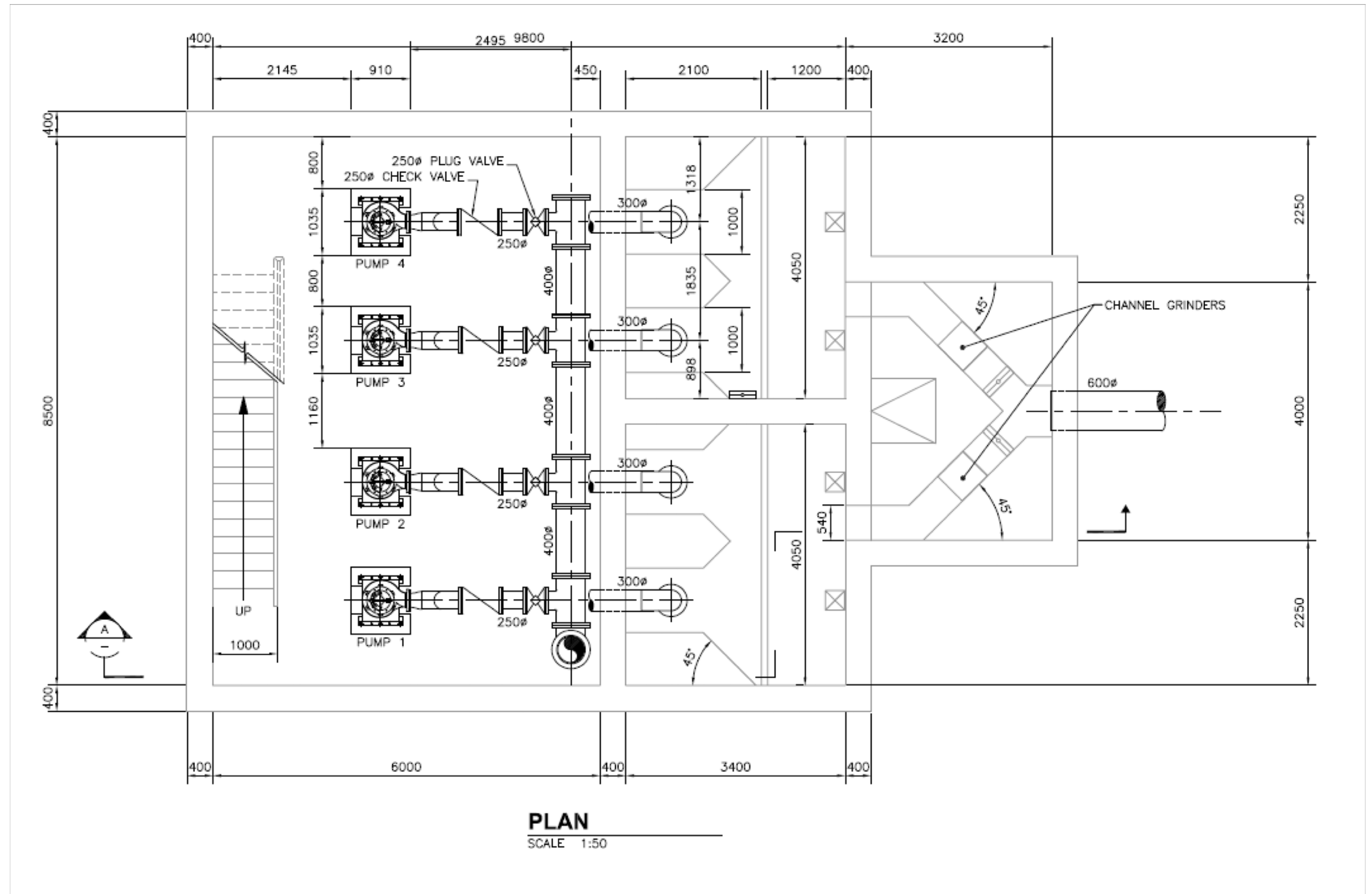
WASTEWATER TREATMENT PLANT

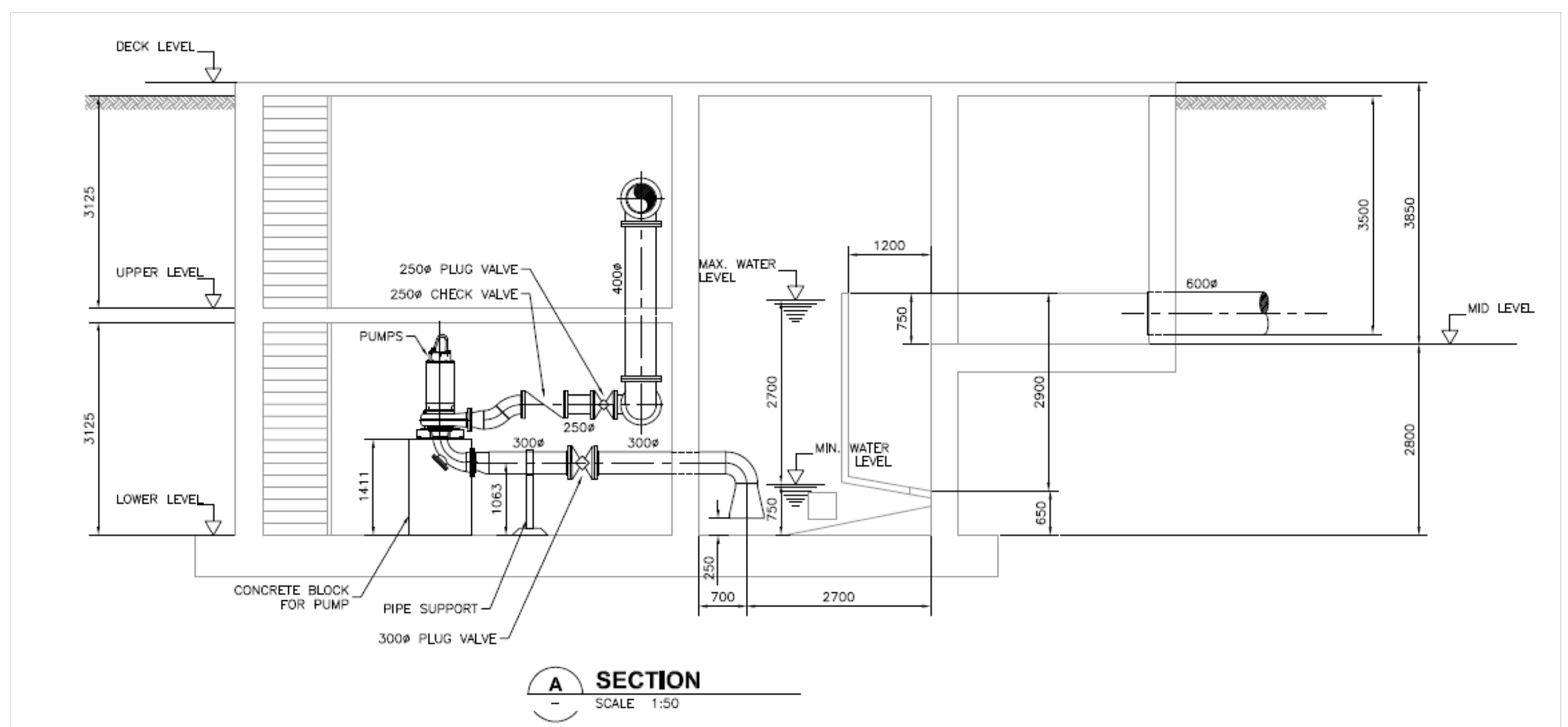
EXAMPLE OF A TYPE II LIFT STATION

PROJECT START DATE (M/Y): May 2009
PROJECT NO.: 110882
FILENAME:
SHEET NO.:
DRAWING NO.:

FIGURE 3.5



PLAN
SCALE 1:50



A SECTION
SCALE 1:50

REV	DESCRIPTION	DRN	CHK	DATE (M/D/Y)

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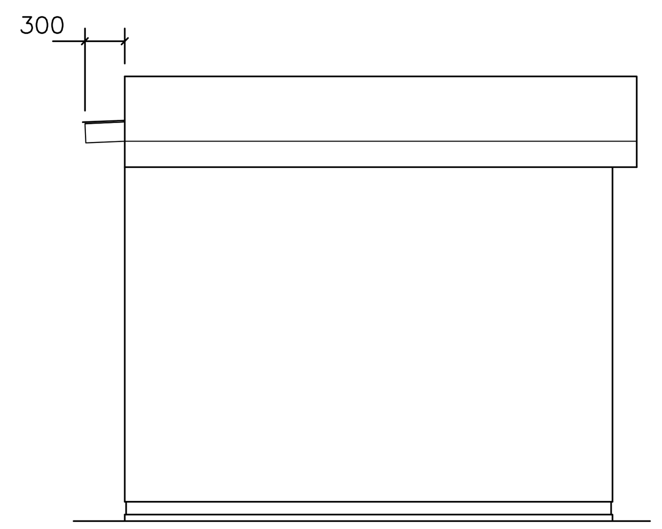
DRN: SRG | CHK:
DES: NW | APP:

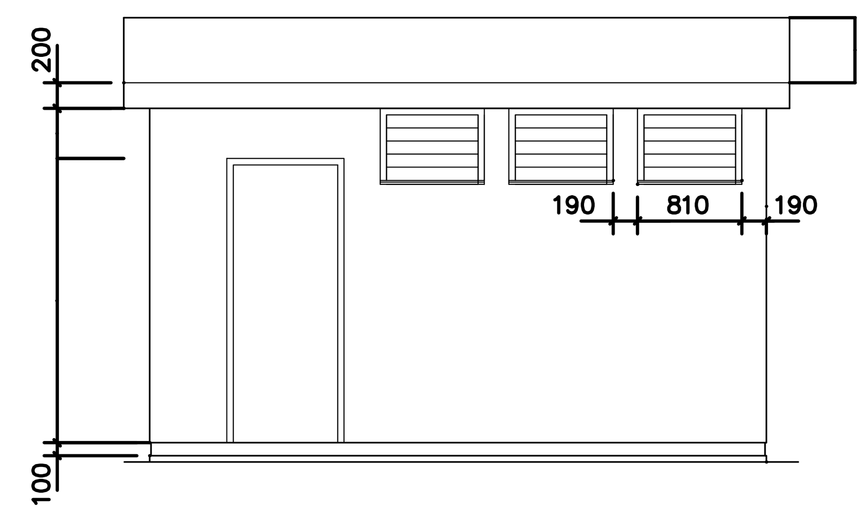
WATER & SEWERAGE AUTHORITY
SAN FERNANDO WASTEWATER PROJECT
WASTEWATER TREATMENT PLANT

EXAMPLE OF A TYPE III LIFT STATION

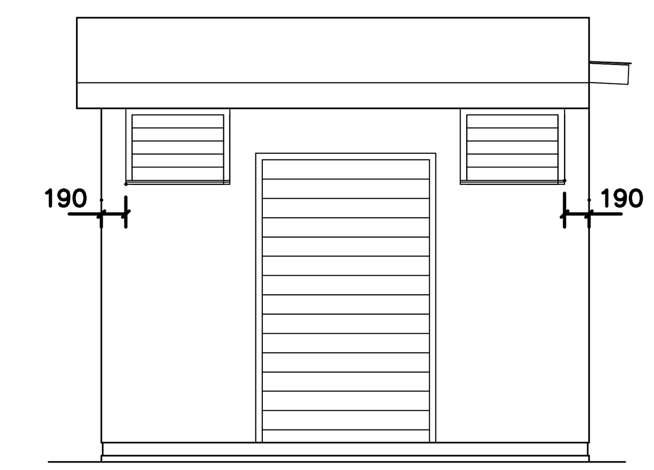
PROJECT START DATE (M / Y): May 2009
PROJECT NO.: 110882
FILENAME:
SHEET NO.:
DRAWING NO.: **FIGURE 3.6**



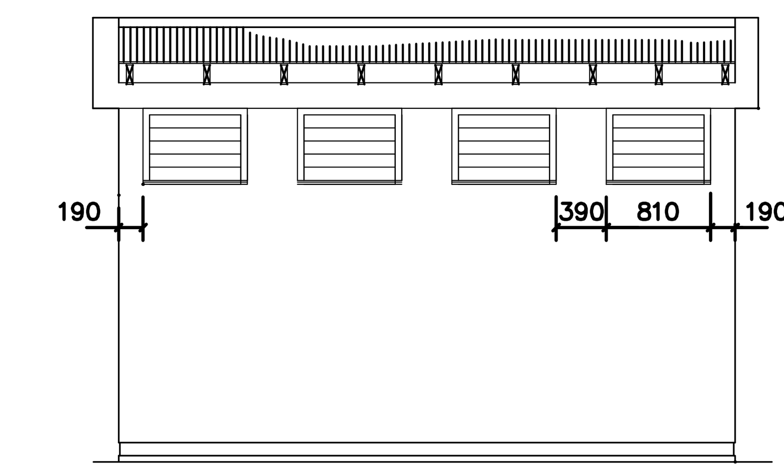
1 S8|S8 NORTH ELEVATION
SCALE 1:50



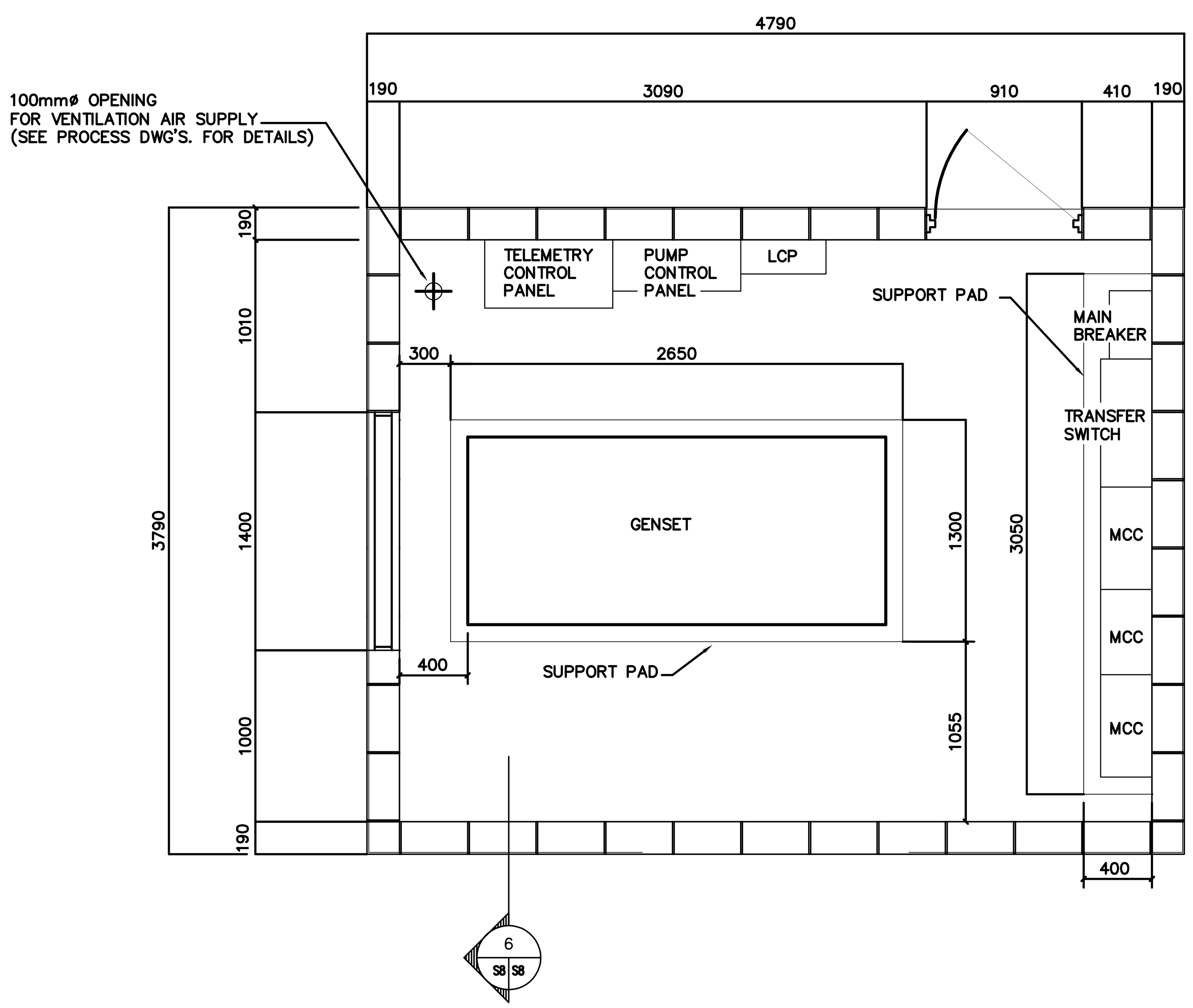
2 S8|S8 WEST ELEVATION
SCALE 1:50



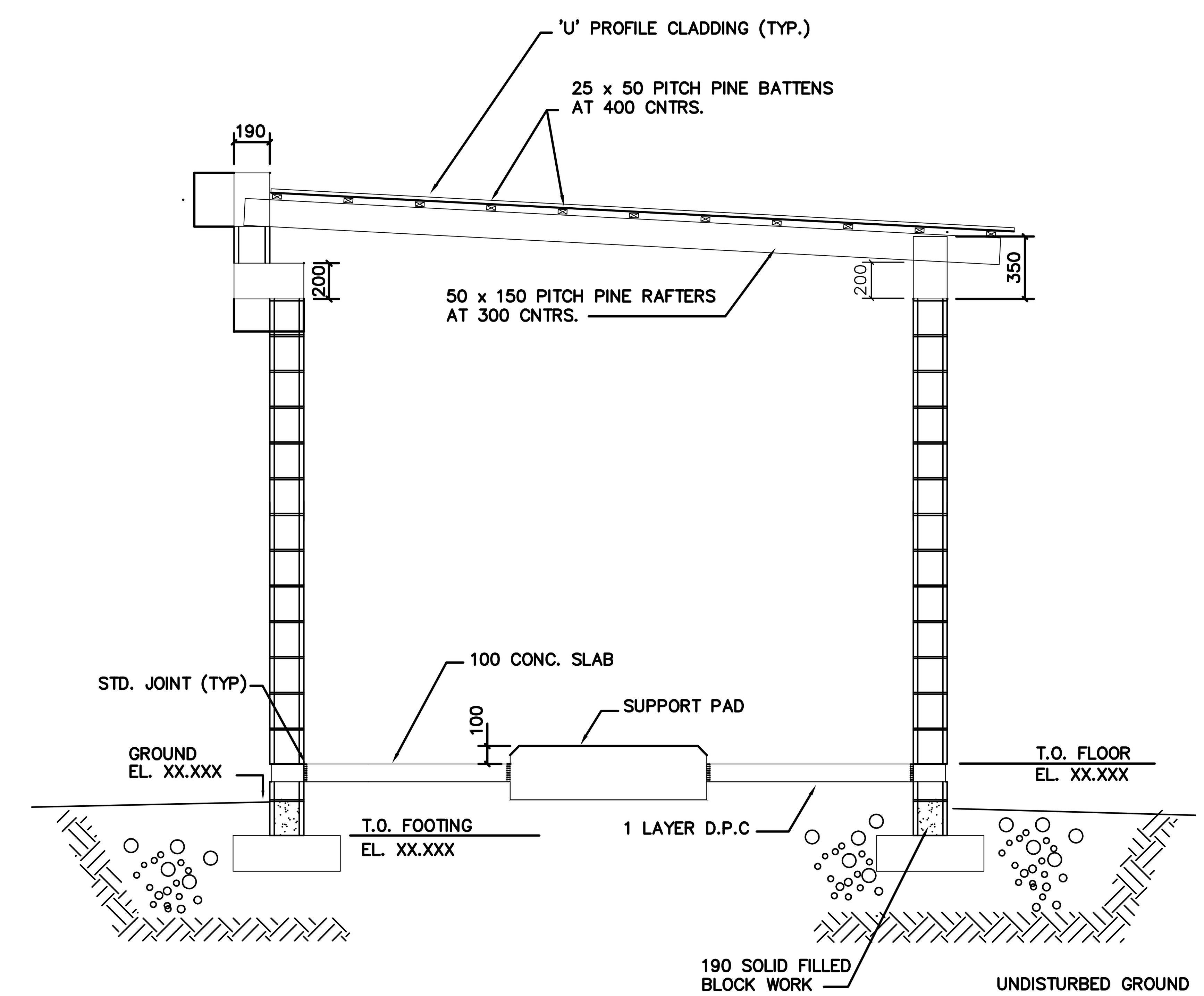
3 S8|S8 SOUTH ELEVATION
SCALE 1:50



4 S8|S8 EAST ELEVATION
SCALE 1:50



5 S8|S8 PLAN
SCALE 1:25



6 S8|S8 SECTION
SCALE 1:25

REV	DESCRIPTION	DRN	CHK	DATE (M/D/Y)

PREPARED FOR
WASA
TRINIDAD AND TOBAGO
WATER AND SEWERAGE AUTHORITY

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DRN: SRG | CHK:
DES: NW | APP:

WATER & SEWERAGE AUTHORITY
SAN FERNANDO WASTEWATER PROJECT
WASTEWATER TREATMENT PLANT

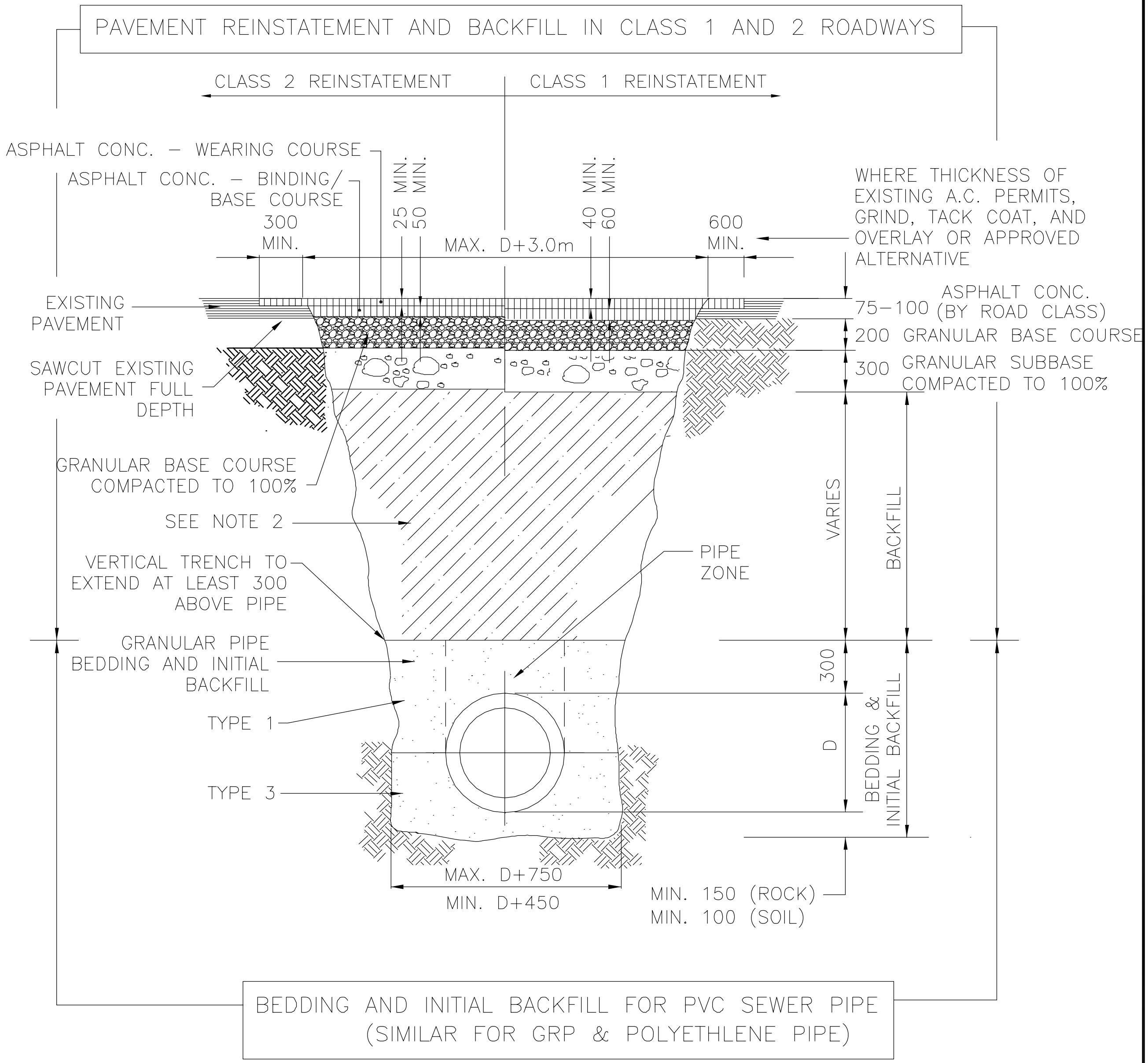
EXAMPLE OF A TYPE II & TYPE III LIFT STATION CONTROL BUILDING

PROJECT START DATE (M / Y): May 2009
PROJECT NO.: 110882
FILENAME:
SHEET NO.:
DRAWING NO.: **FIGURE 3.5**

Appendix C

Project Description

C.4 Collection System Construction Drawings



NOTES:

1. BEDDING AND INITIAL BACKFILL ARE FOR CONDITIONS ABOVE WATER TABLE.

2. TYPE 1 OR SELECT GRANULAR BACKFILL COMPACTED IN LAYERS NOT EXCEEDING 200mm TO 100%. (AS A MINIMUM, TO BE APPROVED FOR USE AS SELECT GRANULAR BACKFILL, GRANULAR EXCAVATED MATERIAL SHALL HAVE ALL PARTICLES GREATER THAN 75mm AND ALL DELETRIOUS MATERIAL REMOVED FROM IT).

3. COMPACTION DENSITIES INDICATED IN % ARE BASED ON ASTM D698 FOR CORRECTED MAXIMUM DENSITY.

4. CLASS OF ROADWAYS
   CLASS 1 – MAJOR THROUGHFARE
   CLASS 2 – PAVED COLLECTOR ROAD

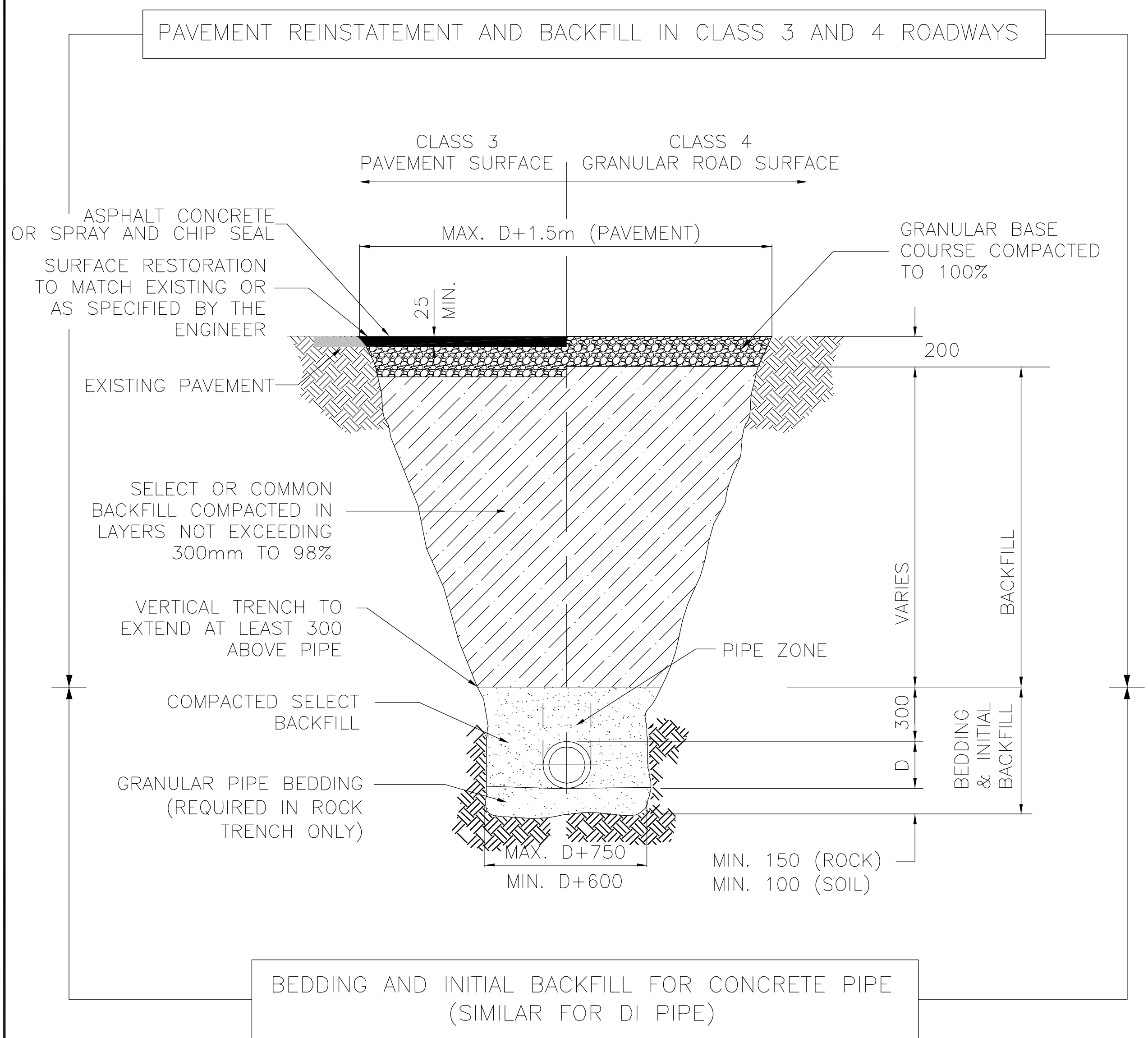
REV	DESCRIPTION	DRN	CHK	DATE (M/D/Y)

DESIGNED	KWF
DRAWN	JP
CHECKED	
APPROVED	

WATER & SEWERAGE AUTHORITY

SCALE	PRJ. START DATE
PROJECT NO.	
DRAWING NO. 01-C-STD 110	REV. -

CIVIL
STANDARD DETAIL 110
TRENCH FOR PVC PIPE



NOTES:

1. BEDDING AND INITIAL BACKFILL ARE FOR CONDITIONS ABOVE WATER TABLE.

2. COMPACTION DENSITIES INDICATED IN % ARE BASED ON ASTM D698 FOR CORRECTED MAXIMUM DENSITY.

3. CLASS OF ROADWAYS
   CLASS 3 – SECONDARY ROAD (PAVED OR SURFACE TREATED)
   CLASS 4 – GRAVEL ROAD

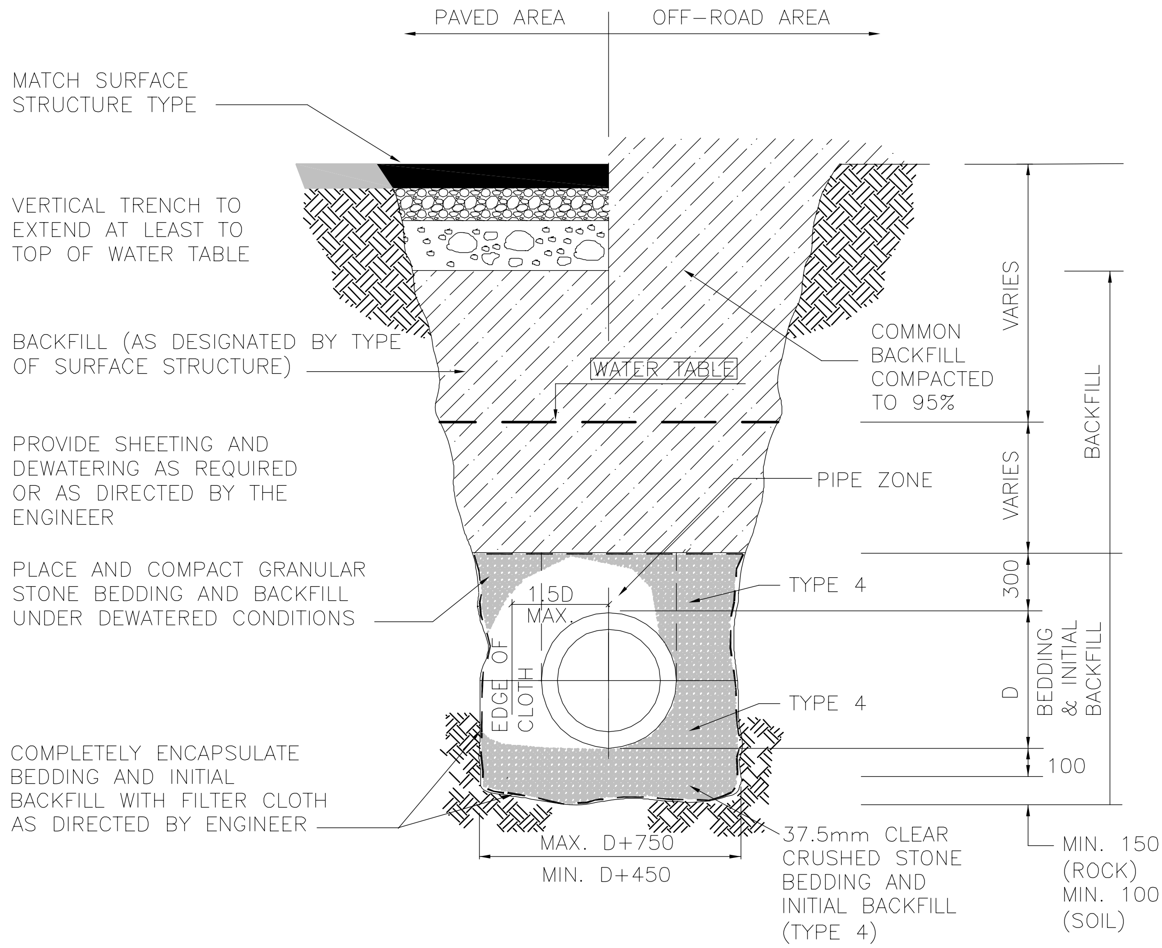
REV	DESCRIPTION	DRN	CHK	DATE (M/D/Y)

DESIGNED	KWF
DRAWN	JP
CHECKED	
APPROVED	

WATER & SEWERAGE AUTHORITY

CIVIL
STANDARD DETAIL 111
TRENCH FOR CONCRETE PIPE

SCALE	PRJ. START DATE
PROJECT NO.	
DRAWING NO.	REV.
01-C-STD 111	-



BEDDING AND INITIAL BACKFILL IN WET TRENCH CONDITIONS (BELOW WATER TABLE)

NOTES:

1. CONTRACTOR MAY ADAPT THIS SECTION FOR COMMON TRENCH (I.E. 2 PIPES IN 1 TRENCH). SUBMIT MODIFIED DETAIL TO ENGINEER SHOWING PROPOSED APPROACH BEFORE COMMENCING WORK.

2. PROVIDE DITCH PLUGS (TRENCH DAMS), CONSTRUCTED OF CONCRETE OR OTHER ACCEPTABLE MATERIAL EXTENDED THROUGH CLEAN STONE BEDDING AND INTIAL BACKFILL AT MAX. ONE BETWEEN EACH MANHOLE. CONTRACTOR TO SUBMIT PROPOSED METHOD OF CONSTRUCTION TO ENGINEER FOR REVIEW.

REV	DESCRIPTION	DRN	CHK	DATE (M/D/Y)

DESIGNED	KWF
DRAWN	JP
CHECKED	
APPROVED	

WATER & SEWERAGE AUTHORITY

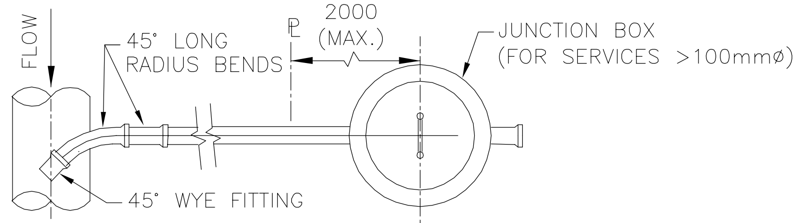
CIVIL
STANDARD DETAIL 112
TRENCH FOR WET CONDITIONS

SCALE	PRJ. START DATE
PROJECT NO.	
DRAWING NO. 01-C-STD 112	REV. -

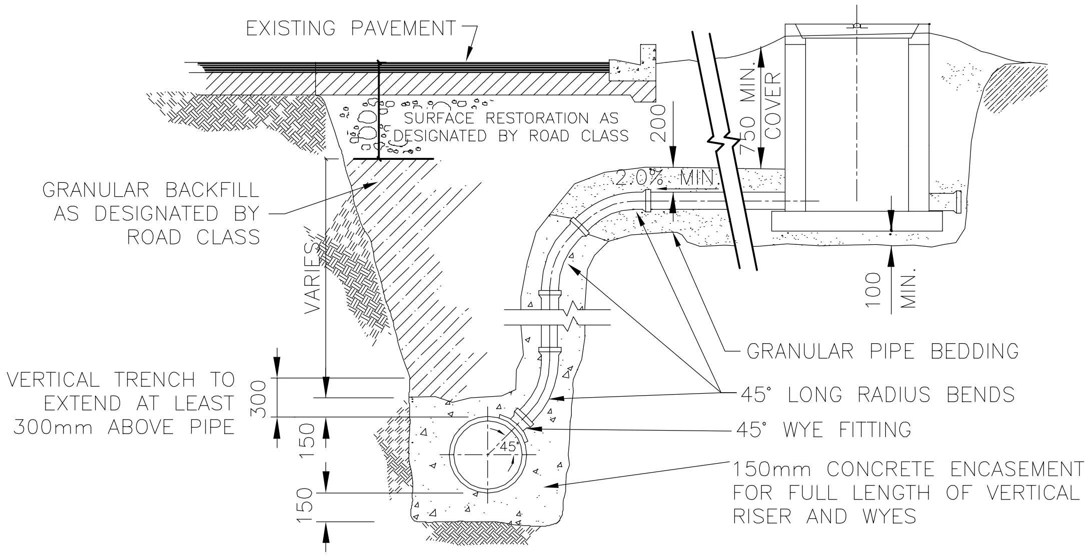
NOTES:

USE TEE SADDLE ONLY WHERE APPROVED IN WRITING BY ENGINEER.

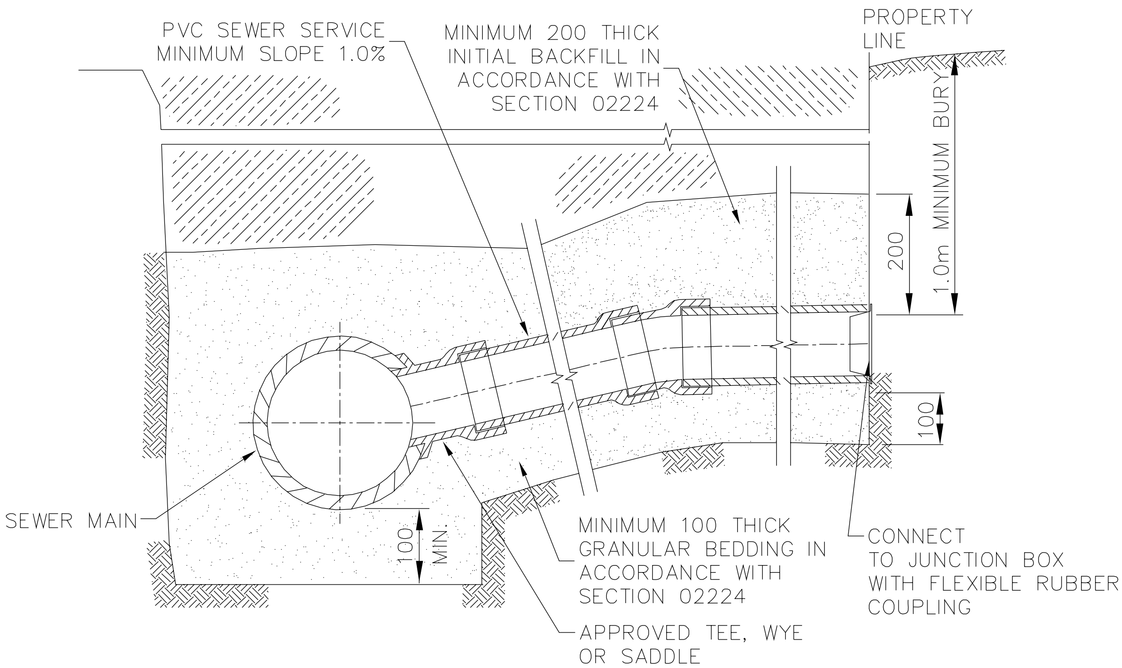
RISER TYPE SERVICE TO BE USED ONLY WHEN SERVICE IS MORE THAN 2.4m ABOVE WYE (TEE) INVERT OR AS DIRECTED BY THE ENGINEER.



PLAN



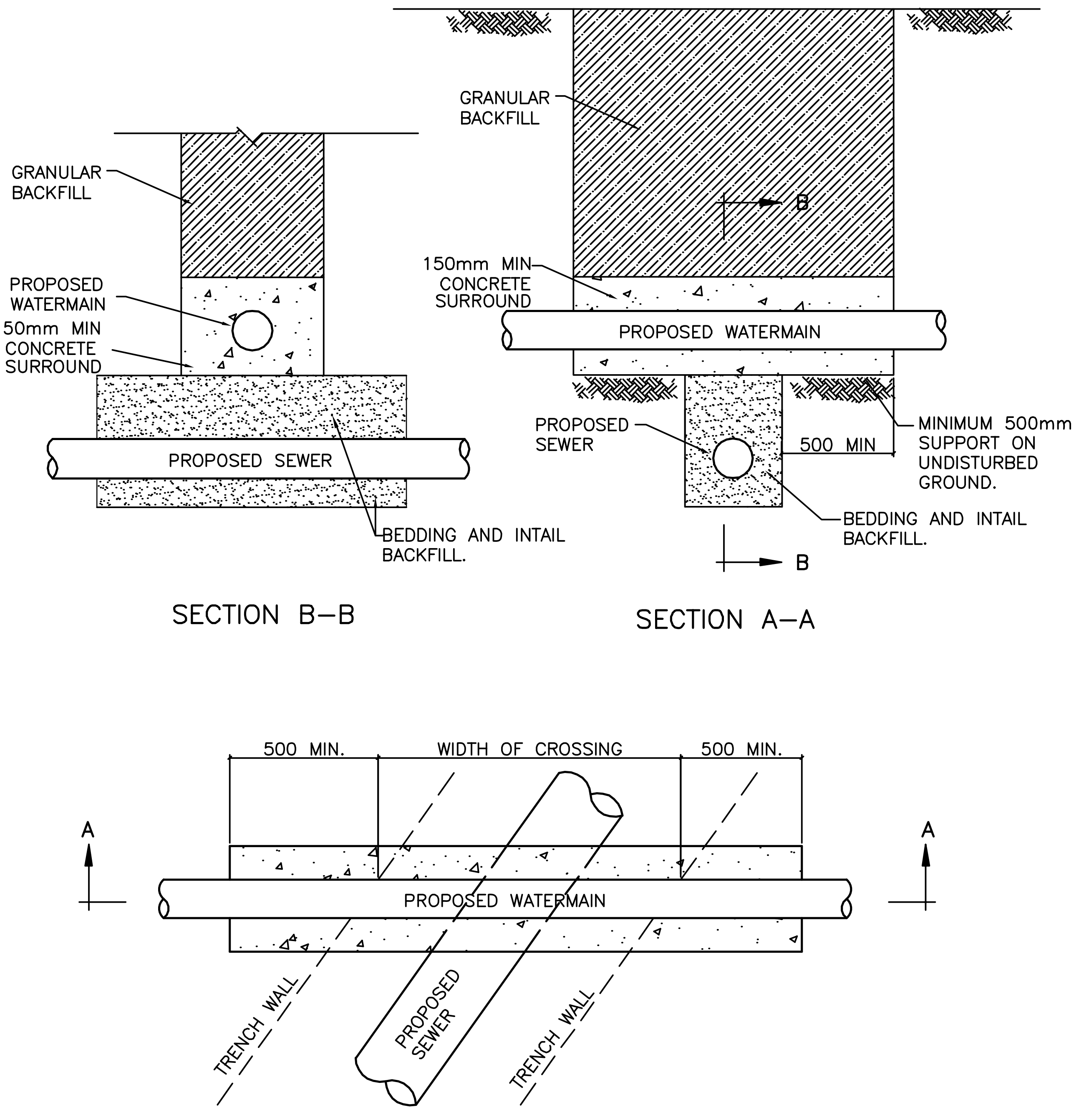
SANITARY SERVICE CONNECTION – ELEVATION



STANDARD SEWER CONNECTION

REV	DESCRIPTION	DRN	CHK	DATE (M/D/Y)

DESIGNED KWF	**WATER & SEWERAGE AUTHORITY**	SCALE	PRJ. START DATE
DRAWN JP		PROJECT NO.	
CHECKED	CIVIL STANDARD DETAIL 117 SEWER SERVICE CONNECTION	DRAWING NO. 01-C-STD 117	REV. -
APPROVED			



CONCRETE ENCASEMENT FOR WATERMAIN/SEWER SEPARATION

NOTE: THIS STANDARD IS APPLICABLE TO WATERMAIN/SEWER SEPARATION ONLY.

REV	DESCRIPTION	DRN	CHK	DATE (M/D/Y)

DESIGNED	KWF
DRAWN	JP
CHECKED	
APPROVED	

WATER & SEWERAGE AUTHORITY

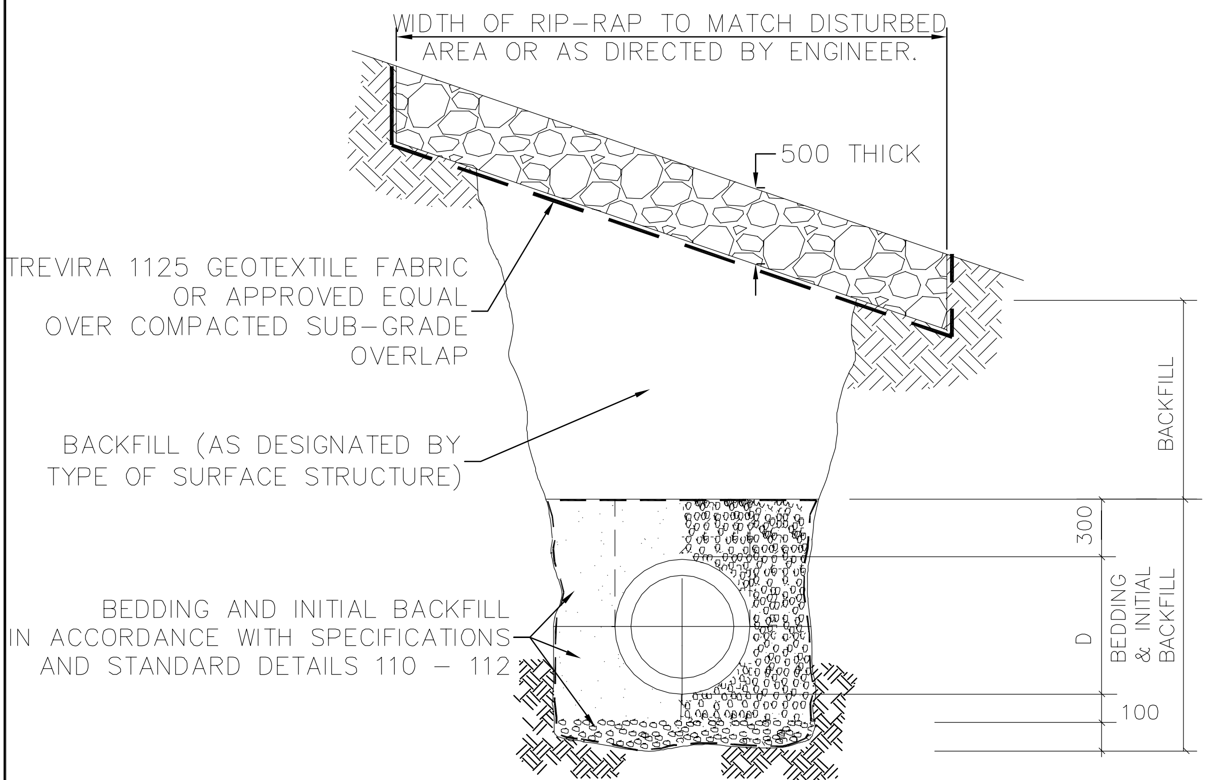
CIVIL
STANDARD DETAIL 124
PIPE CROSSING DETAIL

SCALE	PRJ. START DATE
PROJECT NO.	
DRAWING NO.	REV.
01-C-STD 124	-

Plotted By: gerald.lacoste 04:59:59 PM
Plot File Date Created: 03/12/2009

File Last Save Date: Mon, 9 Mar 2009
Layout-Sheet Name: ISO-A4
Filename: L:\WORK\102000\102348\02A-CAD\PRJ_DRAWINGS\COLLECTION SYSTEM\GEN\CONTR\STANDARD DETAILS\01-C-STD 124.DWG

RIP RAP PROTECTION
- ANGULAR LIMESTONE ROCK SIZES
  RANGING FROM 50mm TO 150mm DIAMETER
- MIN. 50% EQUAL TO OR LARGER THAN 200mm DIAMETER
- MIN. RIP-RAP LAYER 300mm THICK



EROSION PROTECTION FOR TRENCHES ALONG WATERCOURSES

REV	DESCRIPTION	DRN	CHK	DATE (M/D/Y)

DESIGNED KWF	**WATER & SEWERAGE AUTHORITY**	SCALE	PRJ. START DATE
DRAWN JP		PROJECT NO.	
CHECKED	CIVIL STANDARD DETAIL 125 TRENCH EROSION PROTECTION	DRAWING NO. 01-C-STD 125	REV. -
APPROVED			

Appendix C

Project Description

C.5 Applicable Project Specifications

ENVIRONMENTAL AND AESTHETIC PROECTION

1. GENERAL

1.1 Summary

.1 Contractor, in executing Work, shall maintain Work areas on- and off-site free from environmental pollution that would be in violation of these contract documents and local regulations.

.2 Perform work in accordance with the Environmental Management Act and governing regulations of the relevant environmental management and protection authorities having jurisdiction, including but not limited to the Environmental Management Authority (EMA), Town & Country Planning Division (TCPD), the Ministry of Planning, Housing and the Environment, Ministry of Health, Ministry of Agriculture, Ministry of Works and Transport, Ministry of Local Government and other environmental protection agencies.

.3 Horizontal directional drilling (HDD) and microtunnelling has been chosen by the Employer for construction of sections of the collection system, to the degree possible, to minimize traffic disruption and habitat destruction. All other areas apart from these sections; open cut construction techniques are to be employed by the Contractor.

1.2 Environmental Management Plan and Construction Mitigation Strategy

.1 Prepare and submit a draft Environmental Management Plan (EMP) and Construction Mitigation Strategy (CMS) at the Pre-construction meeting. The EMP/ CMS is to identify various environmental concerns that may be adversely impacted by the construction or the works. The EMP/ CMS is to outline the steps the Contractor intends to take to mitigate these impacts so as to minimize any adverse impacts on the delicate ecosystem.

.2 This EMP/ CMS is to be reviewed and approved by the Engineer prior to commencing any construction activities.

1.3 Site Clearing and Plant Protection

.1 Protect trees and plants on site and adjacent property where designated to stay.

.2 Do not remove any trees without approval of the Town and Country Planning Division, Forestry Division, and State Lands.

.3 Protect roots of trees designated to remain to dripline during excavation and site grading to prevent disturbance or damage.

.4 Minimize stripping of topsoil and vegetation.

1.4 Archeological Significant Site

.1 Prior to commencement of on-shore excavation activities the contractor is to meet with the Archeological Committee, the Engineer and the Employer's representative to establish procedures for excavation works.

.2 The contractor is to use every precaution during on-shore excavation work and notify the Engineer immediately upon discovery of an artifact or archeological find.

1.5 Drainage

.1 Prevent construction material, pavement, concrete, earth or other debris from entering existing drains and drainage courses.

.2 Disposal of any construction materials or debris from runoff into any watercourses including the Cipero, Guaracara, Vistabella or Marabella Rivers is strictly forbidden.

.3 Provide holding ponds or approved method which will divert flows, including storm flows and flows created by construction activity, to prevent silting of waterways, flooding damage to property, or discharge to the rivers.

.4 Do not dispose of water containing suspended material (greater than 30 mg/L) into waterways.

1.6 Erosion and Sediment Control

.1 Apply appropriate soil conservation measures to protect project area and adjacent lands. These measures may include, but not be limited to, mulching, rapid growth vegetation, fabric mat, hay bales, filter barriers, sediment traps, and basins.

.2 Select methods of erosion and sediment control for specific job site.

  .1 Adjust sediment control measures in field to meet conditions encountered.

.3 Prepare and submit erosion control plan to Engineer. Plan shall include:

  .1 Limits of disturbance.

  .2 Types(s) of stabilization to be used.

  .3 Existing and proposed culverts, storm drains, and outfalls.

  .4 Location of stabilized construction entrance.

  .5 Location of proposed sediment control measures.

.6 Details of sediment traps and basins and other sediment control measures.

.7 Sequence of construction as it relates to installation, phasing, and removal of sediment control measures.

.4 Provide erosion control measures, in place, before commencing work on project site.

.1 Maintain erosion control measures during the course of construction.

.2 Remove any temporary erosion control measures upon completion of constuction.

1.7 Disposal of Excess Excavated Materials

.1 Excess excavated material not required or not suitable for backfill and other waste material shall be disposed of off-site to an approved disposal site.

.2 Provide watertight conveyance for liquid, semi-liquid or saturated solids which tend to bleed during transport. Liquid loss from transported materials is not permitted, whether being delivered to construction site, hauled to designated spoils area, or hauled away for disposal. Fluid materials hauled for disposal must be specifically acceptable at selected disposal site.

1.8 Disposal of Construction Waste and Debris

.1 All garbage and debris generated on- and off-shore shall be stored and handled in a manner acceptable to the Engineer and in compliance with the Ministry of Local Government Refuse Collection and Disposal Regulations of Trinidad and Tobago.

.2 Do not bury rubbish and waste materials on site.

.3 Do not dump rubbish or debris into any watercourses or water bodies.

.4 Remove all construction waste from the site and dispose at a designated, approved waste landfill on a regular basis or as directed by the Engineer. Waste sites for this project shall be designated by the Ministry of Health.

.5 Provide garbage containers on site and for domestic garbage generated by Contractor’s and Engineer’s personnel and make arrangements for collection and disposal on a regular basis or when directed by the Engineer.

.6 Maintain the site in a tidy condition, free from the accumulation of waste products, debris and litter.

.7 Do not dispose, or allow to be disposed, waste or volatile materials such as mineral spirits, oil, paint, or paint thinners into any waterway, drain or sewer.

.8 Used oil, filter and grease cartridges, lubrication containers and other products of equipment maintenance shall be collected and disposed of at a location approved by the Ministry of Health. Settled oil can be disposed of at the Petrotrin oil refinery.

1.9 Fires

.1 Do not burn trash or grubbed material on construction sites.

1.10 Use of Chemicals

.1 Drilling fluids for use in directional drilling to be approved by the Engineer prior to commencement of drilling activities.

.2 Other chemicals used during project construction or furnished for project operation, whether disinfectant, polymer, reactant or of other classification, shall be approved by the appropriate governmental agency prior to use.

1.11 Fuels and Lubricants

.1 If required, obtain permit for on-site storage of fuel or other inflammable liquids. Observe all restrictions and conditions imposed by the permit regarding special protection and berming to control spills and tank damage; fire protection considerations; provisions for disposal of failed material and used petroleum products.

.2 Fuel storage area and fuel equipment shall be approved by the Engineer and Trinidad & Tobago Fire Service prior to installation. Submit containment provisions to Engineer for approval.

.3 Report spills or leaks from fueling equipment or construction equipment/ vessels to Engineer and local authorities and cleanup as required.

.4 Employer may require Contractor to remove damaged or leaking equipment from Project site.

.5 Used fuels and lubricants to be disposed of according to Section 1.8.8.

1.12 Noise Control

.1 Conduct operations to cause least annoyance to residents in vicinity of Work, and comply with applicable local ordinances.

.2 Equip compressors, hoists, and other apparatus with mechanical devices necessary to minimize noise and dust. Equip compressors with silencers on intake lines.

.3 Equip gasoline or diesel-operated equipment with silencers or mufflers on intake and exhaust lines.

.4 Line storage bins and hoppers with material that will deaden sounds.

.5 Conduct operation of dumping materials and hauling slurry away in trucks so as to cause minimum of noise and dust.

.6 Route vehicles carrying rock, slurry, concrete or other material over such streets as will cause least annoyance to public and do not operate on public streets between hours of 6:00 p.m. and 7:00 a.m., or on Saturdays, Sundays or legal holidays unless approved by Employer.

1.13 Dust Control

.1 Take special care in providing and maintaining temporary site roadways, existing roads and utility roads used during construction operations in clean, dust free condition.

.2 Comply with local environmental regulations for dust control. If Contractor's dust control measures are considered inadequate by Engineer, Engineer may require Contractor to take additional dust control measures.

.3 Prevent sandblasting, blasting and other extraneous materials from contaminating air beyond application area by providing suitable, temporary enclosures or mats.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for access roads, temporary roads and on-site work as specified by the Engineer.

1.14 Site Access and Parking

.1 All site access and parking to be in compliance with Section 01570.

.2 Access to sewer construction site will be along designated road approved by the Engineer, the Ministry of Works and Transport and the Ministry of Local Government. Maintain these roads and repair any damage caused by construction activities to the satisfaction of the Engineer.

.3 Provide and maintain access road to Lift Station sites as indicated or approved by the Engineer.

.4 Restrict vehicle access to these roadways and within the confines of the site.

.5 Employee parking will be restricted on sewer construction site to designated areas off the main roads to avoid traffic congestion.

.6 Employee parking will be permitted on Lift Station sites.

1.15 Contractor's Operations

.1 Confine all operations to the work limits as stated or designated by the Engineer. No activities of any kind may be carried out beyond these work limits without written permission of the Engineer.

.2 Equipment maintenance shall only be carried out at the Contractor's main yard or where approved by the Engineer. Random use of the site for equipment oil changes and other servicing will not be permitted.

.3 Conduct operations at all times in such a manner as to preserve the natural features and vegetation in the area. Cut and fill slopes shall be blended with adjoining topography.

.4 When, in the opinion of the Engineer, negligence on the part of the Contractor results in damage or destruction of any waterways or surrounding land, its vegetation or other environmental features, the Contractor shall be responsible, at his expense, for complete restoration to the satisfaction of the Environmental Management Authority.

1.16 Contractor's Employee Briefing

.1 Conduct regular briefing sessions for all employees and subcontractor employees highlighting the requirements of this specification and the Environmental Management Plan and Construction Mitigation Strategy The personnel should also be instructed on operation of equipment; pollution and garbage management; vehicle access and parking; and care of the environment in the work area.

2. PRODUCTS (NOT USED)

3. EXECUTION (NOT USED)

END OF SECTION

EROSION PROTECTION

1. GENERAL

1.1 Scope of Work

.1 This section outlines the requirements for rip rap and geotextile fabric related to erosion protection of slopes and trenches along river banks and slopes.

2. PRODUCTS

2.1 Bedding

.1 Geotextile fabric bedding material shall be reasonably well graded granular material consisting of sound, hard crushed rock or crushed gravel and shall be free from organic or soft material which would disintegrate through decay or weathering.

.2 Gradation limits for rip rap bedding gravel are as described below:

Sieve Opening	Percentage Passing
75 mm	100
50 mm	55 - 100
25 mm	38 - 100
5 mm	20 - 65
0.315 mm	6 - 30
0.080 mm	2 - 10

.1 Max. Los Angeles Abrasion Loss 35%

2.2 Rip Rap

.1 Hard, dense crushed quarry stone with specific gravity not less than 2.65 durable, a point load index greater than 4.0 Mpa, a water absorption rate ranging between 0.5% to 2.0% maximum, Abrasion Resistance Value less than 20% and magnesium sulphate Soundness less than 12 %.

.2 Gradation as indicated on the drawings.

2.3 Geotextile

.1 Geotextile fabric shall be as indicated on the standard detail.

.2 Furnish geotextile fabric of either woven or nonwoven polyester, polypropylene, stabilized nylon, polyethylene, or polyvinylidene chloride. All fabric shall have the minimum strength values in the weakest primary direction. The Contractor may use nonwoven fabric that is one or a combination of the following: needle punched, heat bonded, or resin bonded.

.3 Furnish geotextile fabric that is insect, rodent, mildew and rot resistant.

.4 Furnish geotextile fabric in a wrapping that protects the fabric from ultraviolet radiation and from abrasion due to shipping and hauling. Keep the geotextile dry until installed.

.5 Clearly mark the geotextile fabric rolls to show the type of fabric.

.6 Provide samples of fabric for testing from the job site as specified by the Engineer.

.7 If using sewn seams, furnish a field sewn seam sample produced from the geotextile fabric and thread and with the equipment proposing to use on the project, before incorporating into the work.

.8 Use fabric conforming to the following physical properties (based on minimum average roll values):

  .1 Minimum grab tensile strength: To ASTM D 4632, 1350 N.

  .2 Minimum puncture strength: To ASTM D 4833, 425 N.

  .3 Minimum apparent breaking elongation: To ASTM D 4632, 15%.

  .4 Maximum apparent opening size: To ASTM D 4751, 600 micron.

  .5 Minimum permittivity: ASTM D 4491, 0.40, s^{-1}

.9 Securing pins: 4.5 mm x 450 mm steel bars, pointed at one end and fabricated with a head to retain a steel washer having an outside diameter of not less than 38 mm.

2.4 Acceptable Manufacturer

.1 Trevira 1125, manufactured by Hoechst Fibers Industries, or equal.

3. EXECUTION

3.1 Geotextile

.1 Place geotextile for trench/ slope erosion protection as indicated on drawings and shown on Standard Details.

.2 At time of installation, fabric shall be rejected if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, storage or handling.

.3 Grade area where geotextile is to be placed to a uniform, even surface and remove all stones, sticks, roots and other sharp objects. Fill depressions with additional bedding material and compact to provide firm level bed.

.4 Where geotextile is to be placed on slopes, a minimum of 50 mm of Type 3 granular bedding is required.

.5 Place the fabric loosely and lay it parallel to the direction of water movement in a sequence approved by the Engineer. A minimum of 600 mm of overlap is required on all abutting lengths of geotextile. Overlap the fabric in the joints at least 600 mm in the direction of flow.

.6 Pin geotextile in the excavated trench at a minimum of 2.0 m on center.

.7 After placing, do not expose the fabric longer than 48 hours before covering.

.8 The plans indicate one method of installation of the geotextile. The "trench" shown on the plans is not required. Contractor may propose an alternative rather than the one shown on the drawings. Alternatives are subject to approval of Engineer.

.9 Geotextile manufacturer's installation recommendations shall take precedence over the specifications.

3.2 Placing Rip Rap Bedding Gravel

.1 Where rip rap bedding gravel is to be placed on slopes, excavate a trench at toe of slope in accordance with dimensions indicated or directed.

.2 Fine grade area to be rip rapped to a uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.

.3 Do not start the placing of rip rap bedding gravel until the geotextile fabric is in place and has been accepted by the Engineer.

.4 Place rip rap bedding gravel to the thickness and according to details indicated or as directed by Engineer.

.5 Do not dislodge or tear the geotextile while placing. Remove and replace any geotextile which is damaged by the rip rap bedding gravel placing operation.

3.3 Placing Rip Rap

.1 Where rip rap is to be placed on slopes, excavate a trench at toe of slope in accordance with dimensions indicated or directed.

.2 Fine grade area to be rip rapped to a uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.

.3 Do not start the placing of rip rap until the geotextile and granular rip rap bedding gravel is in place and has been accepted by the Engineer.

.4 Place rip rap to the thickness and according to details indicated or as directed by Engineer.

.5 Place stones by intermixing the sizes of rip rap material to provide a broad and consistent gradation between the small and large rip rap materials in approved manner to secure surface and provide a stable mass. Place larger stones at bottom of slopes.

.6 Place rip rap to ensure the larger rock and smaller rock is uniformly distributed and that the smaller rock fragments serve to fill the voids between the larger rock, in a manner that will result in a uniform dense layer of rip rap of specified thickness. Place individual rip rap particles to fill visible voids as necessary to secure the results specified.

.7 Do not dump rip rap at the top of the slope for downslope pushing into place. Place to ensure that segregation of sizes does not occur. Place and level rip rap to ensure the completed rip rap is stable with no tendency to slide.

.8 In case shall the free fall height of the riprap exceed 150 mm.

.9 Do not dislodge or tear the rip rap bedding and/or geotextile while placing. Remove and replace any geotextile which is damaged by the rip rap operation. Repair or replace any bedding gravel which is displaced or disturbed by the rip rap operation.

END OF SECTION

Appendix D

Biophysical Baseline Data

Appendix D

Biophysical Baseline Data

D.1 Geotechnical Reports

AECOM

GEOTECHNICAL INVESTIGATION
FOR
SAN FERNANDO WASTE WATER TREATMENT PLANT

SAN FERNANDO

REPORT NO: GA 07 326-II

Prepared by ....
Andrew Budhram
Engineer

2009/12/21

1.0 INTRODUCTION

1.1 Terms of Reference

GEOTECH ASSOCIATES LTD. was commissioned by AECOM to carry out a soil investigation for the San Fernando Waste Water Treatment Plant, San Fernando. The investigation was authorized by Mr. Matt Mc Taggart, Manager, Caribbean Region, AECOM and was carried out in accordance with the stipulated conditions in our proposal letter dated June 13th, 2007.

A factual report (Report No. GA 07 326-I) comprising of the fieldwork and laboratory test results was submitted to the Client on July 9th, 2009. At the time of the preparation of the factual report, the design data for the facilities were not available.

The requisite information required for the design of the facilities was provided by the Client. This report therefore provides the findings of the geotechnical investigation inclusive of recommendations for geotechnical design for the facilities designated for the Waste Water Treatment Plant. Where applicable, it includes all relevant information previously presented in our factual report.

Reports on Geotechnical inputs for sewer pipelines and lift stations shall be submitted as separate documents.

1.2 Objectives

The investigation was geared towards identifying the subsoil parameters within the areas of the proposed new facilities, and providing guidelines and recommendations for design of foundations and all other geotechnical concerns to the project design and construction.

1.3 Scope

The following tasks constituted the scope of the works:

- Fieldwork geared toward obtaining representative samples of the subsoil and necessary *in-situ* parameters;
- Laboratory testing on soil samples to enable proper classification of the soil and provide additional subsoil parameters;
- Presenting detailed information on the subsoil that could govern foundation behaviour - excavations and;
- Providing recommendations concerning any other matters of a geotechnical nature which are likely to affect the proposed development including the subsoil parameters.

2.0 DESCRIPTION OF SITE

2.1 Location & Site Description

The site is located along Riverside St., San Fernando. It is bounded to the west and south by the Cipero River; to the north by a drainage canal and the community of Embacadere and; to the north and west by the community of Gulf View and the Rienzi-Kirton Highway. Topographically, the site slopes gently down towards the drainage canal and Cipero River.

2.2 Topography

The central area and southern side of the site is generally flat (Elevation 1.5m to 2.6m). Beyond the relatively flat area, the site slopes upward towards the northern, eastern and western peripheries of the site. The range of approximate elevations at these sections of the site are presented below;

Northern Section	Elevations ranging from 3.5 to 4.5m,
Eastern Section	Elevations ranging from 3.5 to 4.5m
Western Section	Elevations ranging from 2.0 to 3.5m after which it slopes down towards Cipero River.

2.3 Proposed Development

The development shall consist of a waste water treatment plant. A number of ancillary structures are expected to be founded at the site.

A list of the structures along with ground elevations and design elevations are presented in the Table below.

Structure ID	No. of Units	Content Pressure Only (kPa)	Ground Elevation (m)	
			Existing (m)	Design Base of Slab
Clarifier Tanks (27m dia.)	4	62	2.7 to 4.9	-0.2
Bioreactors	4	70	1.5 to 4.6	0.6
Grit and Screen	1	29	4.2	5.9
	1	64	3.0	1.8
RAS / WAS Chamber	1	70	3.7	-2.4
Filtration	1	35	0.9 to 1.5	-0.1
UV Disinfection	1	31	1.7 to 2.3	-0.1
Chlorination	1	31	1.3	-0.1
Substation	1	Not Available	2.1 to 2.5	2.5

3.0 FIELD INVESTIGATION

3.1 Borehole Locations

The field investigation consisted of drilling ten (10) boreholes across the site designated for the new waste water treatment plant (*Enclosure No.1)*. The boreholes were positioned in the field by ourselves. The specific location of each borehole relevant to ancillary structures within the proposed development is summarized in Table 3.1A below.

The ground elevation at each borehole location as provided by the Client is included in the table.

Table 3.1A Summary of Borehole Coordinates and Elevations

BH No.	Structure Identification	Location (Northing, Easting)	Existing Ground Elev. (m)
1	East of Bio Reactors	North Eastern Section of Site (667272, 1135162)	4.5
2	Close proximity of Substation	Eastern Section of Site (667276, 1135088)	2.7
3	South of Substation	Southern Section of site (667271, 1135055)	2.4
4	South of Bioreactors	Southern Section of Site (667238, 1135055)	1.6
5	Bioreactor 3	Central Section of Site (667240, 1135115)	1.8
6	Between Bioreactor 1 and 2	Northern Section of Site (667195, 1135119)	1.5
7	Southeast of Clarifier 2	South Western Section of Site (667191, 1135059)	1.6
8	Footprint for Clarifier 2	Western Section of Site (667165, 1135063)	3.5
9	North of Clarifier 1	North Western Section of Site (667139, 1135116)	4.5
10	West of Central area for Bioreactors	Western Section of Site (667175, 1135096)	2.9

3.2 Boreholes

The boreholes were advanced with an Acker portable drill rig employing wash boring techniques. The specific depths of the boreholes along with the dates drilled are summarized in Table 3.2A below.

Table 3.2A Summary of Depths of Boreholes

Borehole No.	Depth below Ground Surface (m)	Date Drilled
1		May 29th, 2009
2	12.7	May 30th, 2009
3		June 1st, 2009
4	17.2	April 28th, 2009
5	12.7	April 27th, 2009
6	14.2	June 2nd, 2009
7		April 28th, 2009
8		June 1st, 2009
9	12.7	June 2nd, 2009
10		June 1st, 2009

3.2.1 *Sampling*

Samples were taken at intervals of 0.75 m for the first 3.0 m and at 1.5 m thereafter. Both disturbed split spoon and undisturbed Shelby tube samples were taken. The split spoon sampling procedure also entails the measurement of the Standard Penetration Resistance, or *N value* of the soil.

3.2.2 *Standard Penetration Test*

The Standard Penetration Test (SPT) was carried out in conjunction with split spoon sampling, in accordance with the method outlined on page *(iv)* of the preface. This test gives the Standard Penetration Resistance or *N value* of the soil. The *N value* is related to soil strength and density and is a useful parameter in estimating the bearing capacity of the subsoil.

3.3 Water Levels (Boreholes)

The water levels measured in the boreholes immediately and or 24hours after drilling are plotted on the borehole logs *(Enclosure Nos. 2 to 21).*

4.0 LABORATORY INVESTIGATIONS

4.1 Testing

Laboratory testing consisted of routine classification tests and engineering property tests to determine the properties of the subsoil.

The routine classification tests consisted of:

- Natural moisture contents on all samples;
- Grain size analyses on selected samples;
- Atterberg Limit tests on selected samples.

The engineering properties tests consisted of:

- Pilcon vane (PV) shear tests on undisturbed samples.
- Consolidation tests on selected undisturbed samples.

The results of these tests were used mainly to confirm the visual classifications made in the field, and to give an indication of the likely engineering behaviour of the subsoils.

The PV tests are used for estimating the undrained shear strength, S_u of the subsoil which is used in evaluating the bearing capacity of the subsoil.

The consolidation test provides parameters that are used to estimate likely settlement of shallow foundations.

The results of these tests were used mainly to confirm the visual classifications made in the field, and to give an indication of the likely engineering behaviour of the subsoils.

4.2 Results

The test results are included on the enclosures as outlined below and are discussed in subsequent sections of the report.

- Moisture content Test results are plotted on the Borehole Log *(Enclosure Nos. 2 to 21).*
- The grain size analyses are shown on the Gradation curves *(Enclosure Nos. 22 to 31).*
- The Atterberg's Limits test results are shown on the Modified Plasticity Chart *(Enclosure Nos. 32 to 36).*

- The Consolidation Test results are presented in *Enclosure Nos. 37-39*.
- The Specific Gravity results are presented in *Enclosure Nos. 40-45*.
- The results of the pH, Sulphate and Chloride Tests are presented in *Appendix I*.

5.0 SOIL CONDITIONS

5.1 Soils Map and Geology

The Soils Map of Trinidad and Tobago, produced by the Land and Surveys Department, places the site within the general classification of deep alluvial soil with restricted internal drainage. The soil type is described as Sevilla Clay.

The Geology Map of Trinidad by Kugler places the site in the alluvial deposits of the Cipero River.

5.2 Site Specific Conditions

The detailed soil conditions encountered within the boreholes are shown on the Borehole logs (*Enclosure Nos. 2 to 21*). A summarized account of the salient features pertinent to foundation design is presented below.

The soil profile encountered at the site consists predominantly of cohesive material which can be divided into three (3) soil units. The soil unit was determined by soil types, *N values* and moisture contents obtained from the soil investigation.

<u>Unit 1</u>

Soil Unit 1 extends from the ground surface in Borehole Nos. B3, B4, B6 and B10 to depths ranging from 4.6m to 6.1m (El.-1.7m to El.-3.7m) below the ground surface. (It also extends from the base of a fill layer in Borehole Nos. B2 and B9 to depths of 7.6m and 6.1m (El.-1.6m to El.-4.95m) below the ground surface respectively. In Borehole No. B5, it extends from the base of a stiff clay layer to a depth of 4.6m (El.-2.8m). It consists of very soft to soft and medium stiff silty clays with slight to frequent traces of sand, occasional traces of organic material, isolated gravel and peaty silty clays.

Layers of fill and stiff to very stiff silty clays also occur within this soil unit. The borehole, description and depth that these were encountered are presented in Table 5.2A on the next page.

Table 5.2A Summary on Location of Isolated layers within the soil unit

BH No.	Depth (m)	Description
B9	Ground to 1.5m (El. 4.5m to El. 3.0m)	Fill - Loose silty sand with gravel
B2	1.5 to 2.3m (El. 0.4m to El. 1.1m	
B6	1.5 to 2.3m (El. -0.8m)	
B5	Ground to 1.5m (El. 1.8m to El. 0.1m)	Stiff silty clay
B3	3.0 to 4.6m (El. -0.6m to El. -2.1m	Very Stiff silty clay
B9	3.0 to 4.6m (El. 1.5m to El. 0.0m	

Soil Unit 1 was not encountered in Borehole Nos. B1, B7 and B8.

The N values recorded within the soil unit ranged from 1 to 8 and averaged 5.

High N value of 57 and 9 were recorded within the fill layer present in Borehole Nos. B2 and B9. These values are likely attributed to the spilt spoon striking coarse gravel.

N values ranging from 10 to 27 were recorded within the isolated layers of stiff to very stiff clays present within this soil unit.

The grain size distribution curves show that this unit consists of materials in the following proportions. (Enclosure Nos. 22 to .31).

Gravel - 0.0 - 7.8%
Sand - 1.1 - 23.3%
Silt - 20.7 - 37.1%
Clay - 46.6 - 77.2%

The samples tested can be classified using the Unified Soil Classification System (USCS) as CH. (Enclosure Nos. 32 to 36). Therefore, they can be described as inorganic clays of high plasticity and fat clays.

The natural moisture content of this unit ranged from 27.1 to 66.2%. A high moisture content of 152.9% was recorded in the peaty silty clays present at a depth of 1.5m to 2.3m (Elev. 3.0 to Elev. 2.2m) in Borehole No. B9.

The wet unit weight of the undisturbed samples tested within the soil unit ranged from 15.50 to 18.02kN/m^3.

Soil Unit 2 extends from the base of Soil Unit 1 in Borehole Nos. B4, B5, B6 and B10 to depths ranging from 6.1m to 9.1m (El. 1.5m to El. -2.6m). It consists of stiff clays with slight to occasional traces of sand and isolated gravel.

Isolated Layers of medium stiff and very stiff silty clays occur within this soil unit. The borehole, description and depth that these layers were encountered are presented in Table 5.3A below.

Table 5.3A Summary on Location of Isolated layers within the soil unit

BH No.	Depth (m)	Description
B1	2.3m to 3.0n (El. 2.2m to El. 1.5m)	
B7	1.5m to 2.3m (El. 0.1m to El. -0.7m)	Medium stiff silty clay
B8	2.3m to 3.0m (El. 1.2m to El. 0.4m)	Very stiff silty clay

Soil Unit 2 was not encountered in Borehole Nos. B2, B3 and B9.

The N values recorded within the soil unit ranged from 10 to 14 and averaged 12. N values of 7 and 19 were recorded within the medium stiff and very stiff clay layers present within this soil unit.

The grain size distribution curves show that this unit consists of material in the following proportions. (Enclosure Nos. 22 to 31)

Gravel - 0.0 - 12.8%
Sand - 0.6 - 13.8%
Silt - 20.6 - 31.5%
Clay - 51.6 - 78.4%

The samples tested can be classified using the Unified Soil Classification System (USCS) as CH. (Enclosure Nos. 32 to 36). Therefore, they can be described as inorganic clays of high plasticity and fat clays.

The natural moisture content of this unit ranged from 20.4 to 44.7%

The wet unit weight of the two undisturbed samples tested within this soil unit yielded values of 18.0 and 18.3kN/m^3.

Unit 3

Soil Unit 3 extends from the base of soil unit 1 in Borehole Nos B2 and B9 to the end of these boreholes (12.6m below existing ground surface) (El. -10.0m to El. -8.1m). In Borehole No. B3, it extends from the base of soil unit 1 to a depth of 10.7m (El. -8.2m). It also extends from the base of soil unit 2 in Borehole Nos. B1, B4 to B8 and B10 to the end of these boreholes (12.6m to 17.2m below existing ground) El. -8.1m to El. -15.6m). It consists of very stiff to hard silty clays with slight to frequent traces of sand, occasional gravel, and silty sandy clays.

A layers of dense to very dense sand extends from a depth of 10.7m (El. -8.2m) in Borehole No. B3 to the end of this boreholes (12.6m below existing ground) (El. -10.2m).

The N values recorded within the soil unit ranged from 16 to 64 and averaged 32.

The grain size distribution curves show that this unit consists of material in the following proportions. (Enclosure Nos. 22 to 31)

Gravel - 0.0 - 14.0%
Sand - 0.6 - 39.2%
Silt - 15.3 - 29.2%
Clay - 37.5 - 81.5%

The samples tested can be classified using the Unified Soil Classification System (USCS) as CH. (Enclosure Nos. 32 to 36). Therefore, they can be described as inorganic clays of high plasticity and fat clays.

The natural moisture content of this unit ranged from 21.0 to 51.0%

5.3 Engineering Properties of Soil

5.3.1 Undrained Shear Strength (S_u) & Shearing Resistance ( ) Parameters

The Undrained Shear Strength (S_u) for the cohesive deposits (fine grained soils) were determined from correlation with N Values and pilcon vane results where applicable. The shearing resistance parameter ( ) is zero for the cohesive soils.

A summary of these results for the soil units are presented in Table 5.3A below:

Table 5.3A Summary of Undrained Shear Strength for the Soil Units

Soil Description	Undrained Shear Strength for Fine Grained Soils (S_u)
Soil Unit 1	30kPa
Soil Unit 2	65kPa
Soil Unit 3	200kPa

5.4 Groundwater Conditions

Ground water levels were measured in the boreholes immediately and twenty four hours after drilling. The recorded levels in the boreholes are plotted on the Borehole Logs (Enclosure Nos. 2 to 21) and presented in Table 5.4A below:

Table 5.4A Summary of Groundwater Conditions

Borehole No	Water Levels Measured in the Boreholes (m)	
	Immediately after drilling	24hours after drilling
1	4.0 (El. 0.5m)	3.0 (El. 1.5m)
2	1.5 (El. 1.2m)	1.8 (El. 0.9m)
3	1.2 (El. 1.3m)	1.5 (El. 1.0m)
4	2.7 (El.-1.1m)	3.0 (El.-1.4m)
5	0.9 (El. 0.9m)	1.0 (El. 0.8m)
6	1.2 (El. 0.3m)	1.5 (El. 0.0m)
7	2.1 (El.-0.5m)	2.3 (El.-0.7m)
8	1.8 (El. 1.7m)	1.8 (El. 1.7m)
9	1.5 (El. 3.0m)	1.5 (El. 3.0m)
10	0.6 (El. 2.3m)	1.0 (El. 1.9m)

The recorded water levels are likely influenced by the presence of wash water in the boreholes.

6.0 FOUNDATION ANALYSIS AND DESIGN

6.1 Site Specific Conditions

The soils encountered across the site consists of three (3) soil units with soil unit 1 being relatively incompetent and highly compressible in nature (very soft to soft and medium stiff silty clays with some presence of organic material).

The depths and elevations of the layers of soft to medium stiff clay layers present beneath the design base of concrete slab for the relevant structures are presented in Table 6.1A below.

Table 6.1A Summary of Borehole Locations Specific to Proposed structures and Thickness and Soft to medium stiff deposits beneath the base of each structure.

Structure Identification	BH Nos.	Design Elev. Bottom of Base Slab	Subsoil condition
Bio Reactors	5 and 6	0.6m	Base Elevations of Soft to medium stiff compressible material is -2.8m & -3.1. Thickness of soft clay 3.4 and 3.7m
Grit and Screen Facility	B1 and B5 (B5 Worst Case)	5.9 and 1.8	1.2 to 1.7m of FILL Placement Required. Base elevation of Soft clay = -2.8 Thickness of soft clay =3.1m
Clarifiers	B10 (Worst Case)	-0.2	Base Elevations of Medium Stiff compressible material is -1.7m. Thickness of Medium Stiff Clay = 1.5m
RAS / WAS Pumping Station	B10	-2.4	Base shall be founded in stiff clays
Substation	B2	2.7	Base shall be founded in FILL. Top and base Elevations of Soft to Medium Stiff compressible material is 0.4m & –4.9m respectively. Thickness of compressible layer is 5.3m.
Filtration	B 4 (close proximity to river channel	-0.1	Base of raft shall be founded in soft clays Top and base Elevations of Soft to Medium Stiff compressible material is 0.1 and -4.47m respectively. Thickness of compressible material = 4.6m
UV Disinfection		-0.1	
Chlorination Facility		-0.1	

The relatively thick layers of compressible material within the locations for the Bio reactors, Filtration Unit, UV Disinfection Unit, Chlorination Facility, and the Grit and Screen Facility would lead to bearing capacity failure and or significant differential settlement for these structures if shallow foundations are used. The use of deep foundations to support these structures are required to eliminate both bearing capacity and settlement concerns.

This aspect of the analyses is presented in Section 6.3 of the report.

Bearing capacity and settlement at the locations for the other structures due to the anticipated imposed pressures of contents and site specific subsoil profiles beneath the relevant structures are discussed in section 6.2 of the report.

6.2 Shallow Foundations

Concrete pads (raft foundations) with thickness of approximately 500mm are expected to be constructed to support loads for the following structures;

- Clarifiers
- RAS / WAS Pumping Station
- Substation

6.2.1 Ultimate Bearing Capacity

The ultimate bearing capacity of the site soil was estimated using the following relationship (Navfac DM7.2, 1982):

<u>Spread Foundations (Clays):</u>

$$q_{ult} = CN_c + \gamma D$$

Where q_{ult} = Ultimate bearing capacity
C = Undrained Shear strength
γ = Unit weight of soil
N_c = bearing capacity factor
and D = footing depth

6.2.2 Maximum Safe Bearing Capacity

The maximum safe bearing capacity incorporates a factor of 3.0 for the specified structures with the exception of the Clarifiers. A factor of 1.5 is considered acceptable for the Clarifier Tanks.

A summary of the maximum safe bearing capacity of the subsoil along with the anticipated assumed loading conditions are presented in the Table 6.2.2A below.

Table 6.2.2A Summary of Maximum Safe Bearing Capacity for Structures

Structure ID	Maximum SAFE Bearing Capacity (kPa)	Content Pressure (kPa)	Assumed Structure Pressure (kPa)	Total Imposed Pressure (kPa)
Clarifiers	122	62	8	70
RAS / WAS Pumping Station	195	70	15	85
Substation	180	Not Applicable	15	15

Typically, the imposed pressure for the tanks are not expected to exceed 8kPa. A pressure of 15kPa was assumed for the self weight of the other structures on the rafts. In the event that the self weight of the structures impose pressures which are higher than the assumed values, then the total imposed pressure should be re-examined and compared to the maximum safe bearing capacity. In the event that the imposed pressure exceeds the maximum safe bearing capacity, then piles should be used to support the structure.

6.2.3 Upthrust Pressure

The site soils shall be excavated to varying depths to meet the design elevation for the proposed reinforced concrete mats. Based on this scenario, the base of the mats shall be subject to upthrust pressures due to stress relief of the site soil. This is of particular concern for the Clarifier Tanks and RAS / WAS Pumping Station.

The critical condition shall be when the vessels are empty. The analyses also takes into consideration an assumed imposed pressure of 12.5kN/m^2 due to the base slab and assumed structure pressures of 8kPa and 15kPa for the Clarifier Tanks and RAS / WAS Pumping Chamber respectively.

The results of the detailed analyses are presented on ***Enclosure No. 46*** and summarized in Table 6.2.3A below.

Table 6.2.3A Summary of Upthrust Pressures

Structure ID	Upthrust Pressure (kPa)			Assumed Empty Vessel + Raft Pressure (kPa)	Net Upthrust Pressure at Critical Condition	
	Max	Min	Ave		Max. (kPa)	Average (kPa)
Clarifier Tank 1	92	72	82	20.5	71	50
Clarifier Tank 2	72	59	66		52	37
Clarifier Tank 3	70	68	69		50	46
Clarifier Tank 4	79	52	66		59	30
RAS / WAS Station	90			27.5	63	

The concrete mats for the Clarifier Tanks and RAS / WAS Pumping station should be designed to resist the maximum upthrust pressures presented in Table 6.2.3A above.

6.2.4 Settlement

Clarifier Tanks and RAS / WAS Pumping Station

The total net average downward pressure ranges from 2kPa to 18kPa (***See Enclosure No. 46)*** for the Clarifier Tanks and RAS / WAS Pumping station. Total settlement of these structures under the net downward pressure is not expected to be of concern due to the minimal thickness of compressible material underlying the design base of the raft foundations supporting these structures.

While total settlement shall not be of concern, uniform distribution to the subsoil shall be required to eliminate concerns on localized failures. This must be achieved through the use of a granular pad with adequate elastic modulus to support the raft. This scenario is further discussed in Section 6.25 below.

Substation

The settlement analyses were carried out for raft foundations designed to impose a bearing pressures of 15kPa at the location for the substation.

The total consolidation settlement of the raft foundation was determined using Terzaghi's one-dimensional consolidation equation which uses results of the consolidation tests from our laboratory investigation. The maximum theoretical settlement estimate was computed using the following relationship (Navfac DM7.1, 1982)

$$\Delta H = C_r(H_t / 1 + e_0)(\log(P_c / P_0) + C_c(H_t/(1 + e_0)) (\log(P_3 / P_c)$$

Where ΔH = total settlement
H_t = thickness of layer
C_r = recompression index
C_c = compression index
e_0 = initial void ratio
P_c = preconsolidation pressure
P_0 = overburden pressure - effective
dP = change in pressure
P_3 = final pressure

Results

The results of the total settlement for the shallow foundations designed to support the anticipated design load (15kPa) shall be 24mm. This settlement estimate is marginal for shallow foundations. Additional considerations as discussed in Section 6.2.5 below should be implemented. In the event that the design load is greater than 15kPa, then the structure should be supported on piles. The pile capacity estimates for the Bioreactors (Section 6.3) are considered applicable for the substation location.

6.2.5 *Additional Considerations*

From a bearing capacity perspective, the reinforced rafts for supporting the structures are safe

Due to the presence of soft to medium stiff clays within the soil matrix, it is strongly recommended that the rafts are supported on granular pads to spread the loads uniformly on the subsoil and eliminate the potential for differential settlement.

The thickness of granular pads and location of structures for which this will be required are presented in Table 6.2.5A below. The distance beyond the periphery of the raft for which the pads should extend are also presented in the Table.

Table 6.2.5A Summary on Thickness of Granular Pads

Structure ID	Thickness of Granular Pad (m)	Horizontal Distance for Granular pad beyond the periphery of the Rafts (m)
Clarifier Tanks	1.0	0.5
RAS / WAS Pumping Station	0.3	0.15
Substation	0.5	0.25

The pads should be constructed in the following sequence:

> The site within the relevant structure footprints and to the minimum horizontal distances specified in the Table above, should be proof rolled to reveal any soft spots in localized areas. If soft spots are encountered, the localized areas should be over excavated to a depth of 500mm below design grade and replaced with material meeting the following minimum requirements.
>
> > Well-graded sand and gravel with no more than 20% passing the No. 200 sieve, and should have a maximum particle size of 75mm. The fines should have a liquid limit not exceeding 25, a plasticity index not greater than 8, and be capable of achieving a minimum soaked CBR of 30%. The material should be compacted in lifts not exceeding 200mm thick to at least 95 percent of the Modified Proctor maximum dry density.

The material for construction of the granular pad should conform to the following:

> Well-graded sand and gravel with no more than 20% passing the No. 200 sieve, and should have a maximum particle size of 75mm. The fines should have a liquid limit not exceeding 25, a plasticity index not greater than 8, and be capable of achieving a minimum soaked **CBR of 80%**. The material should be compacted in lifts **not exceeding 150mm thick to at least 95 percent of the Modified Proctor maximum dry density.**

6.3 Deep Foundations (Piles)

6.3.1 *General*

Deep foundations are recommended to support the structural loads for the following structures;

- Bioreactors;
- Grit and Screen Facilities;
- Filtration Facility;
- UV Disinfection Facility and;
- Chlorination Facility.

The analyses for the above structures assume that the pile tips shall be founded at a minimum penetration of 1.0m in the hard clay stratum. A summary on minimum pile lengths and pile tip elevations are presented in Table 6.3.1A below.

Structure ID	Base Elevation of Structure (m)	Pile Tip elevation (m)	Minimum Pile Penetration (m)
Bioreactors	0.6	-10.0	10.5
Screen Facility	1.8	-10.0	11.0
Grit Facility	5.9	-10.0	15.0
Filtration, UV Disinfection and Chlorination Facilities	-0.1	-13.6	14

Based on the above, the pile capacities for the Bio-reactors are considered applicable for the screen facility. All other facilities were analysed by themselves.

The piles considered for supporting the relevant structures were 406mm octagonal and 508mm octagonal precast prestressed concrete piles.

6.3.2 *Vertical Compression and Uplift Capacities - Driven Piles*

The undrained load capacity is generally taken as the critical value for pile capacity. Analyses were therefore carried out to determine allowable pile capacities for the aforementioned pile sizes for a range of pile penetrations.

The analyses were done using the computer program **APILE**. This program uses the API RP2A method as well as the Lamda (λ) method.

6.3.3 *Analyses*

The results of the computations are tabulated below *(Table 6.3.3A)* and shown graphically as a function of pile embedment length in ***Appendix II***.

These allowable capacities employed an overall safety factor of 1.5 on skin friction and 3.0 on tip resistance. The allowable uplift resistance for the piles are estimated from the skin friction on the piles. A safety factor of 3.0 is applied to the ultimate skin friction.

Table 6.3.3A Estimated Allowable Vertical Compression and Uplift Capacities for Single Piles

Structure ID	Pile Dimensions	Pile Tip Elevation (m)	Total Skin Friction (kN)	Total End Bearing Resistance (kN)	Allowable Pile Capacity (kN)	
					Compression	Uplift
Bio-reactors & Screen Facilities	406mm Octagonal precast prestressed concrete	-10	384	246	338	128
		-11	476	246	399	159
		-12	569	246	461	190
		-13	617	246	493	206
	508mm Octagonal precast prestressed concrete	-10	480	385	448	160
		-11	595	385	525	198
		-12	712	385	603	237
		-13	831	385	682	277
Grit Facility	406mm Octagonal precast prestressed concrete	-10	626	246	499	209
		-11	734	246	571	245
		-12	844	246	645	281
		-13	956	246	719	319
	508mm Octagonal precast prestressed concrete	-10	782	385	650	261
		-11	918	385	740	306
		-12	1055	385	832	352
		-13	1194	385	924	398

Table 6.3.3A Estimated Allowable Vertical Compression and Uplift Capacities for Single Piles

Structure ID	Pile Dimensions	Pile Tip Elevation (m)	Total Skin Friction (kN)	Total End Bearing Resistance (kN)	Allowable Pile Capacity (kN)	
					Compression	Uplift
Filtration, UV Disinfection and Chlorination Facilities	406mm Octagonal precast prestressed concrete	-13.6	578	246	467	193
		-14.6	675	246	532	225
		-15.6	774	246	598	258
		-16.6	874	246	665	291
	508mm Octagonal precast prestressed concrete	-13.6	722	385	610	241
		-14.6	844	385	691	281
		-15.6	967	385	773	322
		-16.6	1093	385	857	364

Based on the theoretical allowable pile capacities presented in Table 6.3.3A, and bearing in mind a minimum penetration of 1.0m in the hard clay stratum (Elevations -10.0m to -13.6) the minimum theoretical allowable pile capacity for the pile sizes analysed are as follows;

Bioreactors and Screen Facility (Pile Tip Elevation = -10.0m)

- 406mm octagonal PPC - 338kN compression & 128kN uplift
- 508mm octagonal PPC - 4487kN compression & 160kN uplift

Grit Facility (Pile Tip Elevation = -10.0m)

- 406mm octagonal PPC - 499kN compression & 209kN uplift
- 508mm octagonal PPC - 650kN compression & 261kN uplift

Filtration, UV Disinfection & Chlorination Facilities (Pile Tip Elevation = -13.6m)

- 406mm octagonal PPC - 467kN compression & 193kN uplift
- 508mm octagonal PPC - 6107kN compression & 241kN uplift

6.4 Lateral Pile Capacity

6.4.1 *General*

The lateral pile capacity analyses for the piles supporting the Boioreactors , Grit and Screen Facilities, and Filtration, UV Disinfection and Chlorination Facilities were carried out using were carried out using the LPILE Plus Program. The applicable soil conditions were incorporated into the analyses

6.4.2 Boundary Conditions

The lateral pile capacities for piles were analyzed under fixed head pile conditions i.e, the model considers that the pile head is fixed i.e slope dy/dx at pile head is zero and there is no restrictions to lateral movement. A range of shear forces (30 to 90kN) were applied to the pile head to determine induced bending moment in the pile. The axial loads applied to the pile assumes that piles are driven to the recommended minimum pile tip elevations.

The relevant analyses were carried out using the finite difference computer program LPILE^{plus}.

6.4.3 Results

The graphical and data output for lateral deflection (m) versus depth (m) and bending moment (kN-m) versus depth using soil parameters retrieved within the footprint for the relevant structures are presented in the following Appendices

Bio-reactors and Screen Facility	-	Appendix III
Grit Facility	-	Appendix IV
Filtration, UV Disinfection, & Chlorination Facilities	-	Appendix V

The lateral deflections and bending moments induced on pile as a result of the shear forces applied to the pile head are presented in Table 6.4.3A.

Table 6.4.3A Summary Lateral Deflections and Bending Moments induced in Pile due to Applied Shear Forces

Structure ID.	Pile Size	Shear Force at Pile Head (kN)	Lateral Deflection (mm)	Induced Bending Moment (kN-m)
Bioreactors and Screen Facility	406mm Octagonal PPC	30	2	38
		60	6	91
		90	11	152
	508mm Octagonal PPC	30	1	42
		60	2	101
		90	5	167
Grit Facility	406mm Octagonal PPC	30	2	40
		60	4	81
		90	6	122
	508mm Octagonal PPC	30	1	47
		60	2	96
		90	3	148

Table 6.4.3A Con't Summary Lateral Deflections and Bending Moments induced in Pile due to Applied Shear Forces

Structure ID.	Pile Size	Shear Force at Pile Head (kN)	Lateral Deflection (mm)	Induced Bending Moment (kN-m)
Filtration,UV Disinfection and Chlorination Facilities	406mm Octagonal PPC	30	2	38
		60	6	92
		90	12	156
	508mm Octagonal PPC	30	1	42
		60	3	103
		90	6	173

It is imperative that the Structural Engineer compare the maximum bending moments induced as a result of the shear force applied to the pile head with the ultimate bending capacity of the pile sections and the acceptable tolerable deflection for the piles. The shear forces should be reduced to ensure the maximum bending moment is less than the ultimate bending moment capacity of the pile section if required.

Where applicable the number of precast prestressed concrete piles per cluster may have to be adjusted to ensure both deflections and bending moments are at acceptable limits.

7.0 DEEP EXCAVATIONS

7.1 General

The site is expected to be excavated to varying levels to found the raft foundations at design elevations for the proposed structures. The depth of excavation for each structure are presented in Table 7.1A below. The depths take into consideration over excavation beneath the depth for founding the raft for construction of granular pads.

Table 7.1 Summary of Excavation Depths

Structure Identification	Existing ground Elevation (m)	Design Elev. Bottom of Base Slab (m)	Design Base of Granular FILL (m)	Total Depth of Excavation (m)
Clarifier Tanks	2.7 to 4.9	-0.2	-1.2	3.9m to 6.1m
Bioreactors	1.5 to 4.6	0.6	Not Applicable	0.9m to 4.0m
Grit	4.2	5.9		Fill
Screen	3	1.8		1.2m
RAS / WAS Chamber	3.7	-2.4	-2.9	6.6m
Filtration	0.9 to 1.5	-0.1	-0.6	1.5m to 2.1m
UV Disinfection	1.7 to 2.3		-0.6	2.3m to 2.9m
Chlorination	2.1 to 2.5		-0.6	2.7m to 3.1m
Substation	2.1 to 2.5	2.5	2	0.1 to 0.5m

Steel sheet piles are recommended for retaining the side walls of the anticipated excavations with depths which are greater than 1.2m. For this scenario the maximum height of excavation for each structure was used for the conduct of the analyses at the various sections of the site. The heights of excavation considered for the analyses are presented in the Table below.

Structure Identification	Depth of Excavation for Sheet Pile Analyses
Clarifier Tanks	6.1m
Bioreactors	4.0m
RAS / WAS Chamber	6.6m
Filtration	2.1m
UV Disinfection	2.9 and 3.1m - Use 3.1m for this design
Chlorination	
GRIT, SCREEN AND SUBSTATION	Not Necessary

The sheet pile analyses further assumes that the piles shall be propped to minimize / reduce deflections, embedment and section modulus.

7.2 Analyses

The analyses were carried out to determine the following;

- Minimum section modulus (cm^3/m)
- Minimum required penetration (m)
- Brace force (kN) and location from top of pile
- Maximum bending moment (kN-m) and location from top of pile

The relevant analyses were carried out using the finite difference Computer Program ReWard for designing embedded retaining walls.

The basic input parameters shall be as follows;

1. Applicable soil conditions on the active and passive sides of the proposed excavations (s)
2. Height of excavation (s)
3. Applicable ground water condition (s)
4. Inclusion of brace if necessary. The brace shall allow for reduction in sheet pile section, reduction in penetration and minimize deflection.

7.3 Results

The results of the earth pressure calculations (computer output) generated for the soil and water table conditions for the proposed depths of excavations are presented in the following Appendices;

Structure Identification	Depth of Excavation for Sheet Pile Analyses	Appendix No.
Clarifier Tanks	6.1m	VI
Bioreactors	4.0m	VII
RAS / WAS Chamber	6.6m	VIII
Filtration	2.1m	IX
UV Disinfection	2.9 and 3.1m - Use 3.1m for this design	X
Chlorination		
GRIT, SCREEN AND SUBSTATION	Not Necessary	--

The results of the analyses are summarized in Table 7.3A.

Table 7.3A Summary of Sheet Pile Wall Analyses

Site Location (Appendix No)	Depth of Excavation (m)	No of Props	Pile Property	Result
Clarifier Tanks (Appendix 3)	6.1	1	*Frodingham 3N Section - Section Modulus (cm^3 /m)*	1688
			Maximum Bending Moment (kNm /m)	225
			Minimum Required Embedment below Existing Grade	8.5
			Prop Force at a depth of 1.0m below Ground (kN /m)	108
Bioreactors Tanks (Appendix 4)	4	1	*Frodingham 3N Section - Section Modulus (cm^3 /m)*	1688
			Maximum Bending Moment (kNm /m)	61
			Minimum Required Embedment below Existing Grade	6
			Prop Force at a depth of 1.0m below Ground (kN /m)	48
RAS / WAS Chamber (Appendix 5)	6.6	1	*Frodingham 3N Section - Section Modulus (cm^3 /m)*	1688
			Maximum Bending Moment (kNm /m)	265
			Minimum Required Embedment below Existing Grade	8.8
			Prop Force at a depth of 1.0m below Ground (kN /m)	135
Filtration (Appendix 6)	2.1	1	*Frodingham 3N Section - Section Modulus (cm^3 /m)*	1688
			Maximum Bending Moment (kNm /m)	7
			Minimum Required Embedment below Existing Grade	3
			Prop Force at a depth of 1.0m below Ground (kN /m)	15
UV Disinfection - Chlorination (Appendix 7)	3.1	1	*Frodingham 3N Section - Section Modulus (cm^3 /m)*	1688
			Maximum Bending Moment (kNm /m)	25
			Minimum Required Embedment below Existing Grade	4.5
			Prop Force at a depth of 1.0m below Ground (kN /m)	31

In the event that the Client proposes to use a different pile section, then the preferred section must have an equivalent section modulus to the analysed section to withstand the anticipated bending moments presented in the Table above.

7.4 Permanent Structures

Reinforced Concrete cantilever retaining walls are recommended to retain the side walls of the permanent structures.

7.4.1 Lateral Earth Pressures

The recommended earth pressure coefficients for design of permanent walls are as follows:

Coefficient of active earth pressure, $K_a = 0.4$
Coefficient of passive earth pressure, $K_p = 2.5$

Lateral earth pressures due to water should be added to the pressures derived from the above, to account for the critical condition. For the purpose of design the water table level can be taken as maximum height in the adjacent river.

Clean inert granular fill is recommended for backfill material behind the walls.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the foregoing discussion, the following conclusions can be drawn and recommendations made:

1. The soil profile encountered at the site consists predominantly of cohesive material which can be divided into three (3) soil units. The soil unit was determined by soil types, *N values* and moisture contents obtained from the soil investigation.

   The general soil profile consists of very soft to soft and medium stiff silty clays with slight to frequent traces of sand, occasional traces of organic material, isolated gravel and peaty silty clays (**Soil Unit 1)** overlying It consists of stiff clays with slight to occasional traces of sand and isolated gravel **(Soil Unit 2)** which is underlain by very stiff to hard silty clays with slight to frequent traces of sand, occasional gravel, and silty sandy clays **(Soil Unit 3).**

   Soil Unit 1 extends from the ground surface in Borehole Nos. B3, B4, B6 and B10 to depths ranging from 4.6m to 6.1m (El.-1.7m to El.-3.7m) below the ground surface. (It also extends from the base of a fill layer in Borehole Nos. B2 and B9 to depths of 7.6m and 6.1m (El.-1.6m to El.-4.95m) below the ground surface respectively. In Borehole No. B5, it extends from the base of a stiff clay layer to a depth of 4.6m (El.-2.8m). Soil Unit 1 was not encountered in Borehole Nos. B1, B7 and B8.

   Soil Unit 2 extends from the base of Soil Unit 1 in Borehole Nos. B4, B5, B6 and B10 to depths ranging from 6.1m to 9.1m (El. 1.5m to El. -2.6m). Soil Unit 2 was not encountered in Borehole Nos. B2, B3 and B9.

   Soil Unit 3 extends from the base of soil unit 1 in Borehole Nos B2 and B9 to the end of these boreholes (12.6m below existing ground surface) (El. -10.0m to El. -8.1m). In Borehole No. B3, it extends from the base of soil unit 1 to a depth of 10.7m (El. -8.2m). It also extends from the base of soil unit 2 in Borehole Nos. B1, B4 to B8 and B10 to the end of these boreholes (12.6m to 17.2m below existing ground) El. -8.1m to El. -15.6m).

2. The water levels measured in the boreholes immediately and 24hours after drilling ranged from 0.6m to 4.0m below ground [Elev. 3.0 to -1.1] and 1.0m to 3.0m below ground [Elev. 1.9 to -1.4] respectively.

   The recorded water levels are likely influenced by the presence of wash water in the boreholes.

   The permanent ground water table is expected to correspond to the maximum water level in the adjacent Cipero River.

3. The relatively thick layers of compressible material within the locations for the Bio reactors, Grit and Screen Facility, UV Disinfection, Filtration and Chlorination Facilities would lead to bearing capacity failure and or significant differential settlement for these structures if shallow foundations are used. The use of deep foundations to support these structures are required to eliminate both bearing capacity and settlement concerns.

   Raft foundations are considered adequate to support the Clarifier Tanks and RAS / WS Pump station.

4. A summary of the maximum safe bearing capacity of the subsoil along with the anticipated assumed loading conditions are presented in the Table below.

Structure ID	Maximum SAFE Bearing Capacity (kPa)	Content Pressure (kPa)	Assumed Structure Pressure (kPa)	Total Imposed Pressure (kPa)
Clarifiers	122	62	8	70
RAS / WAS Pumping Station	195	70	15	85
Substation	180	Not Applicable	15	15

   Typically, the imposed pressure for the tanks are not expected to exceed 8kPa. A pressure of 15kPa was assumed for the self weight of the other structures on the rafts. In the event that the self weight of the structures impose pressures which are higher than the assumed values, then the total imposed pressure should be re-examined and compared to the maximum safe bearing capacity. In the event that the imposed pressure exceeds the maximum safe bearing capacity, then piles should be used to support the structure.

5. The reinforced concrete mats shall be subject to upthrust pressures due to stress relief of the site soil. This is of particular concern for the Clarifier Tanks and RAS / WAS Pumping Station. The critical condition shall be when the vessels are empty. The concrete mats for the Clarifier Tanks and RAS / WAS Pumping station should be designed to resist the maximum upthrust pressures presented below.

Structure ID.	Max Upthrust Pressure (kPa)
Clarifier Tank 1	71
Clarifier Tank 2	52
Clarifier Tank 3	50
Clarifier Tank 4	59
RAS / WAS Pump Station	63

6. The total net average downward pressure ranges on foundations for Clarifier Tanks and RAS / WAS Pup Station ranges from 2kPa to 18kPa. Total settlement of these structures under the net downward pressure is not expected to be of concern due to the minimal thickness of compressible material underlying the design base of the raft foundations supporting these structures.

7. Raft foundations designed to impose a maximum bearing pressure of 15kPa is recommended to support the structural loads for the **substation**. In the event that the design load is greater than 15kPa, then the structure should be supported on piles. The pile capacity estimates for the Bioreactors (Section 6.3) are considered applicable for the substation location.

8. It is strongly recommended that the rafts for the Clarifier Tanks, RAS / WAS Pump Station and the substation are supported on granular pads to spread the loads uniformly on the subsoil and eliminate the potential for localized failures and or differential settlement.

The thickness of granular pads and location of structures for which the granular pads will be required are presented in the table below. The distance beyond the periphery of the raft for which the pads should extend are also presented in the Table.

Structure ID	Thickness of Granular Pad (m)	Horizontal Distance for Granular pad beyond the periphery of the Rafts (m)
Clarifier Tanks	1.0	0.5
RAS / WAS Pumping Station	0.3	0.15
Substation	0.5	0.25

Full details on material and compaction characteristics are presented in Section 6.2.5 of the Report.

9. The piles considered for supporting the following structures were 406mm octagonal and 508mmm octagonal precast prestressed concrete piles.

- Bioreactors;
- Grit and Screen Facilities;
- Filtration, UV Disinfection and Chlorination Facilities.

It is strongly recommended that the pile tips are founded at a minimum penetration of 1.0m in the hard clay stratum. A summary on minimum pile lengths and pile tip elevations are presented in the Table below.

Structure ID	Base Elevation of Structure (m)	Pile Tip elevation (m)	Minimum Pile Penetration (m)
Bioreactors	0.6	-10.0	10.5
Screen Facility	1.8	-10.0	11.0
Grit Facility	5.9	-10.0	15.0
Filtration, UV Disinfection and Chlorination Facilities	-0.1	-13.6	14

The minimum theoretical allowable pile compression and uplift capacities for the pile sizes analysed are as follows;

Bioreactors and Screen Facility (Pile Tip Elevation = -10.0m)

- 406mm octagonal PPC - 338kN compression & 128kN uplift
- 508mm octagonal PPC - 4487kN compression & 160kN uplift

Grit Facility (Pile Tip Elevation = -10.0m)

- 406mm octagonal PPC - 499kN compression & 209kN uplift
- 508mm octagonal PPC - 650kN compression & 261kN uplift

Filtration, UV Disinfection & Chlorination Facilities (Pile Tip Elevation = -13.6m)

- 406mm octagonal PPC - 467kN compression & 193kN uplift
- 508mm octagonal PPC - 6107kN compression & 241kN uplift

For pile capacities at deeper penetration, the reader should refer to Table 6.3.3A of the report.

10. The results of the lateral pile capacity analyses are presented in Section 6.4 of the report. It is imperative that the Structural Engineer compare the maximum bending moments induced as a result of the shear force applied to the pile head with the ultimate bending capacity of the pile sections and the acceptable tolerable deflection for the piles.

The shear forces should be reduced to ensure the maximum bending moment is less than the ultimate bending moment capacity of the pile section if required.

Where applicable the number of precast prestressed concrete piles per cluster may have to be adjusted to ensure either or both deflections and bending moments are at acceptable limits.

11. All excavations for foundations should be blinded with lean concrete as soon as possible after excavation to avoid possible loss of shear strength of the subsoil as result of exposure to weather or construction equipment.

12. The recommended modulus of subgrade reaction for the inistu soils are as follows;

- Clarifier Tanks and Substation Locations 18,000kN/m^3 and;
- RAS / WAS Pump Station Location 24,000kN/m^3

13. The site is suitable for slab-on-grade construction. The exposed grade should be proof-rolled to reveal any possible "soft spots" which should be excavated and replaced with adequately compacted the approved granular fill with a minimum thickness of 225 mm.

    Replacement material should conform to the following;

    - well-graded sand and gravel with no more than 20 % passing the No. 200 sieve, and should have a maximum particle size of 75 mm. The fines should have a liquid limit not exceeding 25, a plasticity index not greater than 8, and be capable of achieving a minimum soaked CBR of 30. Typically, locally available pitrun would meet the above criteria. This material should be compacted in lifts not exceeding 200 mm thick to at least 95 percent of the Modified Proctor maximum dry density.

14. Fill for raising site elevation to found rafts should meet the material and compaction characteristics presented in Point 13 above.

15. Fill for raising site elevation only in areas where structures will not be placed should consist of material capable of achieving a minimum soaked California Bearing Ratio (CBR) of eight (8) percent. Additionally the general fill should be free of deleterious material and clay lumps. This material should be compacted in lifts not exceeding 200 mm thick to at least 95 percent of the Modified Proctor maximum dry density. General fill is only recommended for use to raise site elevation. Raft foundations must not be constructed on this fill.

16. Steel sheet piles are recommended for retaining the side walls of the anticipated excavations with depths greater than 1.2m across the site for founding the various elements of the development. It is recommended that the sheet piles are braced or tied back to minimize / reduce deflections, embedment and section modulus.

    The recommended minimum section modulus of the sheet pile to support the temporary excavation is a Frodingham 3N Section with modulus of 1688cm^3/m. Full results on brace forces, minimum penetrations - pile length and induced moments are presented in ***Table 7.3A*** of the report.

    For temporary excavations with a depth of less than 1.2m, the sides may be sloped at a gradient of 1Vertical to 1horizontal. Alternatively, the excavation may be vertical provided that adequate shoring is placed by the Contractor.
    In the event that the Client proposes to use a different pile section, then the preferred section must have an equivalent section modulus to the analysed section to withstand the anticipated bending moments presented in Table 7.3A of the report.

17. The recommended earth pressure coefficients for design of permanent walls are as follows:

    Coefficient of active earth pressure, K_a = 0.4
    Coefficient of passive earth pressure, K_p = 2.5

Lateral earth pressures due to water should be added to the pressures derived from the above, to account for the critical condition. For the purpose of design the water table level can be taken as maximum height in the adjacent river.

Clean inert granular fill is recommended for backfill material behind the walls.

18. The results of the relevant chemical testing on selected samples retrieved from the field investigation indicated the following ranges of pH, Sulphate and Chloride contents;

pH	6.87	-	7.94
Sulphate (%)	0.005	-	0.027
Chloride (%)	0.033	-	0.274

    The sulphate content of the subsoil was determined as less than 0.2 percent. Ordinary Portland Cement can be used for the construction of concrete structures in contact with the ground. A minimum cement content of 310kg/m^3 for a maximum water cement ratio of 0.55 is recommended.

19. The Client should cater for minor groundwater seepage in open excavations. Measures should be put in place for pumping of water within excavation during construction. An adequate number of sumps and pumps can be used to remove the water during construction.

20. Earthquake resistant designs should be carried out in accordance with the latest International Building Code (IBC) requirements.

GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. **2**

BOREHOLE LOG

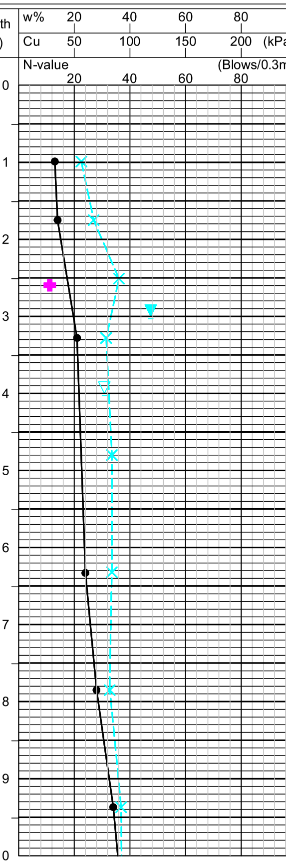
BOREHOLE No: **B 1**
Sheet 1 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 4.51 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 5/29/09 Completed on: 5/29/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
	Ground Surface	0			
	Stiff, brown and light grey, SILTY CLAY, with occasional to frequent traces of sand and slight traces of gravel.	1	1		
		2	2		
	Medium stiff, brown and whitish grey, SILTY CLAY, with occasional traces of sand.	3	3	18.37	
	Very stiff, brown and whitish grey, SILTY CLAY, with slight traces of sand.	4	4		
		5	5		
		6	6		
		7			
		8	7		
		9			
	Hard, dark grey, SILTY CLAY, with slight traces of sand.	10	8		



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TRINIDAD, WI

REPORT No. GA 07 326 | ENCLOSURE No. **3**

BOREHOLE LOG

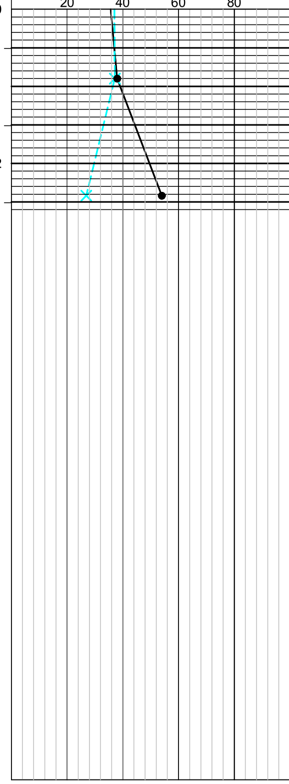
BOREHOLE No: **B 1**
Sheet 2 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 4.51 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 5/29/09 Completed on: 5/29/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	w% 20 40 60 80 / Cu 50 100 150 200 (kPa) / N-value 20 40 60 80 (Blows/0.3m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	(continued)	10					
		11			9		
		12			10		
	End of Borehole at 12.65m.						



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TRINIDAD, WI

REPORT No. GA 07 326 | ENCLOSURE No. **4**

BOREHOLE LOG

BOREHOLE No: **B 2**
Sheet 1 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 2.67 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 5/30/09 Completed on: 5/30/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	w% 20 40 60 80 / Cu 50 100 150 200 (kPa) / N-value 20 40 60 80 (Blows/0.3m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0					
	Loose, brown, SILTY, GRAVELLY SAND, with occasional traces of clay. (FILL)	1			1		
	Stiff, greenish olive brown, SILTY CLAY, with occasional traces of sand and isolated gravel.	2			2	16.78	
	Medium stiff, greenish grey, SILTY CLAY with occasional traces of sand.	3			3		
	Very soft, greenish grey, SILTY CLAY, with occasional traces of sand.	4			4	16.82	
	Soft, greenish grey, SILTY CLAY, with frequent traces of sand and slight traces of gravel.	5			5		
	Medium stiff, greenish grey, SILTY CLAY, with occasional traces of sand and peat.	6, 7			6		
	Very stiff, grey, SILTY CLAY, with frequent traces of sand and gravel.	8, 9, 10			7, 8		
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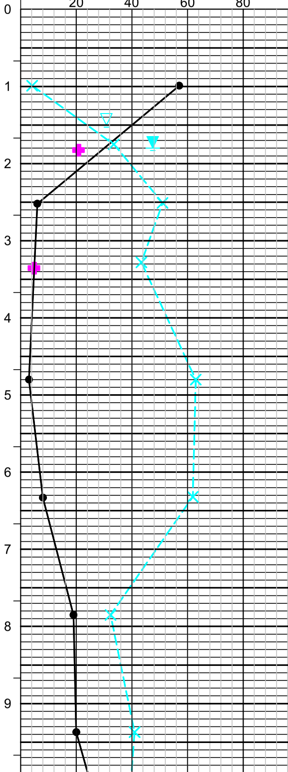

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GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **5**

BOREHOLE LOG

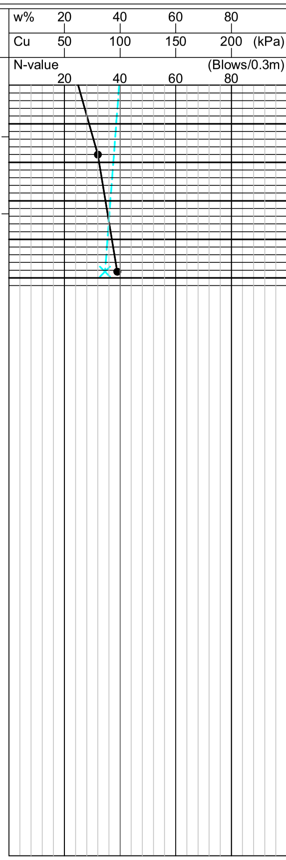
BOREHOLE No: **B 2**
Sheet 2 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 2.67 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 5/30/09 Completed on: 5/30/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
	(continued)	10			
	Hard, greenish grey, SILTY CLAY, with slight traces of sand.	11	9		
		12	10		
	End of Borehole at 12.65m.				



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GEOTECH ASSOCIATES LTD.
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REPORT No. GA 07 326 ENCLOSURE No. **6**

BOREHOLE LOG

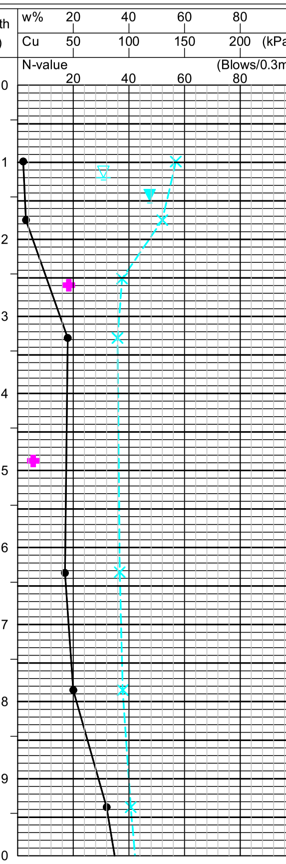
BOREHOLE No: **B 3**
Sheet 1 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 2.45 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 6/1/09 Completed on: 6/1/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
	Ground Surface	0			
	Very soft to soft, grey, SILTY CLAY, with slight traces of sand.	1	1		
		2	2		
	Medium stiff, grey, SILTY CLAY, with slight traces of sand.		3	17.99	
	Very stiff, light grey and brown, SILTY CLAY, with slight traces of gravel.	3	4		
		4			
	Soft, light grey and brown, SILTY CLAY, with slight traces of sand.	5	5		
		6			
	Very stiff, grey and brown, SILTY CLAY, with frequent traces of sand.		6		
		7			
	Very stiff, grey, SANDY CLAY, with frequent traces of silt, gravel and isolated traces of organic material.	8	7		
		9			
	Hard, grey, SILTY CLAY, with frequent traces of gravel.		8		
		10			



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GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 7

BOREHOLE LOG

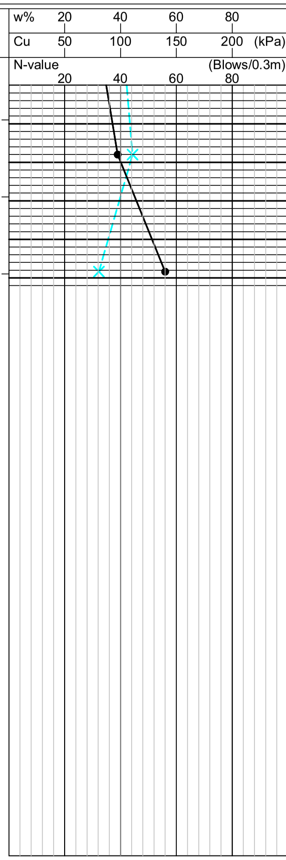
BOREHOLE No: B 3
Sheet 2 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 2.45 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 6/1/09 Completed on: 6/1/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
(continued)	10			
Dense, grey, CLAYEY SAND, with frequent traces of gravel and isolated traces of silt and organic material.	11	9		
Very dense, grey, CLAYEY SAND, with frequent traces of gravel and isolated traces of silt and organic material.	12	10		
End of Borehole at 12.65m.				



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GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 8

BOREHOLE LOG

BOREHOLE No: B 4
Sheet 1 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 1.63 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 4/28/09 Completed on: 4/28/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
Ground Surface			
Medium stiff, grey, SILTY CLAY, with slight traces of sand.	1	17.99	
Very soft to soft, grey, SILTY CLAY, with occasional traces of peat and slight traces of sand.	2		
	3		
	4	15.50	
	5		
Stiff, grey, SILTY CLAY, with slight traces of sand.	6		
Very stiff, grey, SILTY, SANDY CLAY.	7		
Very stiff, grey, SILTY CLAY, with slight traces of sand.	8		

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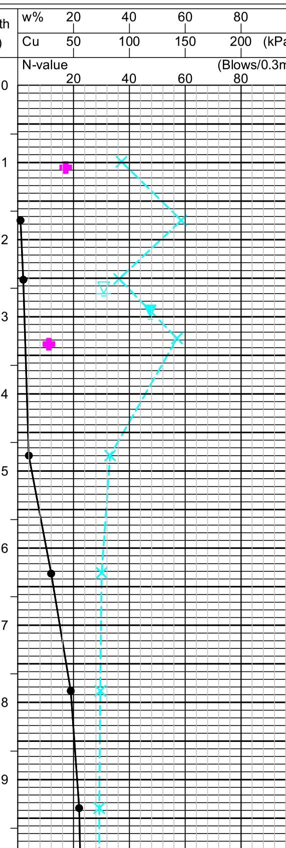

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TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **9**

BOREHOLE LOG

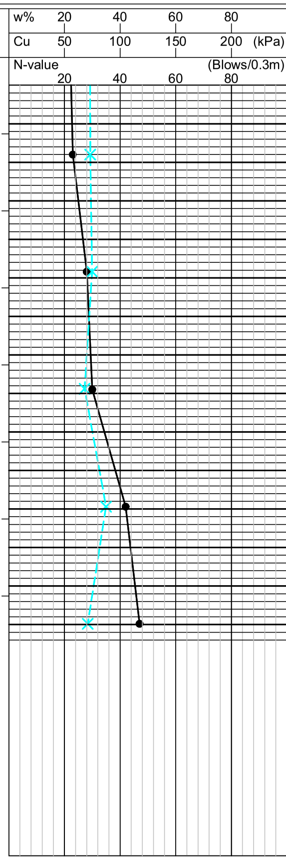
BOREHOLE No: **B 4**
Sheet 2 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 1.63 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 4/28/09 Completed on: 4/28/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	(continued)	10				
		11	Split spoon	9		
		12	Split spoon	10		
		13–14	Split spoon	11		
	Hard, grey, SILTY CLAY, with slight traces of sand.	15	Split spoon	12		
		16–17	Split spoon	13		
	End of Borehole at 17.22m.					



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TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **10**

BOREHOLE LOG

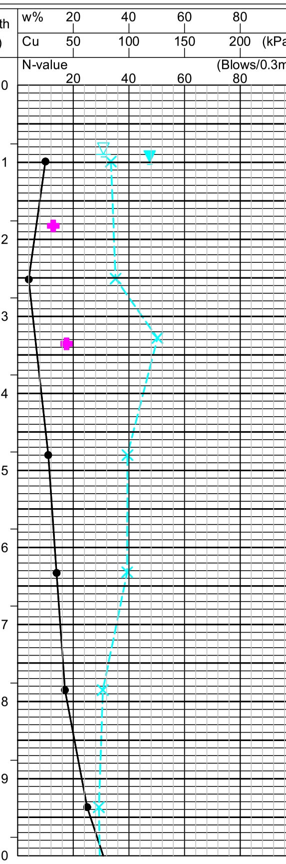
BOREHOLE No: **B 5**
Sheet 1 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 1.76 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 4/27/09 Completed on: 4/27/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Stiff, greyish brown, SILTY CLAY, with slight traces of sand.	1	Split spoon	1		
	Medium stiff, greyish brown, SILTY CLAY, with slight traces of sand.	2	Shelby tube	2		
	Soft, greyish brown, SILTY CLAY, with slight traces of sand.	3	Split spoon	3	17.60	
	Medium stiff, greyish brown, SILTY CLAY, with slight traces of sand.	4	Shelby tube	4	16.14	
	Stiff, greyish brown, SILTY CLAY, with slight traces of sand.	5	Split spoon	5		
		6	Split spoon	6		
	Very stiff, brown, SILTY CLAY, with slight traces of sand.	8	Split spoon	7		
		9	Split spoon	8		
	Continued Next Page	10				



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 11

BOREHOLE LOG

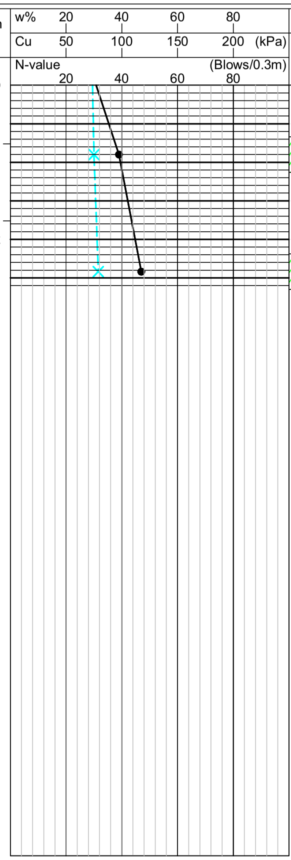
BOREHOLE No: B 5
Sheet 2 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 1.76 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 4/27/09 Completed on: 4/27/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
(continued)	10			
Hard, brown, SILTY CLAY, with slight traces of sand.	11	9		
	12	10		
End of Borehole at 12.65m.				



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 12

BOREHOLE LOG

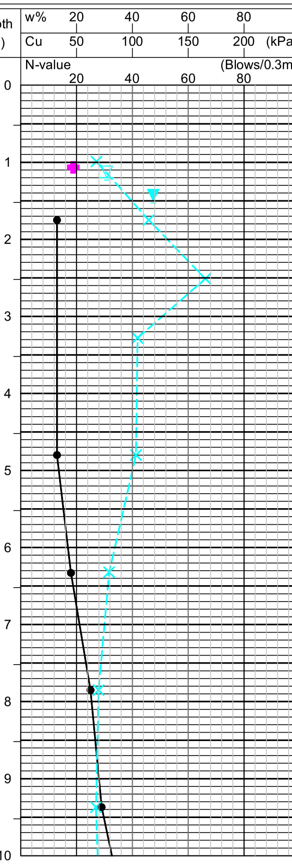
BOREHOLE No: B 6
Sheet 1 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 1.52 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 6/2/09 Completed on: 6/2/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
Ground Surface	0			
Medium stiff, grey, SILTY CLAY, with slight traces of sand and gravel.	1	1	18.10	
Stiff, grey, SILTY CLAY, with slight traces of sand and gravel.	2	2		
Soft, grey, SILTY CLAY.	3	3		
Medium stiff, brownish grey, SILTY CLAY, with slight traces of sand.	4	4		
Stiff, brownish grey, SILTY CLAY, with slight traces of sand.	5	5		
Very stiff, brownish grey, SILTY CLAY, with occasional traces of sand and slight traces of gravel.	6, 7	6		
	8	7		
	9	8		
	10			



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GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **13**

BOREHOLE LOG

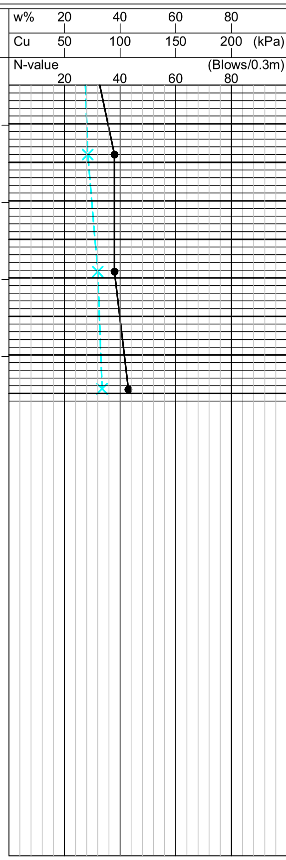
BOREHOLE No: **B 6**
Sheet 2 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 1.52 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 6/2/09 Completed on: 6/2/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
	(continued)	10			
	Hard, brownish grey, SILTY CLAY, with slight traces of sand and gravel.	11	9		
		12	10		
		13			
		14	11		
	End of Borehole at 14.17m.				



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **14**

BOREHOLE LOG

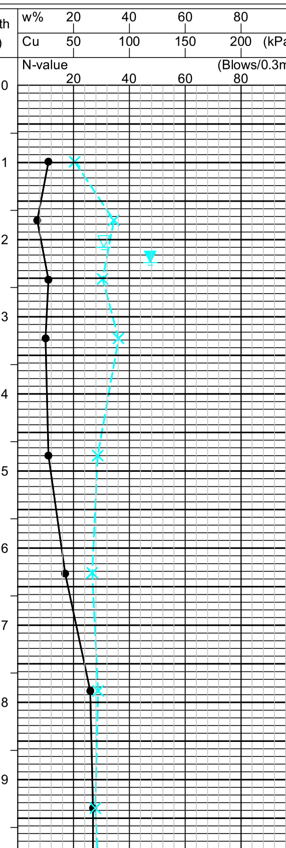
BOREHOLE No: **B 7**
Sheet 1 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 1.62 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 5/29/09 Completed on: 5/29/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
	Ground Surface	0			
	Stiff, brown, SILTY CLAY, with slight traces of sand.	1	1		
	Medium stiff, brown, SILTY CLAY, with slight traces of sand.	2	2		
	Stiff, brownish grey, SILTY CLAY, with slight traces of sand.	3	3		
		4	4		
		5	5		
	Very stiff, brownish grey, SILTY CLAY, with occasional traces of sand.	6	6		
		7			
		8	7		
		9	8		
	Continued Next Page	10			



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 15

BOREHOLE LOG

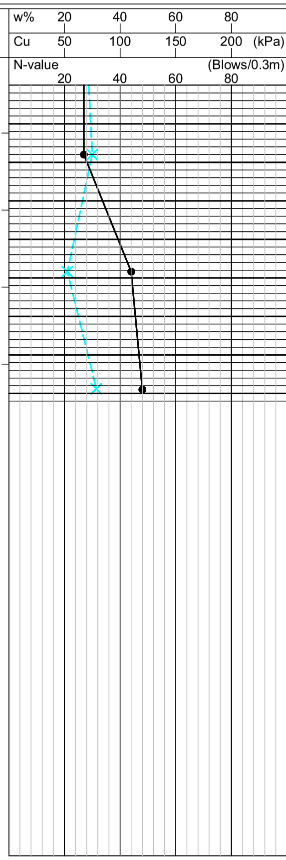
BOREHOLE No: B 7
Sheet 2 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 1.62 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 5/29/09 Completed on: 5/29/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	(continued)	10				
		11		9		
		12				
	Hard, brown, SILTY CLAY, with occasional traces of sand.			10		
		13				
		14		11		
	End of Borehole at 14.17m.					



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 16

BOREHOLE LOG

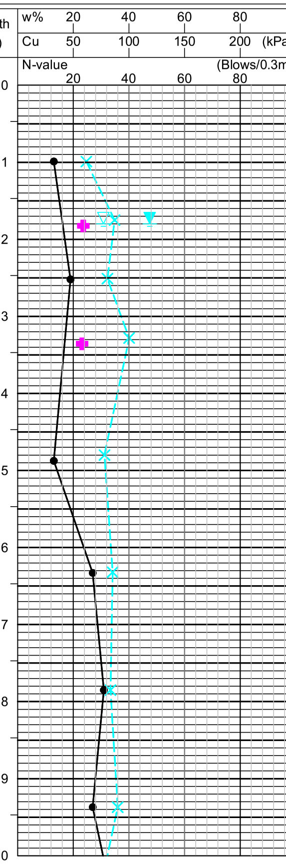
BOREHOLE No: B 8
Sheet 1 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 3.47 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 6/1/09 Completed on: 6/1/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Stiff, brown, SILTY CLAY, with slight traces of sand.	1		1		
				2	18.26	
		2				
	Very stiff, brown and whitish grey, SILTY CLAY, with slight traces of sand.			3		
	Stiff, brown, SILTY CLAY, with slight traces of sand.	3		4	18.00	
		4				
		5		5		
	Very stiff, brown and grey, SILTY CLAY, with slight traces of sand.	6		6		
		7				
		8		7		
		9		8		
	Continued Next Page	10				



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **17**

BOREHOLE LOG

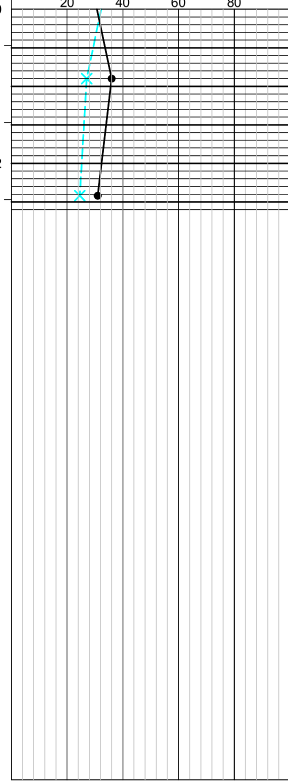
BOREHOLE No: **B 8**
Sheet 2 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 3.47 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 6/1/09 Completed on: 6/1/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	w% 20 40 60 80 / Cu 50 100 150 200 (kPa) / N-value 20 40 60 80 (Blows/0.3m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	(continued)	10					
	Hard, grey, SILTY CLAY, with occasional traces of sand.	11			9		
		12			10		
	End of Borehole at 12.65m.						



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **18**

BOREHOLE LOG

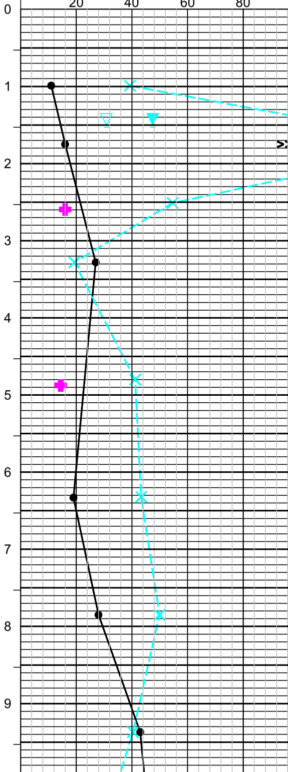
BOREHOLE No: **B 9**
Sheet 1 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 4.53 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 6/2/09 Completed on: 6/2/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	w% 20 40 60 80 / Cu 50 100 150 200 (kPa) / N-value 20 40 60 80 (Blows/0.3m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0					
	Loose, dark brown and black, SILTY SAND, with isolated gravel. (FILL)	1			1		
	Medium stiff, black, PEATY, SILTY CLAY, with frequent traces of sand.	2	>>		2		
	Medium stiff, grey and black, SILTY CLAY, with frequent traces of sand.	3			3	16.13	
	Very stiff, grey and black, SILTY CLAY, with frequent traces of sand and occasional traces of peat.	4			4		
	Medium stiff, grey, SILTY CLAY, with frequent traces of sand, isolated gravel and peat.	5			5	17.40	
	Very stiff, grey, SILTY, SANDY CLAY, with occasional traces of peat.	6, 7, 8			6, 7		
	Hard, dark grey, SILTY CLAY, with occasional traces of peat.	9, 10			8		



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TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 19

BOREHOLE LOG

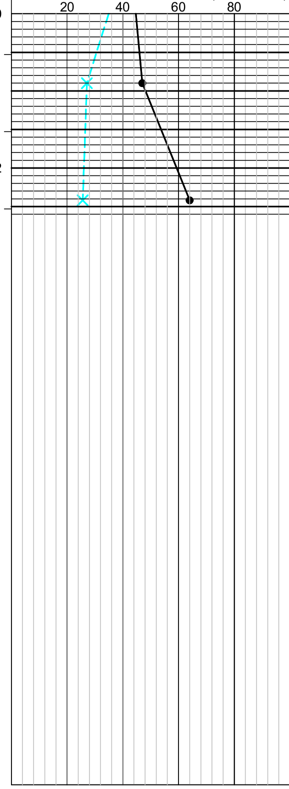
BOREHOLE No: B 9
Sheet 2 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 4.53 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 6/2/09 Completed on: 6/2/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
(continued)	10				
Hard, brown and grey, SILTY CLAY, with slight traces of sand and gravel.	11	Split Spoon	9		
	12	Split Spoon	10		
End of Borehole at 12.65m.					



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GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 20

BOREHOLE LOG

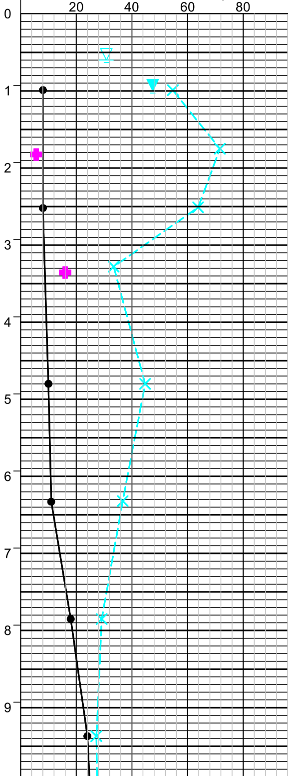
BOREHOLE No: B10
Sheet 1 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 2.93 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 6/1/09 Completed on: 6/1/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
Ground Surface	0				
Medium stiff, brown, SILTY CLAY, with occasional traces of sand and slight traces of gravel.	1	Split Spoon	1		
Soft, grey, SILTY CLAY, with occasional traces of sand, peat and slight traces of gravel.	2	Shelby Tube	2	16.50	
Medium stiff, grey, SILTY CLAY, with occasional traces of sand and slight traces of gravel.	3	Split Spoon	3		
	4	Shelby Tube	4	18.27	
Stiff, grey, SILTY CLAY, with occasional traces of sand.	5	Split Spoon	5		
	6	Split Spoon	6		
	8	Split Spoon	7		
Very stiff, greyish brown, SILTY CLAY, with occasional traces of sand.	9	Split Spoon	8		
	10				



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GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 21

BOREHOLE LOG

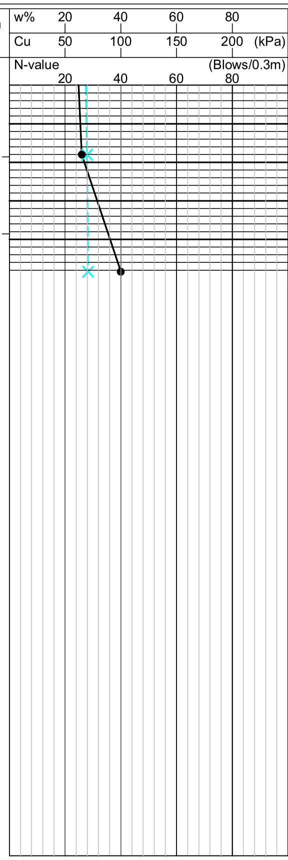
BOREHOLE No: B10
Sheet 2 of 2

Client: Earth Tech
Project: Geo. Services for Wastewater Treatment Plant
Location: San Fernando
Ground Elevation: 2.93 m
Boring Method: Wash Boring
Prep by: A. Budhram
Boring Started on: 6/1/09 Completed on: 6/1/09

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	w% / Cu (kPa) / N-value (Blows/0.3m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	(continued)	10					
		11			9		
		12					
	Hard, greyish brown, SILTY CLAY, with occasional traces of sand.				10		
	End of Borehole at 12.65m.						



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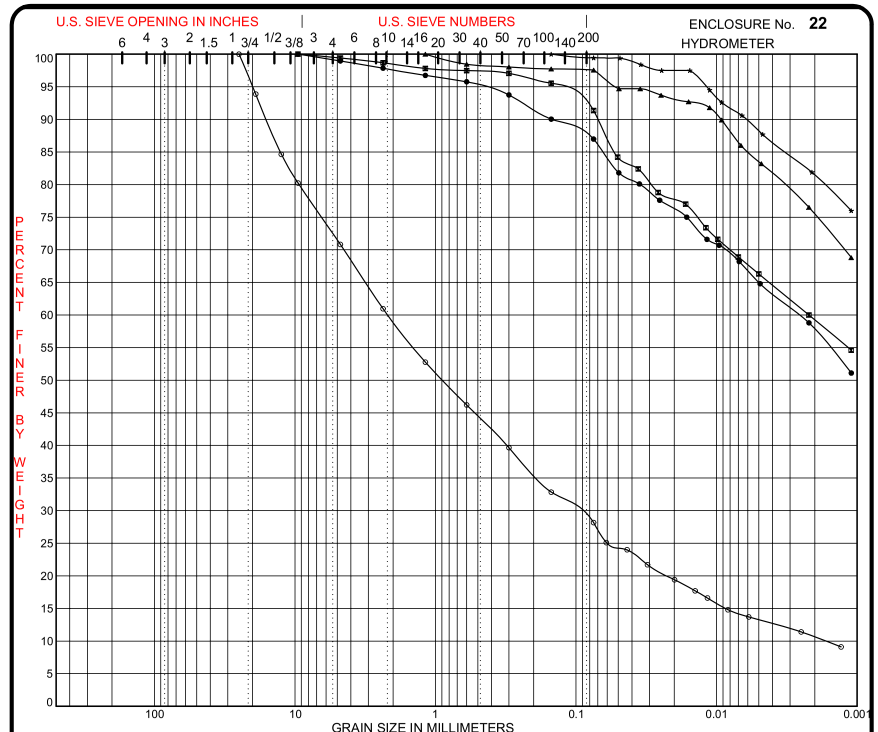
ENCLOSURE No. 22



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B 1/S 1	1.0	FAT CLAY CH		72	27	44		
⧗	B 1/S 3	2.5	FAT CLAY CH	43	60	30	30		
▲	B 1/S 7	7.9	FAT CLAY CH		71	28	43		
★	B 1/S 9	10.9	FAT CLAY CH		80	21	59		
⊙	B 2/S 1	1.0						2.65	1295.9

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B 1/S 1	1.0	9.50	0.00			1.0	12.0	29.2	57.7
⧗	B 1/S 3	2.5	9.50	0.00			0.6	8.1	32.1	59.3
▲	B 1/S 7	7.9	1.18				0.0	2.4	22.1	75.4
★	B 1/S 9	10.9	0.15				0.0	0.6	18.0	81.5
⊙	B 2/S 1	1.0	25.00	2.18	0.887	0.098	29.2	42.6	17.6	10.6

PROJECT Geo. Services for Wastewater Treatment Plant - San Fernando

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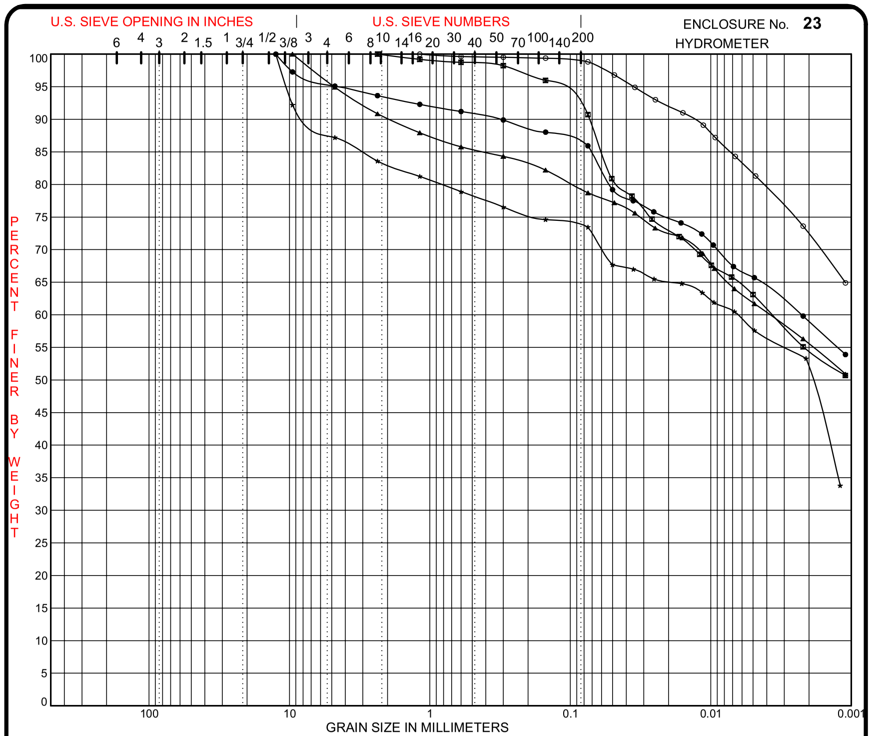
ENCLOSURE No. 23



COBBLES	GRAVEL coarse	GRAVEL fine	SAND coarse	SAND medium	SAND fine	SILT OR CLAY

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B 2/S 2	1.8	FAT CLAY CH		60	25	36		
⊠	B 2/S 4	3.3	FAT CLAY CH		60	22	38		
▲	B 2/S 5	4.8	FAT CLAY with SAND CH		63	25	38		
★	B 2/S 8	9.4	FAT CLAY with SAND CH		61	25	37		
⊙	B 2/S10	12.4	FAT CLAY CH		67	23	45		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B 2/S 2	1.8	12.50	0.00			4.9	9.2	26.9	59.0
⊠	B 2/S 4	3.3	2.36	0.00			0.0	9.3	36.2	54.5
▲	B 2/S 5	4.8	9.50	0.00			5.1	16.2	23.2	55.6
★	B 2/S 8	9.4	12.50	0.01	0.002		12.8	13.8	21.9	51.6
⊙	B 2/S10	12.4	1.18				0.0	1.2	26.4	72.4

PROJECT Geo. Services for Wastewater Treatment Plant - San Fernando

JOB NO. GA 07 326
DATE December 2009

GRADATION CURVES

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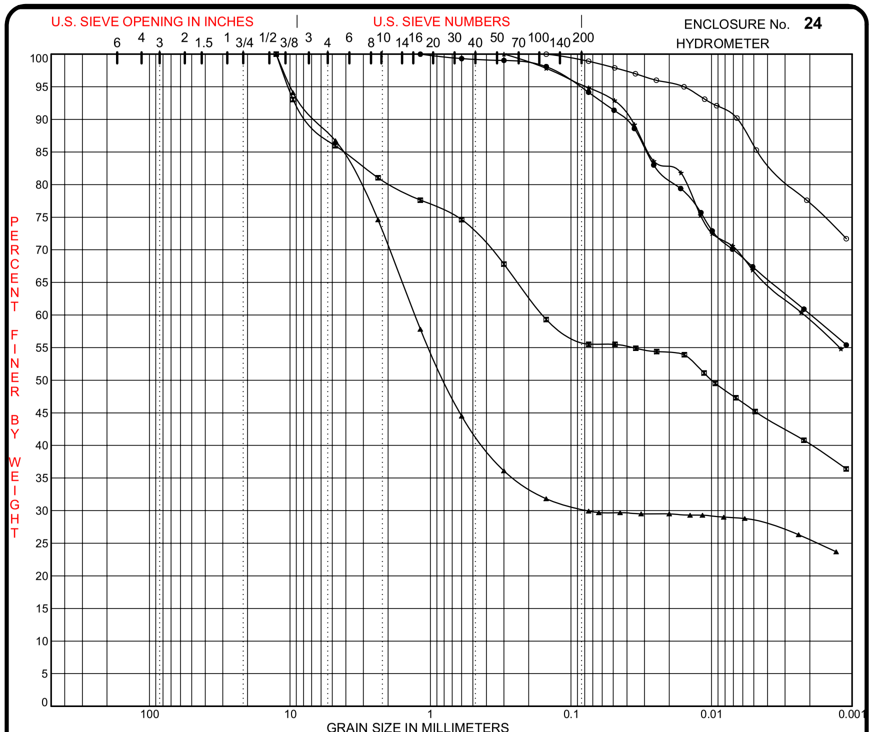
ENCLOSURE No. 24



COBBLES	GRAVEL coarse	GRAVEL fine	SAND coarse	SAND medium	SAND fine	SILT OR CLAY

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B 3/S 3	2.5	FAT CLAY CH		57	23	34		
⊠	B 3/S 7	7.9	SANDY FAT CLAY CH		60	28	33		
▲	B 3/S 9	10.9	CLAYEY SAND SC		76	34	43		
★	B 4/S 1	1.0	FAT CLAY CH		70	29	41		
⊙	B 4/S 3	2.5	FAT CLAY CH		75	27	48		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B 3/S 3	2.5	1.18	0.00			0.0	5.8	34.0	60.1
⊠	B 3/S 7	7.9	12.50	0.16	0.010		14.0	30.4	15.3	40.2
▲	B 3/S 9	10.9	12.50	1.29	0.794	0.077	13.3	56.8	4.4	25.5
★	B 4/S 1	1.0	0.30	0.00			0.0	5.2	35.6	59.2
⊙	B 4/S 3	2.5	0.15				0.0	1.1	21.8	77.2

PROJECT Geo. Services for Wastewater Treatment Plant - San Fernando

JOB NO. GA 07 326
DATE December 2009

GRADATION CURVES

Geotech Associates Ltd

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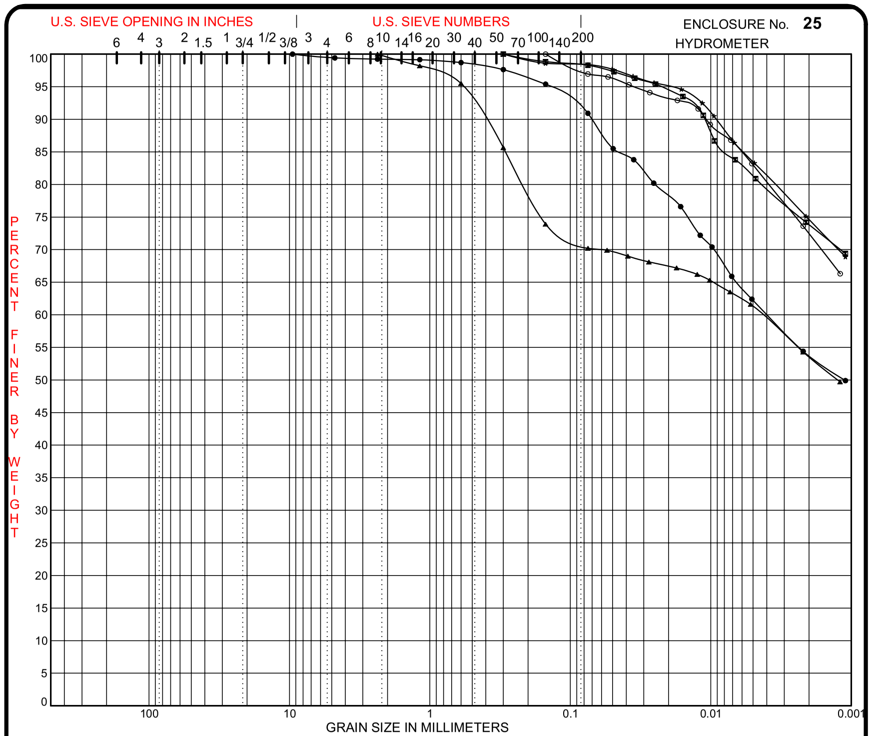
ENCLOSURE No. 25



COBBLES	GRAVEL coarse	GRAVEL fine	SAND coarse	SAND medium	SAND fine	SILT OR CLAY

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B 4/S 4	3.4	FAT CLAY CH		59	24	34		
⊠	B 4/S 5	4.8	FAT CLAY CH		64	29	35		
▲	B 4/S 7	7.9							
★	B 4/S 9	10.9	FAT CLAY CH		70	26	43		
⊙	B 4/S13	17.0	FAT CLAY CH		66	29	38		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B 4/S 4	3.4	9.50	0.00	0.001		0.6	8.5	37.1	53.8
⊠	B 4/S 5	4.8	0.30				0.0	1.7	24.5	73.8
▲	B 4/S 7	7.9	2.36	0.00	0.001		0.0	29.8	16.6	53.6
★	B 4/S 9	10.9	0.30				0.0	1.6	23.8	74.6
⊙	B 4/S13	17.0	0.15				0.0	3.0	24.5	72.5

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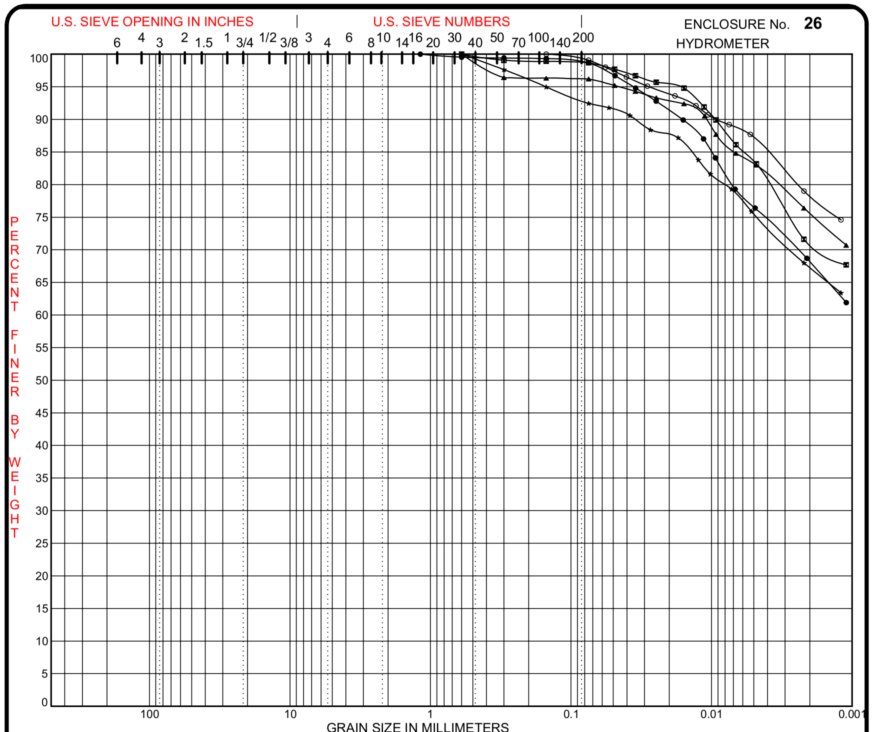
GRADATION CURVES

Geotech Associates Ltd

GRSZL-2 07326.GPJ 12/21/09

ENCLOSURE No. 26



COBBLES	GRAVEL coarse	GRAVEL fine	SAND coarse	SAND medium	SAND fine	SILT OR CLAY

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B 5/S 2	1.8	FAT CLAY CH		71	27	45		
⊠	B 5/S 4	3.3	FAT CLAY CH	42	72	30	42		
▲	B 5/S 6	6.3	FAT CLAY CH		78	31	47		
★	B 5/S 8	9.4	FAT CLAY CH		60	24	36		
⊙	B 5/S10	12.4	FAT CLAY CH		67	26	41		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B 5/S 2	1.8	1.18				0.0	1.3	30.5	68.2
⊠	B 5/S 4	3.3	0.60				0.0	1.3	27.6	71.1
▲	B 5/S 6	6.3	0.60				0.0	3.8	20.6	75.6
★	B 5/S 8	9.4	0.60				0.0	7.5	25.2	67.3
⊙	B 5/S10	12.4	0.15				0.0	0.9	20.8	78.3

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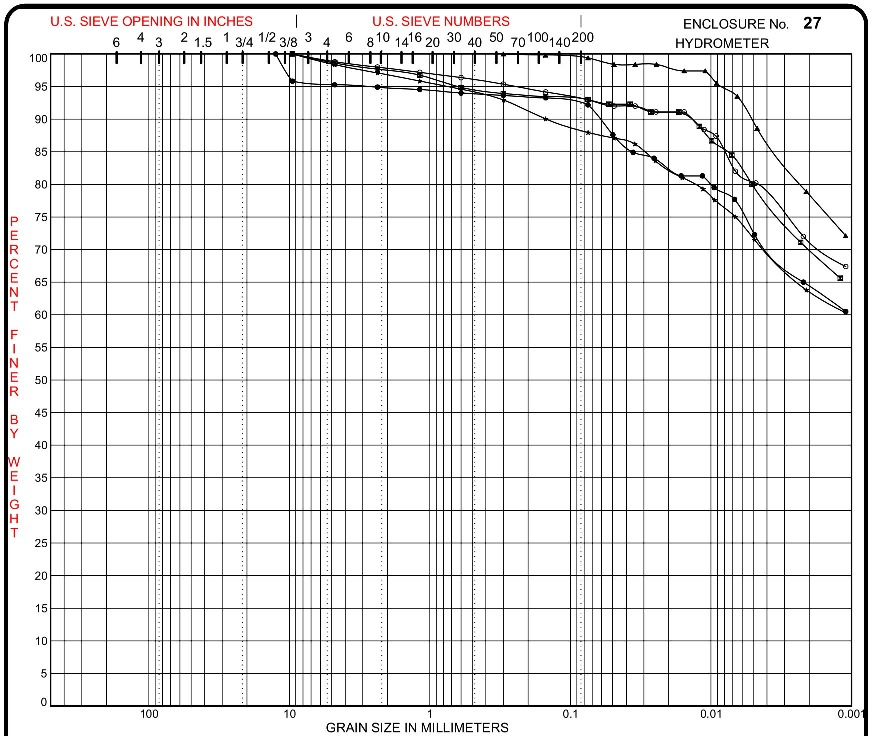
GRADATION CURVES

Geotech Associates Ltd

GRSZL-2 07326.GPJ 12/21/09

ENCLOSURE No. 27



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B 6/S 1	1.0	FAT CLAY CH		74	31	43		
⌧	B 6/S 4	3.3	FAT CLAY CH		77	29	48		
▲	B 6/S 5	4.8	FAT CLAY CH		78	31	47		
★	B 6/S 7	7.9	FAT CLAY CH		65	26	39		
⊙	B 6/S 9	10.9	FAT CLAY CH		59	25	35		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B 6/S 1	1.0	12.50				4.7	3.1	27.8	64.4
⌧	B 6/S 4	3.3	9.50				1.4	5.6	23.1	69.9
▲	B 6/S 5	4.8	0.30				0.0	0.6	21.0	78.4
★	B 6/S 7	7.9	9.50				1.7	10.4	24.4	63.5
⊙	B 6/S 9	10.9	9.50				1.2	5.8	21.6	71.4

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GRADATION CURVES

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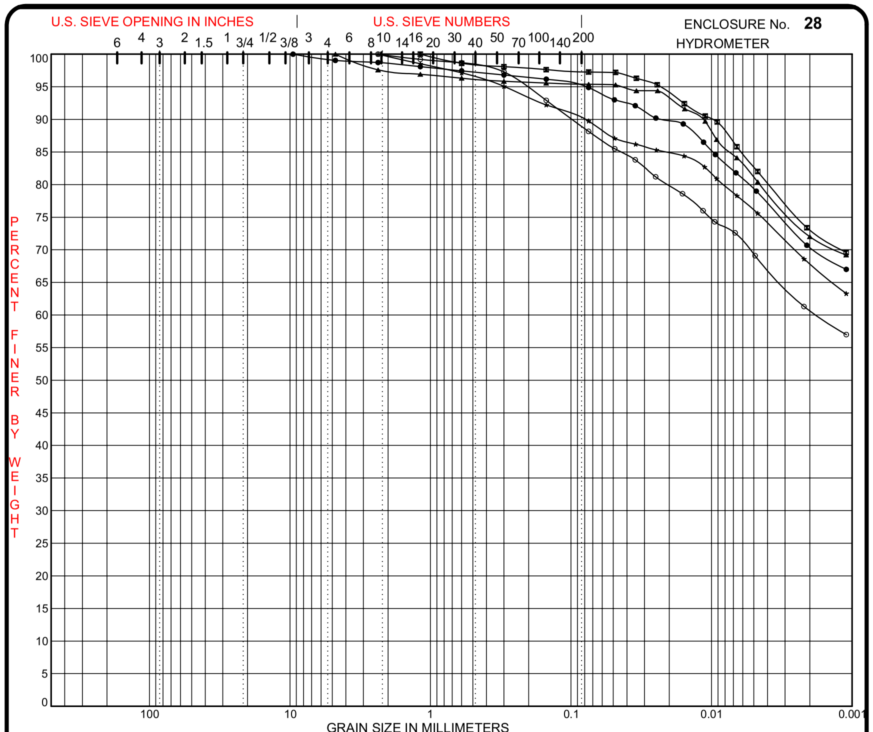
*GRSZL-2 07326.GPJ 12/21/09

ENCLOSURE No. 28



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B 6/S10	12.4	FAT CLAY CH		69	28	41		
⌧	B 7/S 2	1.8	FAT CLAY CH		78	31	47		
▲	B 7/S 5	4.8	FAT CLAY CH		68	26	42		
★	B 7/S 7	7.9	FAT CLAY CH		59	26	33		
⊙	B 7/S 9	10.9	FAT CLAY CH		57	23	34		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B 6/S10	12.4	9.50				1.0	4.1	24.5	70.4
⌧	B 7/S 2	1.8	1.18				0.0	2.7	24.1	73.1
▲	B 7/S 5	4.8	4.75				0.0	4.6	23.4	72.0
★	B 7/S 7	7.9	2.36				0.0	10.2	21.9	67.9
⊙	B 7/S 9	10.9	2.36	0.00			0.0	11.8	27.4	60.7

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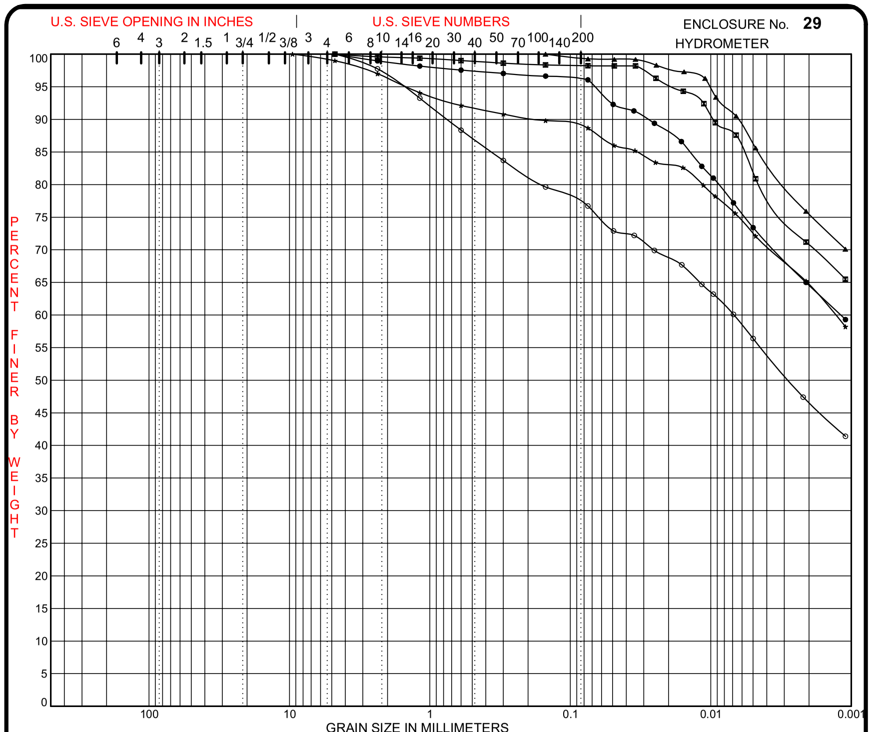
GRADATION CURVES

Geotech Associates Ltd

*GRSZL-2 07326.GPJ 12/21/09

ENCLOSURE No. 29



	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B 8/S 2	1.8	FAT CLAY CH		65	27	38		
⊠	B 8/S 4	3.3	FAT CLAY CH		71	28	43		
▲	B 8/S 7	7.9	FAT CLAY CH		74	26	47		
★	B 8/S 9	10.9	FAT CLAY CH		64	26	39		
⊙	B 9/S 3	2.5	ELASTIC SILT with SAND MH		63	43	20		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B 8/S 2	1.8	4.75	0.00			0.0	3.9	31.5	64.6
⊠	B 8/S 4	3.3	4.75				0.0	1.8	27.5	70.8
▲	B 8/S 7	7.9	0.15				0.0	0.7	23.8	75.5
★	B 8/S 9	10.9	9.50	0.00			1.0	10.3	24.0	64.7
⊙	B 9/S 3	2.5	4.75	0.01	0.003		0.0	23.3	30.1	46.6

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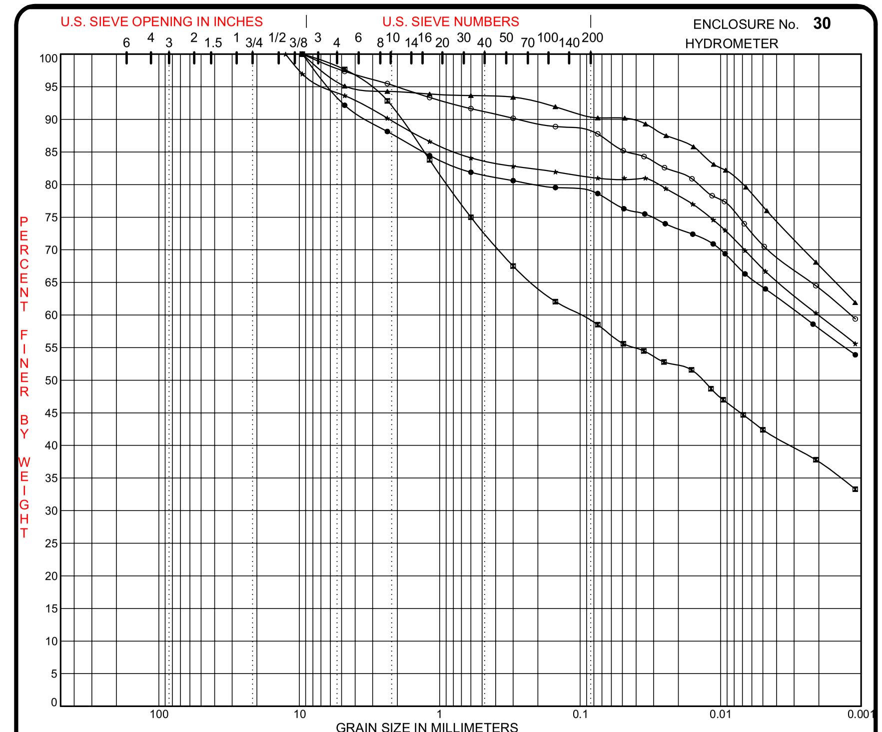
GRADATION CURVES

Geotech Associates Ltd

*GRSZL-2 07326.GPJ 12/21/09

ENCLOSURE No. 30



	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B 9/S 5	4.8							
⊠	B 9/S 7	7.9	SANDY FAT CLAY CH		60	29	31		
▲	B 9/S 9	10.9	FAT CLAY CH		62	22	40		
★	B10/S 2	1.8	FAT CLAY with SAND CH		65	25	39		
⊙	B10/S 4	3.3	FAT CLAY CH		65	29	36		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B 9/S 5	4.8	9.50	0.00			7.8	13.5	20.7	58.0
⊠	B 9/S 7	7.9	9.50	0.10	0.014		2.3	39.2	21.1	37.5
▲	B 9/S 9	10.9	9.50				4.9	4.9	22.6	67.6
★	B10/S 2	1.8	12.50	0.00			6.3	12.7	21.1	59.9
⊙	B10/S 4	3.3	9.50	0.00			2.6	9.6	23.7	64.1

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DATE December 2009

GRADATION CURVES

Geotech Associates Ltd

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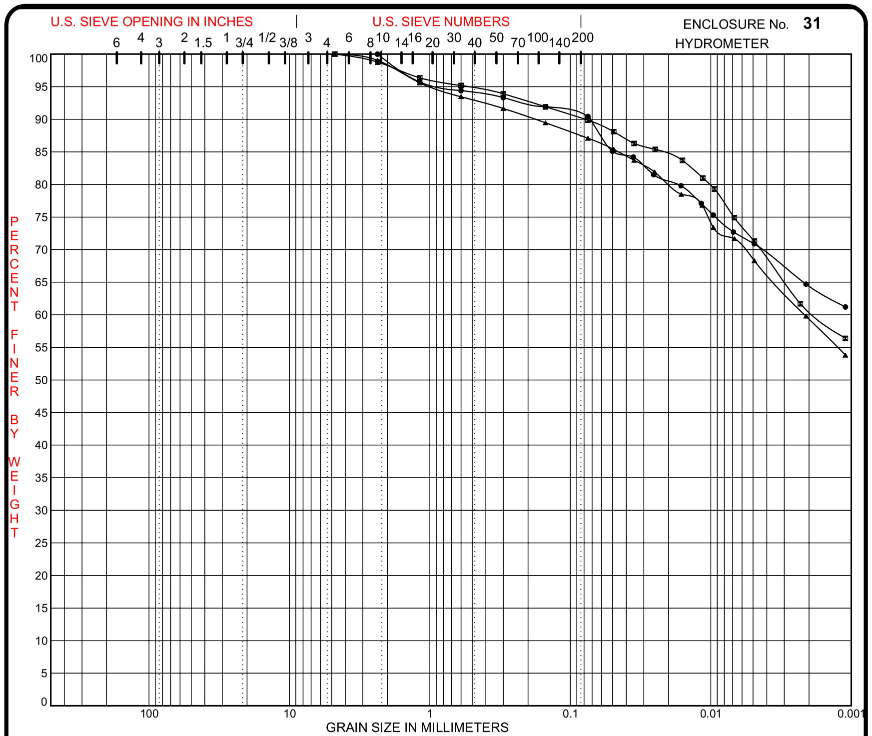
ENCLOSURE No. 31



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B10/S 6	6.3	FAT CLAY CH		71	24	47		
⊠	B10/S 8	9.4	FAT CLAY CH		63	26	37		
▲	B10/S10	12.4	FAT CLAY CH		59	26	34		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B10/S 6	6.3	2.36				0.0	9.6	26.0	64.4
⊠	B10/S 8	9.4	4.75	0.00			0.0	10.1	29.2	60.7
▲	B10/S10	12.4	4.75	0.00			0.0	12.9	27.7	59.3

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GRADATION CURVES

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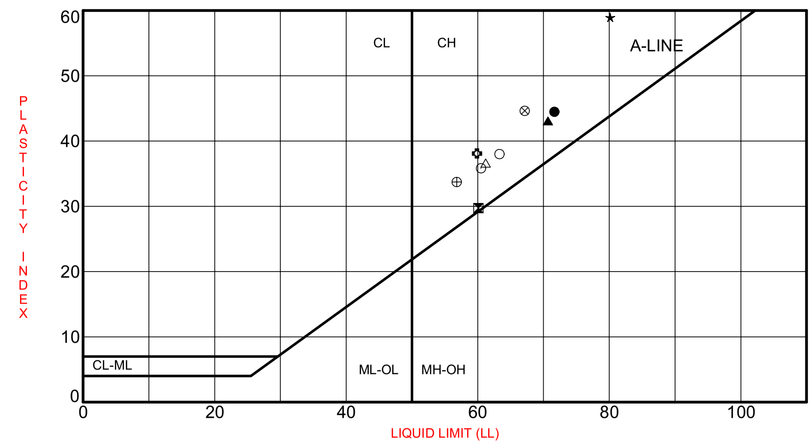
ENCLOSURE No. 32



CL - INORGANIC CLAYS, SILTY CLAYS, SANDY CLAYS OF LOW PLASTICITY
ML - INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, WITH SLIGHT PLASTICITY
OL - ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
CH - INORGANIC CLAYS OF HIGH PLASTICITY
MH - INORGANIC SILTS OF HIGH PLASTICITY
OH - ORGANIC CLAYS OF HIGH PLASTICITY

	Sample Id.	Depth,m	LL	PL	PI	Fines	Classification
●	B 1/S 1	1.0	72	27	45	87.0	FAT CLAY CH
⊠	B 1/S 3	2.5	60	30	30	91.4	FAT CLAY CH
▲	B 1/S 7	7.9	71	28	43	97.6	FAT CLAY CH
★	B 1/S 9	10.9	80	21	59	99.4	FAT CLAY CH
⊙	B 2/S 2	1.8	60	25	35	85.9	FAT CLAY CH
✿	B 2/S 4	3.3	60	22	38	90.7	FAT CLAY CH
○	B 2/S 5	4.8	63	25	38	78.7	FAT CLAY with SAND CH
△	B 2/S 8	9.4	61	25	36	73.5	FAT CLAY with SAND CH
⊗	B 2/S10	12.4	67	23	45	98.8	FAT CLAY CH
⊕	B 3/S 3	2.5	57	23	34	94.2	FAT CLAY CH

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MODIFIED PLASTICITY CHART

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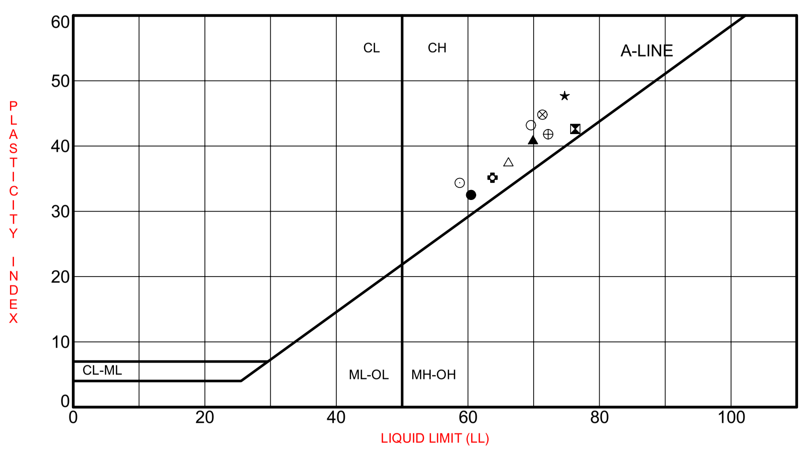
*ATTBLSZ 07326.GPJ 12/21/09

ENCLOSURE No. 33



CL - INORGANIC CLAYS, SILTY CLAYS, SANDY CLAYS OF LOW PLASTICITY
ML - INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, WITH SLIGHT PLASTICITY
OL - ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
CH - INORGANIC CLAYS OF HIGH PLASTICITY
MH - INORGANIC SILTS OF HIGH PLASTICITY
OH - ORGANIC CLAYS OF HIGH PLASTICITY

	Sample Id.	Depth,m	LL	PL	PI	Fines	Classification
●	B 3/S 7	7.9	60	28	32	55.5	SANDY FAT CLAY CH
⧗	B 3/S 9	10.9	76	34	42	29.9	CLAYEY SAND SC
▲	B 4/S 1	1.0	70	29	41	94.8	FAT CLAY CH
★	B 4/S 3	2.5	75	27	48	98.9	FAT CLAY CH
○	B 4/S 4	3.4	59	24	35	90.9	FAT CLAY CH
✿	B 4/S 5	4.8	64	29	35	98.3	FAT CLAY CH
○	B 4/S 9	10.9	70	26	44	98.4	FAT CLAY CH
△	B 4/S13	17.0	66	29	37	97.0	FAT CLAY CH
⊗	B 5/S 2	1.8	71	27	44	98.7	FAT CLAY CH
⊕	B 5/S 4	3.3	72	30	42	98.7	FAT CLAY CH

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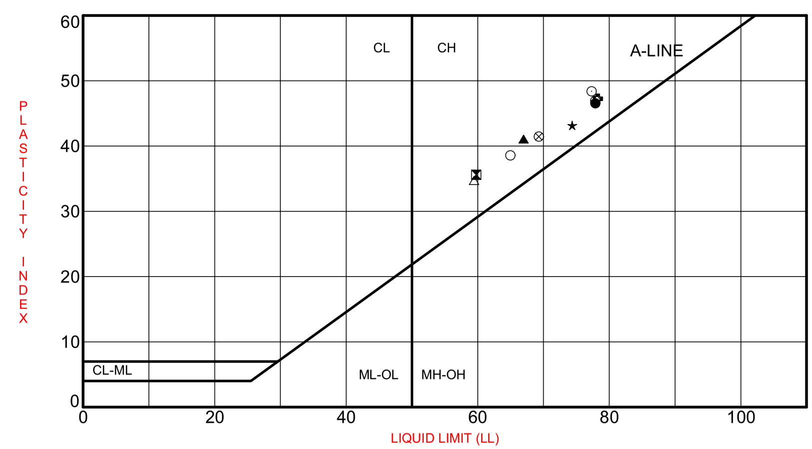
MODIFIED PLASTICITY CHART

Geotech Associates Ltd

ENCLOSURE No. 34



CL - INORGANIC CLAYS, SILTY CLAYS, SANDY CLAYS OF LOW PLASTICITY
ML - INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, WITH SLIGHT PLASTICITY
OL - ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
CH - INORGANIC CLAYS OF HIGH PLASTICITY
MH - INORGANIC SILTS OF HIGH PLASTICITY
OH - ORGANIC CLAYS OF HIGH PLASTICITY

	Sample Id.	Depth,m	LL	PL	PI	Fines	Classification
●	B 5/S 6	6.3	78	31	47	96.2	FAT CLAY CH
⧗	B 5/S 8	9.4	60	24	36	92.5	FAT CLAY CH
▲	B 5/S10	12.4	67	26	41	99.1	FAT CLAY CH
★	B 6/S 1	1.0	74	31	43	92.2	FAT CLAY CH
○	B 6/S 4	3.3	77	29	48	93.0	FAT CLAY CH
✿	B 6/S 5	4.8	78	31	47	99.4	FAT CLAY CH
○	B 6/S 7	7.9	65	26	39	88.0	FAT CLAY CH
△	B 6/S 9	10.9	59	25	34	92.9	FAT CLAY CH
⊗	B 6/S10	12.4	69	28	41	94.9	FAT CLAY CH
⊕	B 7/S 2	1.8	78	31	47	97.3	FAT CLAY CH

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MODIFIED PLASTICITY CHART

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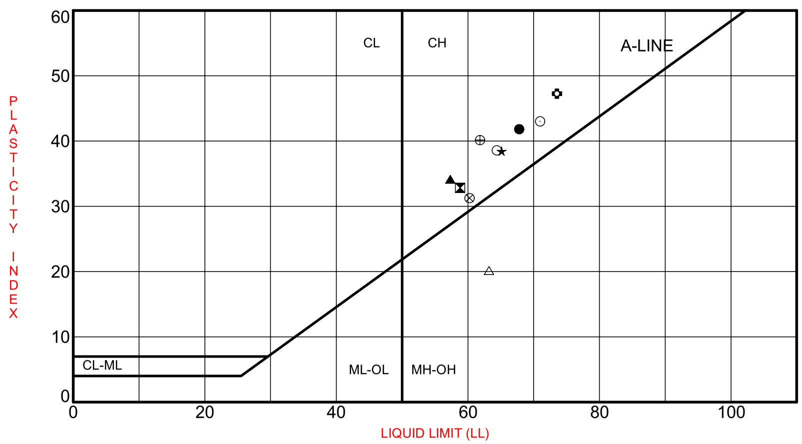

CL - INORGANIC CLAYS, SILTY CLAYS, SANDY CLAYS OF LOW PLASTICITY
ML - INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, WITH SLIGHT PLASTICITY
OL - ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
CH - INORGANIC CLAYS OF HIGH PLASTICITY
MH - INORGANIC SILTS OF HIGH PLASTICITY
OH - ORGANIC CLAYS OF HIGH PLASTICITY

	Sample Id.	Depth,m	LL	PL	PI	Fines	Classification
●	B 7/S 5	4.8	68	26	42	95.4	FAT CLAY CH
⧗	B 7/S 7	7.9	59	26	33	89.8	FAT CLAY CH
▲	B 7/S 9	10.9	57	23	34	88.2	FAT CLAY CH
★	B 8/S 2	1.8	65	27	38	96.1	FAT CLAY CH
⊙	B 8/S 4	3.3	71	28	43	98.2	FAT CLAY CH
✿	B 8/S 7	7.9	74	26	48	99.3	FAT CLAY CH
○	B 8/S 9	10.9	64	26	38	88.7	FAT CLAY CH
△	B 9/S 3	2.5	63	43	20	76.7	ELASTIC SILT with SAND MH
⊗	B 9/S 7	7.9	60	29	31	58.5	SANDY FAT CLAY CH
⊕	B 9/S 9	10.9	62	22	40	90.2	FAT CLAY CH

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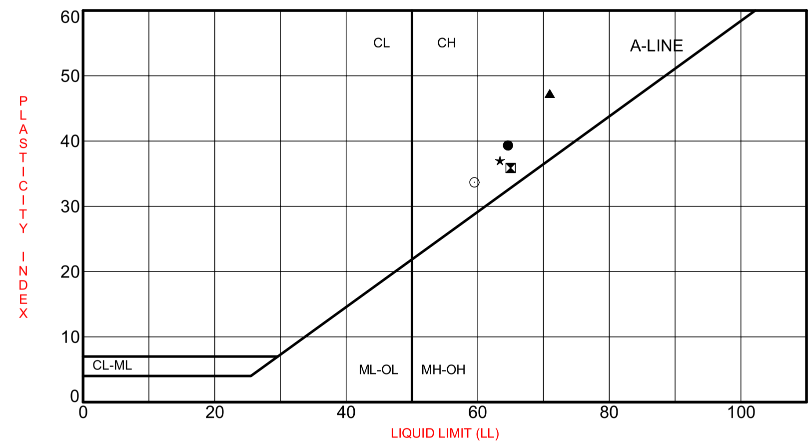
MODIFIED PLASTICITY CHART
Geotech Associates Ltd

*ATTBLSZ 07326.GPJ 12/21/09



CL - INORGANIC CLAYS, SILTY CLAYS, SANDY CLAYS OF LOW PLASTICITY
ML - INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, WITH SLIGHT PLASTICITY
OL - ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
CH - INORGANIC CLAYS OF HIGH PLASTICITY
MH - INORGANIC SILTS OF HIGH PLASTICITY
OH - ORGANIC CLAYS OF HIGH PLASTICITY

	Sample Id.	Depth,m	LL	PL	PI	Fines	Classification
●	B10/S 2	1.8	65	25	40	81.0	FAT CLAY with SAND CH
⧗	B10/S 4	3.3	65	29	36	87.8	FAT CLAY CH
▲	B10/S 6	6.3	71	24	47	90.4	FAT CLAY CH
★	B10/S 8	9.4	63	26	37	89.9	FAT CLAY CH
⊙	B10/S10	12.4	59	26	33	87.1	FAT CLAY CH

PROJECT Geo. Services for Wastewater Treatment Plant - San Fernando
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MODIFIED PLASTICITY CHART
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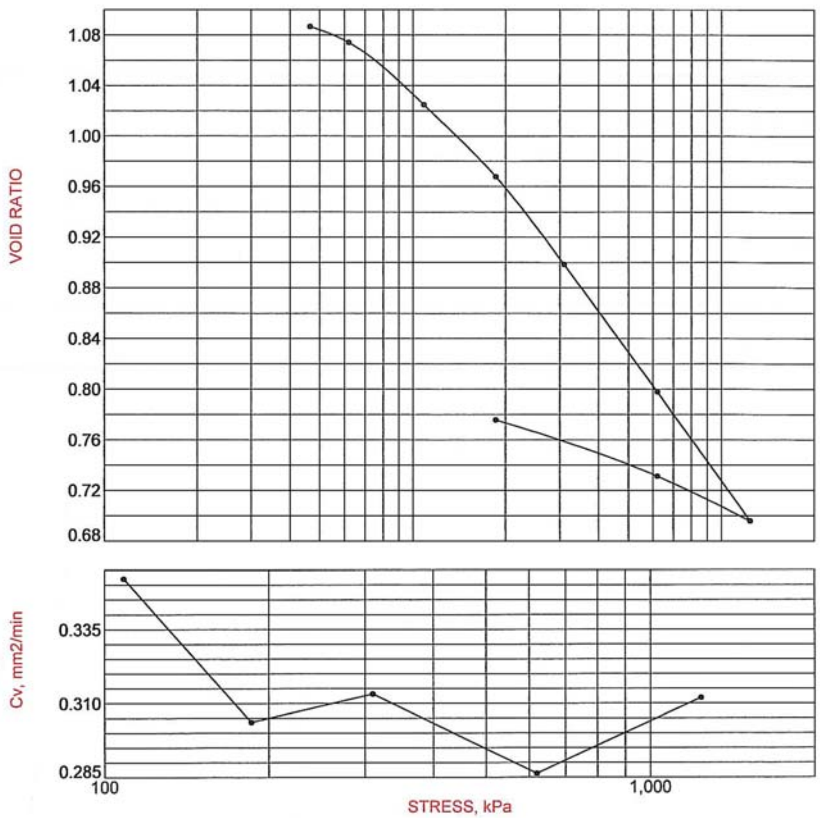
*ATTBLSZ 07326.GPJ 12/21/09



Specimen ID: B 1/S 3 Depth: 2.5 m

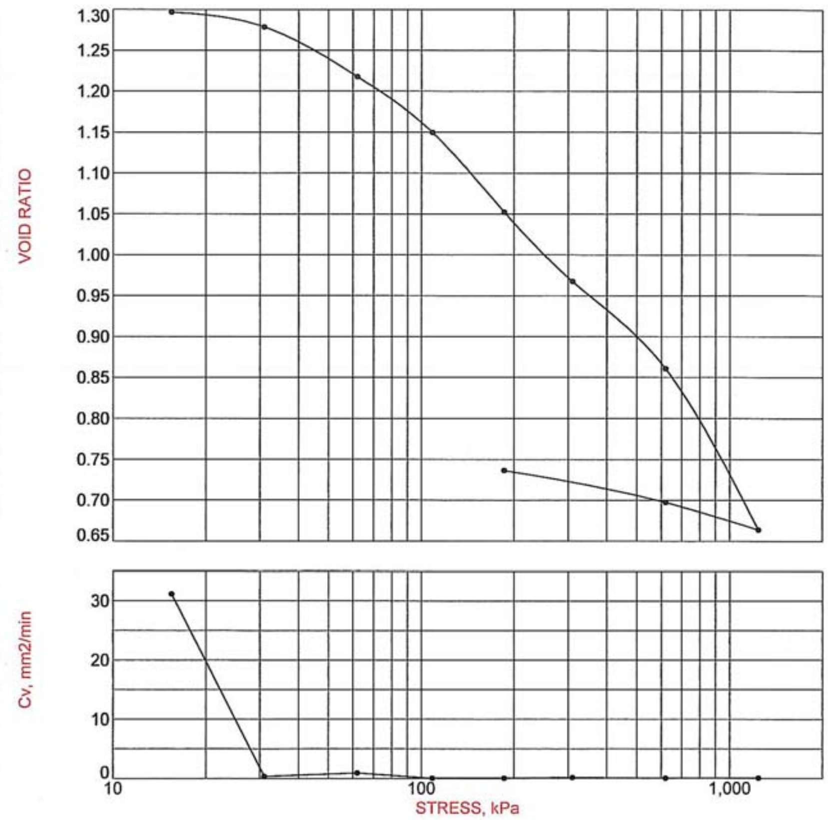
Dry Unit Weight, γ_d = 12.7 kN/m^3
Water Content, wc = 42.9 %

Initial Void Ratio, e0 = 1.131
Compression ratio, Cc = 0.335
Recompression ratio, Cr = 0.122

PROJECT	Geo. Services for Wastewater Treatment Plant - San Fernando	JOB NO.	GA 07 326
		DATE	December 2009

CONSOLIDATION TEST
Geotech Associates Limited

CONSOL 07326.GPJ 18/12/09



Specimen ID: B 3/S 5 Depth: 4.8 m

Dry Unit Weight, γ_d = 11.7 kN/m^3
Water Content, wc = 46.8 %

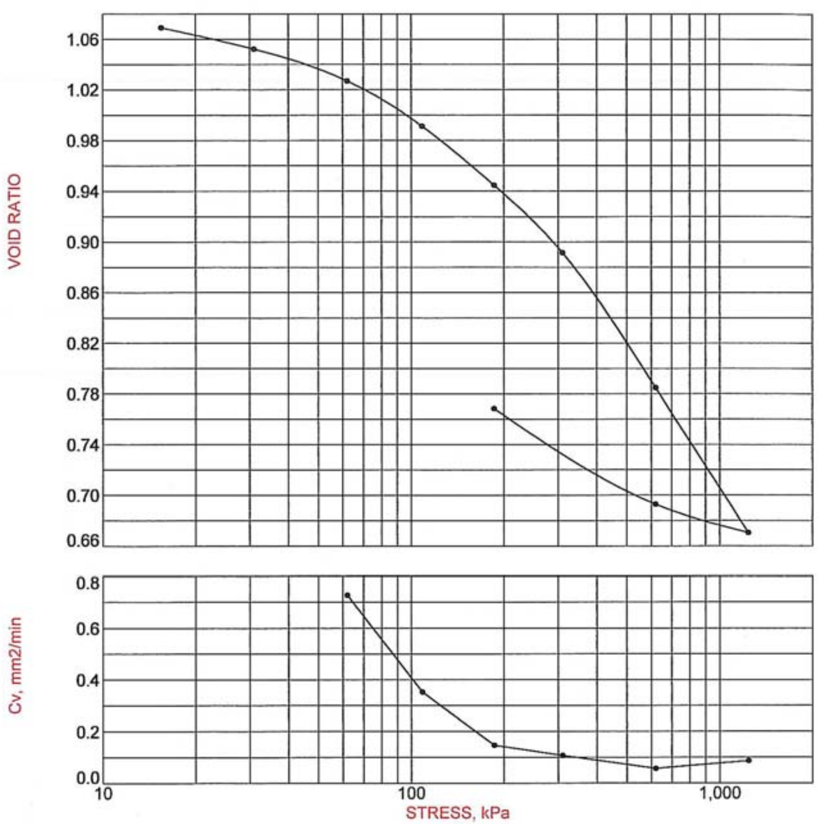
Initial Void Ratio, e0 = 1.314
Compression ratio, Cc = 0.670
Recompression ratio, Cr = 0.110

PROJECT	Geo. Services for Wastewater Treatment Plant - San Fernando	JOB NO.	GA 07 326
		DATE	December 2009

CONSOLIDATION TEST
Geotech Associates Limited

CONSOL 07326.GPJ 18/12/09

ENCLOSURE No. 39



Specimen ID: B 5/S 4 Depth: 3.3 m

Dry Unit Weight, γ_d = 12.9 kN/m^3
Water Content, wc = 41.9 %

Initial Void Ratio, e0 = 1.086
Compression ratio, Cc = 0.365
Recompression ratio, Cr = 0.062

PROJECT Geo. Services for Wastewater Treatment Plant - San Fernando

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CONSOLIDATION TEST
Geotech Associates Limited

*CONSOL 07326.GPJ 18/12/09

Enclosure No. 40

DETERMINATION OF SPECIFIC GRAVITY
(FINE AGGREGATES)

PROJECT No. GA 07 326 **PROJECT NAME:** Geo. Services for Wastewater Treatment Plant

SOURCE Client **SPECIMEN ID.** B 1/S 3

MATERIAL DESCRIPTION

TESTED BY A. B. **CHECKED BY** A. Budhram

TEST No.		1	2
BOTTLE No.		G	F
Wt. BOTTLE + WATER + SOIL = W_{bws}	g	452.8	459.4
TEMPERATURE, (T_W)	°C	28	28
Wt. BOTTLE + WATER = W_{bwc} (From calibrated curve)	g	438.0	444.6
Wt. OF EVAP. OF DISH + DRY SOIL	g	-	-
Wt. OF EVAP. OF DISH	g	-	-
Wt. OVEN DRY SOIL = W_s	g	25	25
SG of Water at T_w		0.9980	0.9980
G_s		2.446	2.446

REMARKS

AVERAGE SPECIFIC GRAVITY (G_s) = 2.446

Enclosure No. 41

DETERMINATION OF SPECIFIC GRAVITY
(FINE AGGREGATES)

PROJECT No. GA 07 326 **PROJECT NAME:** Geo. Services for Wastewater Treatment Plant

SOURCE Client **SPECIMEN ID.** B 2/S 2

MATERIAL DESCRIPTION

TESTED BY A. B. **CHECKED BY** A. Budhram

TEST No.		1	2
BOTTLE No.		G	F
Wt. BOTTLE + WATER + SOIL = W_{bws}	g	452.9	457.2
TEMPERATURE, (T_W)	°C	28	28
Wt. BOTTLE + WATER = W_{bwc} (From calibrated curve)	g	438.0	442.4
Wt. OF EVAP. OF DISH + DRY SOIL	g	-	-
Wt. OF EVAP. OF DISH	g	-	-
Wt. OVEN DRY SOIL = W_s	g	25	25
SG of Water at T_w		0.9980	0.9980
G_s		2.470	2.446

REMARKS

AVERAGE SPECIFIC GRAVITY (G_s) = 2.458

Enclosure No. 42

DETERMINATION OF SPECIFIC GRAVITY
(FINE AGGREGATES)

PROJECT No. GA 07 326 **PROJECT NAME:** Geo. Services for Wastewater Treatment Plant

SOURCE Client **SPECIMEN ID.** B 2/S 4

MATERIAL DESCRIPTION

TESTED BY A. B. **CHECKED BY** A. Budhram

TEST No.		1	2
BOTTLE No.		G	F
Wt. BOTTLE + WATER + SOIL = W_{bws}	g	456.5	439.1
TEMPERATURE, (T_W)	°C	28	28
Wt. BOTTLE + WATER = W_{bwc} (From calibrated curve)	g	443.3	425.9
Wt. OF EVAP. OF DISH + DRY SOIL	g	-	-
Wt. OF EVAP. OF DISH	g	-	-
Wt. OVEN DRY SOIL = W_s	g	25	25
SG of Water at T_w		0.9980	0.9980
G_s		2.114	2.114

REMARKS

AVERAGE SPECIFIC GRAVITY (G_s) = 2.114

DETERMINATION OF SPECIFIC GRAVITY
(FINE AGGREGATES)

PROJECT No. GA 07 326 **PROJECT NAME:** Geo. Services for Wastewater Treatment Plant

SOURCE Client **SPECIMEN ID.** B 3/S 5

MATERIAL DESCRIPTION

TESTED BY A. B. **CHECKED BY** A. Budhram

TEST No.		1	2
BOTTLE No.		G	F
Wt. BOTTLE + WATER + SOIL = W_{bws}	g	454.3	458.6
TEMPERATURE, (T_W)	°C	28	28
Wt. BOTTLE + WATER = W_{bwc} (From calibrated curve)	g	439.6	443.9
Wt. OF EVAP. OF DISH + DRY SOIL	g	-	-
Wt. OF EVAP. OF DISH	g	-	-
Wt. OVEN DRY SOIL = W_s	g	25	25
SG of Water at T_w		0.9980	0.9980
G_s		2.422	2.422

REMARKS

AVERAGE SPECIFIC GRAVITY (G_s) = 2.422

DETERMINATION OF SPECIFIC GRAVITY
(FINE AGGREGATES)

PROJECT No. GA 07 326 **PROJECT NAME:** Geo. Services for Wastewater Treatment Plant

SOURCE Client **SPECIMEN ID.** B 4/S 1

MATERIAL DESCRIPTION

TESTED BY A. B. **CHECKED BY** A. Budhram

TEST No.		1	2
BOTTLE No.		G	F
Wt. BOTTLE + WATER + SOIL = W_{bws}	g	440.9	457.2
TEMPERATURE, (T_W)	°C	28	28
Wt. BOTTLE + WATER = W_{bwc} (From calibrated curve)	g	425.9	442.2
Wt. OF EVAP. OF DISH + DRY SOIL	g	-	-
Wt. OF EVAP. OF DISH	g	-	-
Wt. OVEN DRY SOIL = W_s	g	25	25
SG of Water at T_w		0.9980	0.9980
G_s		2.495	2.495

REMARKS

AVERAGE SPECIFIC GRAVITY (G_s) = 2.495

Enclosure No. 45

DETERMINATION OF SPECIFIC GRAVITY
(FINE AGGREGATES)

PROJECT No. GA 07 326 **PROJECT NAME:** Geo. Services for Wastewater Treatment Plant

SOURCE Client **SPECIMEN ID.** B 5/S 4

MATERIAL DESCRIPTION

TESTED BY A. B. **CHECKED BY** A. Budhram

TEST No.		1	2
BOTTLE No.		G	F
Wt. BOTTLE + WATER + SOIL = W_{bws}	g	453.4	460.0
TEMPERATURE, (T_W)	°C	28	28
Wt. BOTTLE + WATER = W_{bwc} (From calibrated curve)	g	438.0	444.6
Wt. OF EVAP. OF DISH + DRY SOIL	g	-	-
Wt. OF EVAP. OF DISH	g	-	-
Wt. OVEN DRY SOIL = W_s	g	25	25
SG of Water at T_w		0.9980	0.9980
G_s		2.600	2.600

REMARKS

AVERAGE SPECIFIC GRAVITY (G_s) = 2.600

Enclosure No. 46

Uplift Pressure Calculations

Structure ID	Existing Ground Elevations		Design Base Elevation	Assumed Water Table Elev	Overburden Pressures		Structure + concrete Pressure	Water Pressure	UPTHRUST			NET UPLIFT AT Critical Condition UPTHRUST		
					Max	Min			Total Max Pressure	Total Min Pressure	Average Pressure	Total Max Pressure	Total Min Pressure	Average Pressure
Clarifier Tank 1	4.9	3.8	-0.2	0	90	70	20.5	2	92	72	82	71	50	60
Clarifier Tank 2	3.8	3.1	-0.2	0	70	57	20.5	2	72	59	66	52	37	44
Clarifier Tank 3	3.7	3.6	-0.2	0	68	66	20.5	2	70	68	69	50	46	48
Clarifier Tank 4	4.2	2.7	-0.2	0	77	50	20.5	2	79	52	66	59	30	44
RAS WAS Pump Station	3.7	3.7	-2.4	0	67	67	27.5	23.5	90	90	90	63	63	63

Total Net downward Pressure after Infill			Structure ID
Total Max downward	Total Min downward	Average downward	
-9	12	2	Clarifier Tank 1
10	25	18	Clarifier Tank 2
12	16	14	Clarifier Tank 3
3	32	18	Clarifier Tank 4
7	7	7	RAS WAS

APPENDIX I

ENVIRONMENTAL ENGINEERING LABORATORY

Soil Testing Report

Client: Geotech and Associates Ltd

Date Rec'd June, 2009

Report Date: 01 July, 2009

Project: **GA 07326 –WASA Waste water sludge system**

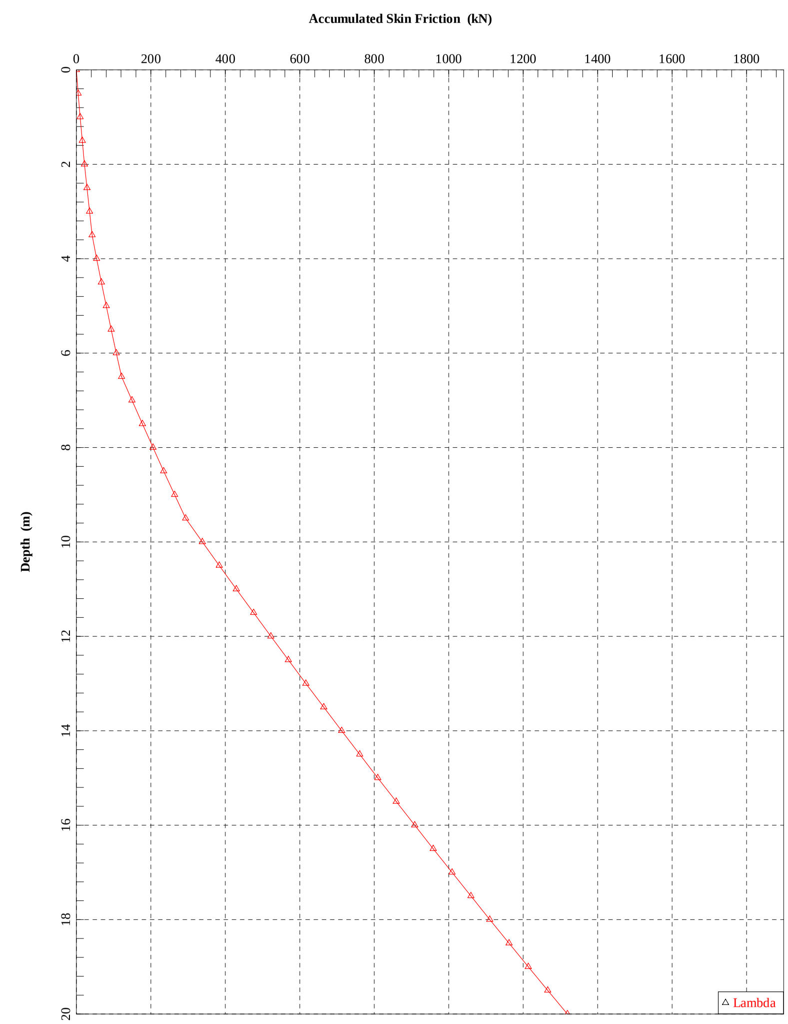
No.	Sample Source	pH	Sulphate %	Chlorides %
1	BH 3 SA 4 10.0 –11.5 ft	7.15	0.005	0.034
2	BH 2 SA 7 25.0 – 26.5ft	7.94	0.020	0.353
3	BH 4 SA 1 2.5 – 4.0 ft	6.87	0.004	0.086
4	BH 8 SA 6 20.0 – 21.5 ft	7.71	0.027	0.129
5	BH 9 SA6 15.0 – 16.5 ft	7.47	0.015	0.033
6	BH 6 SA6 20.0 – 21.5 ft	7.49	0.012	0.254
7	BH 1 SA 3 7.5 – 9.0 ft	7.22	0.006	0.274

Note: Samples were tested in accordance with BS: 1377: Part 3: 1990 – Total (acid Soluble) Sulfate, Electrometric- water soluble pH and Mercuric chloride – water soluble Chloride method

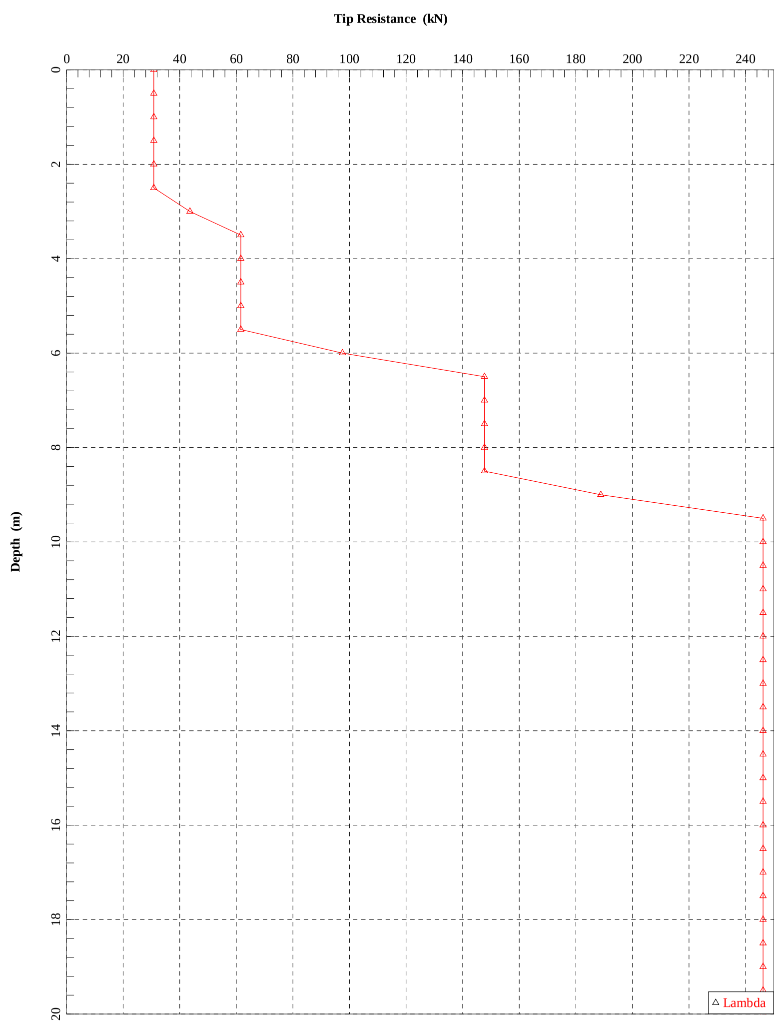
Althea Richardson
Senior Laboratory Technician
UWI

THE UNIVERSITY OF THE WEST INDIES
FACULTY OF ENGINEERING
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

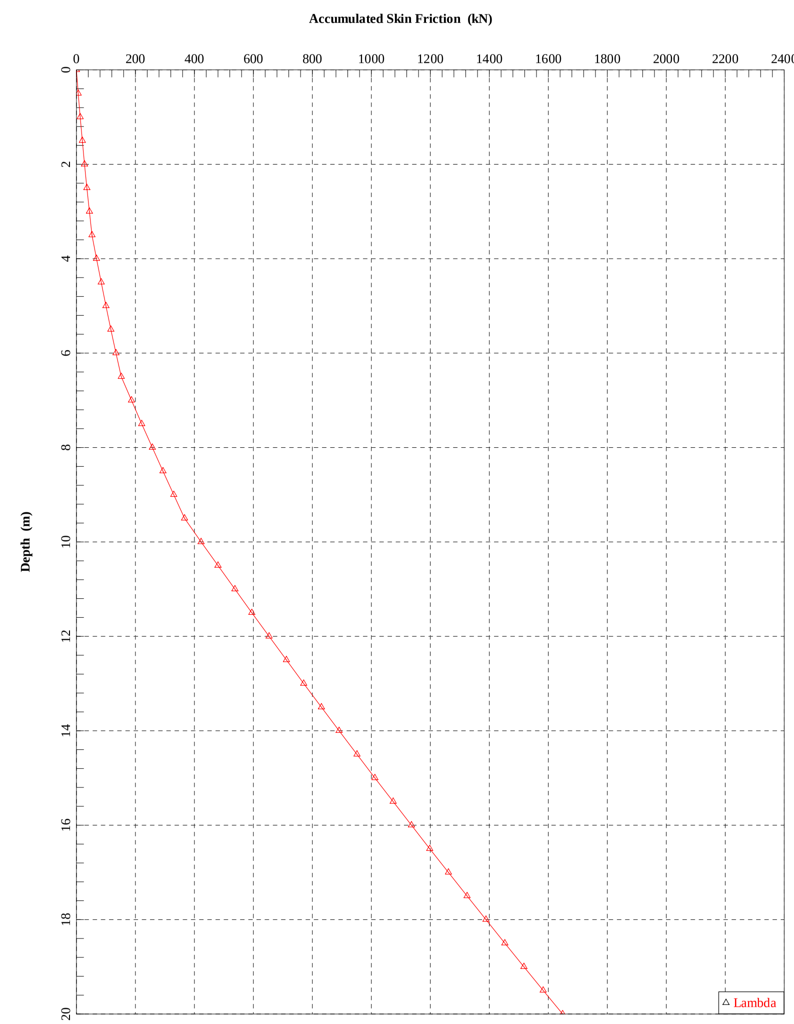
APPENDIX II



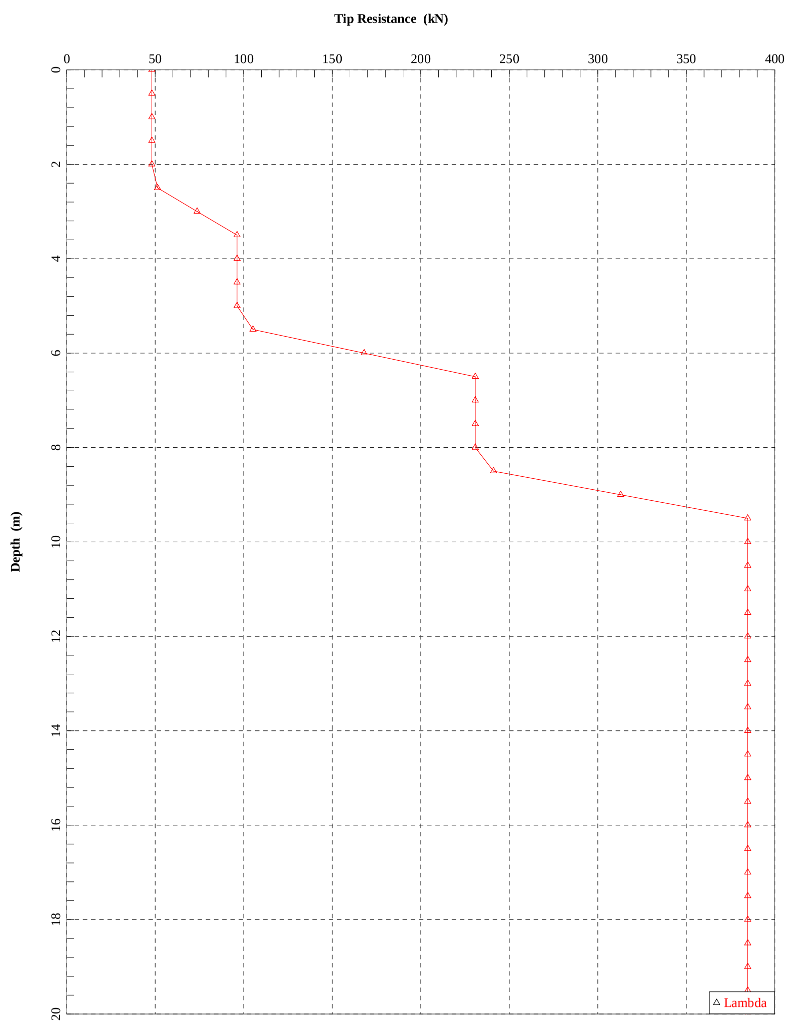
Bioreactors and Screen Facility - 406mm Octagonal PPC Pile



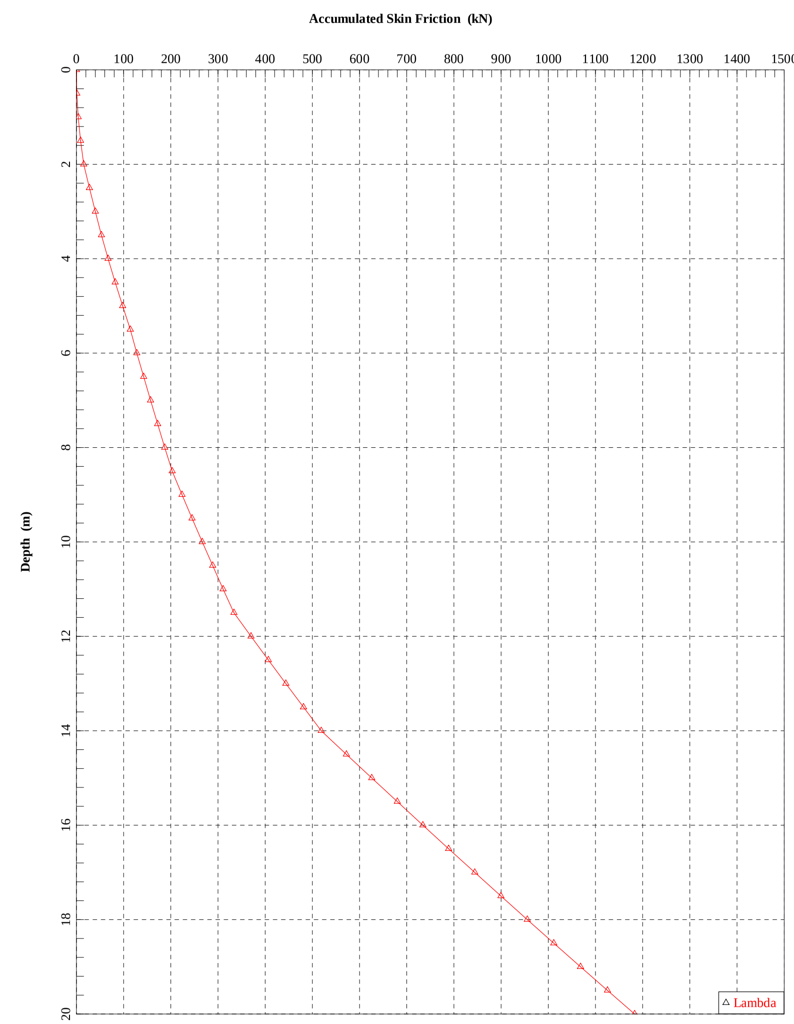
Bioreactors and Screen Facility - 406mm Octagonal PPC Pile



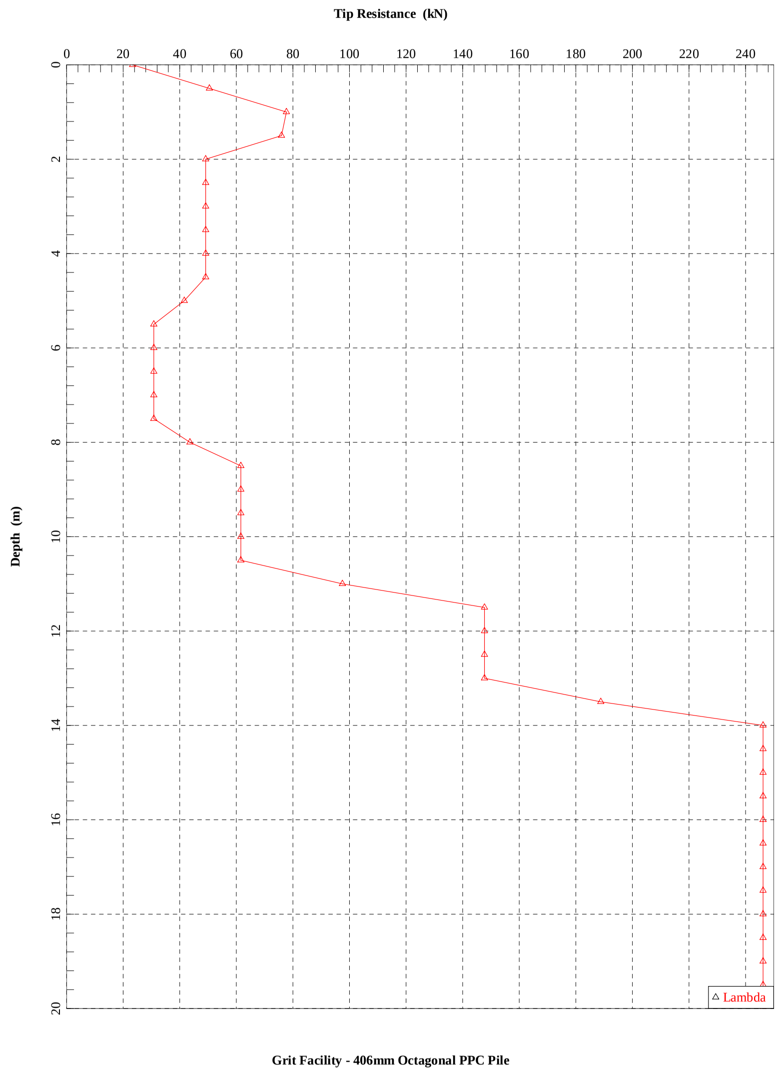
Bioreactors and Screen Facility - 508mm Octagonal PPC Pile



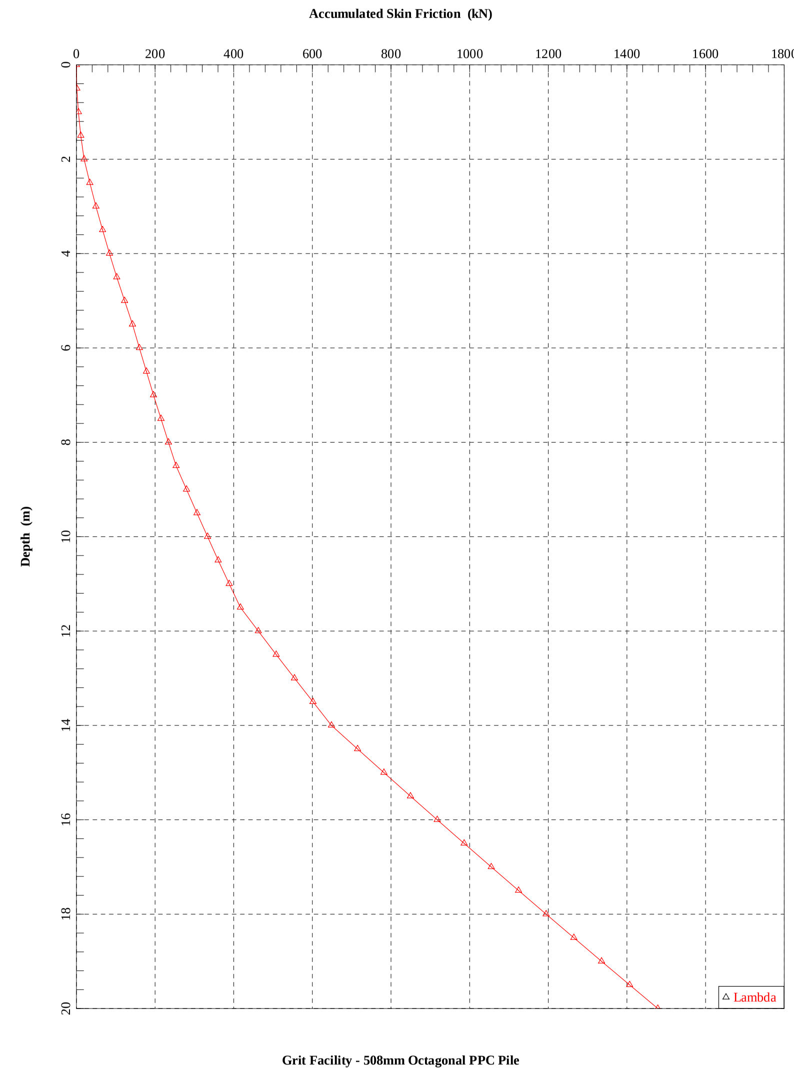
Bioreactors and Screen Facility - 508mm Octagonal PPC Pile



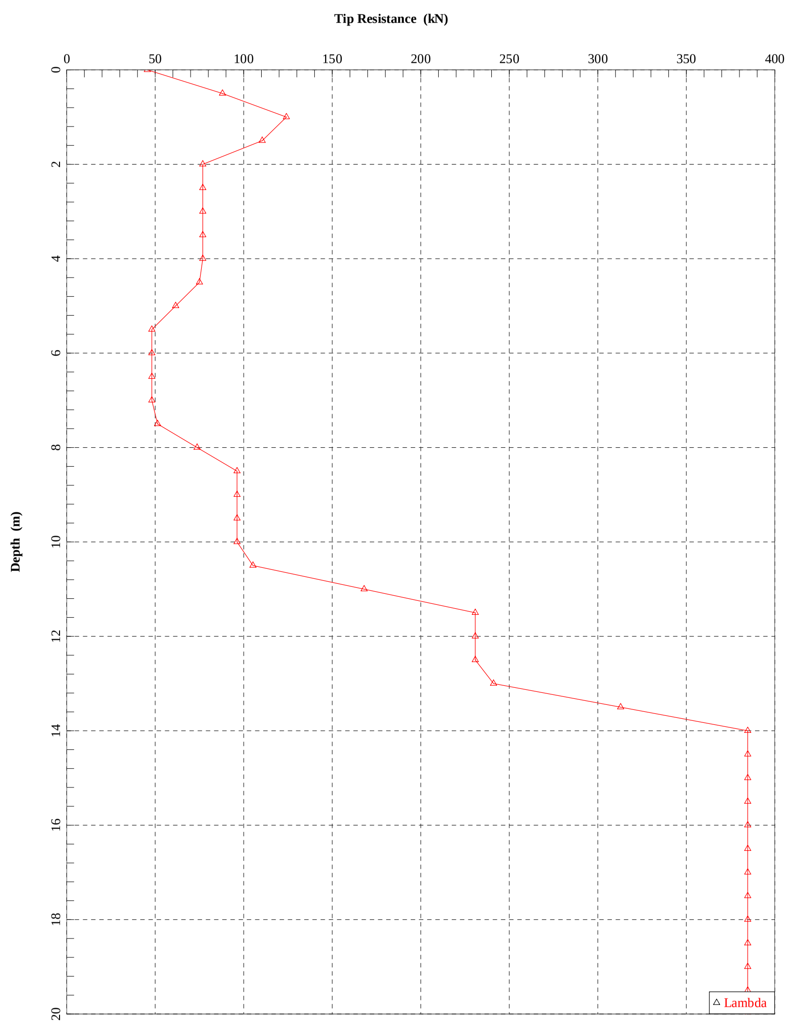
Grit Facility - 406mm Octagonal PPC Pile



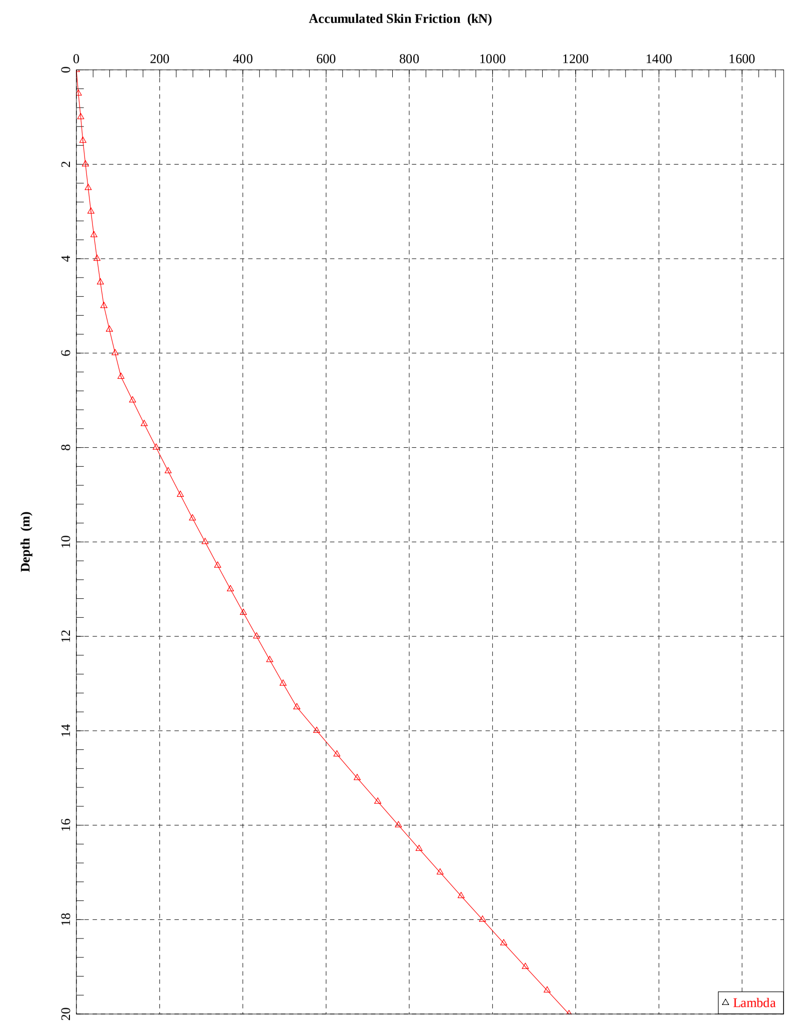
Grit Facility - 406mm Octagonal PPC Pile



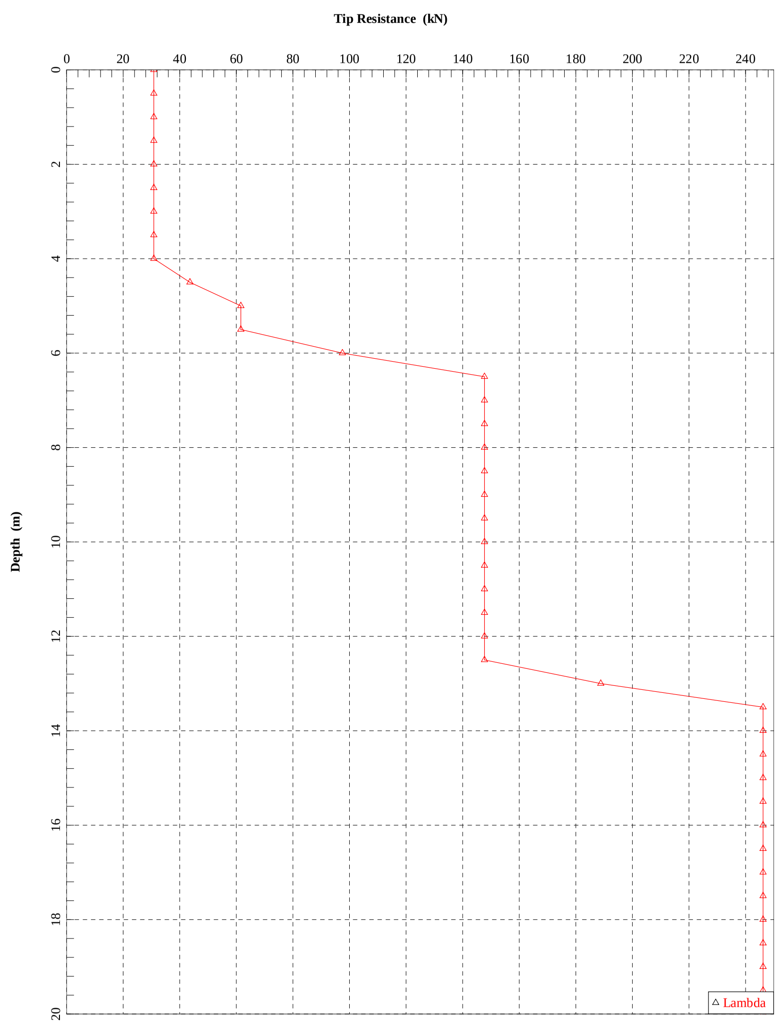
Grit Facility - 508mm Octagonal PPC Pile



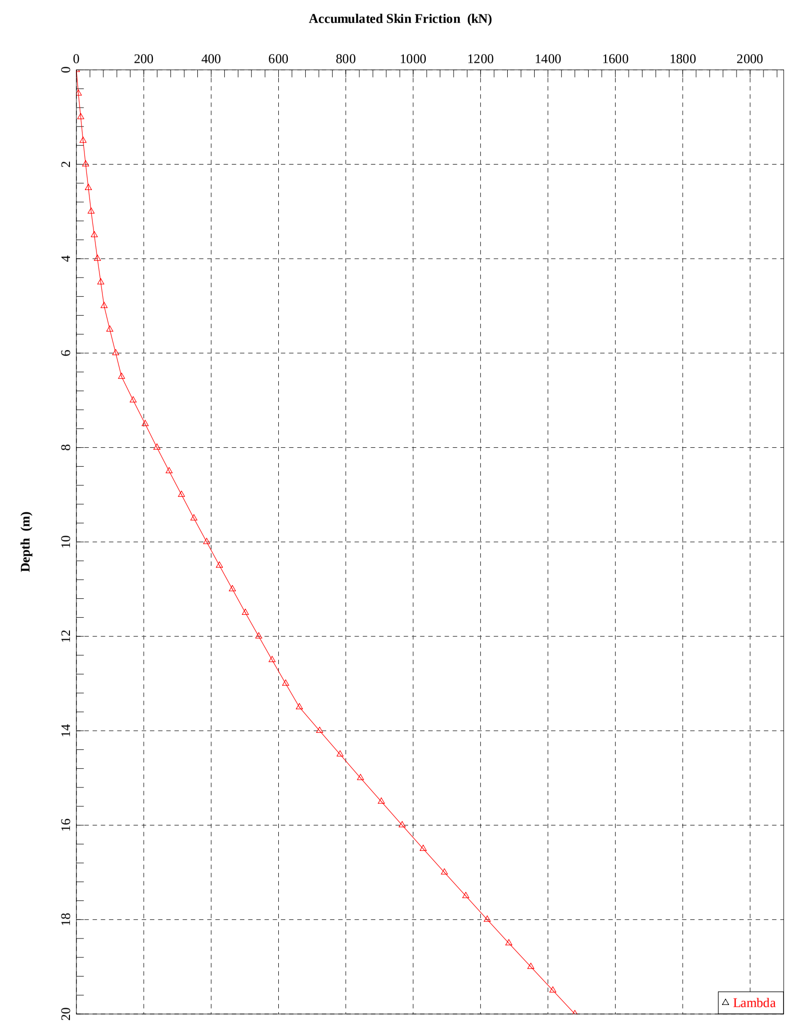
Grit Facility - 508mm Octagonal PPC Pile



UV Disinfection, Filtration and Chlorination Facilities - 406mm Octagonal PPC Pile

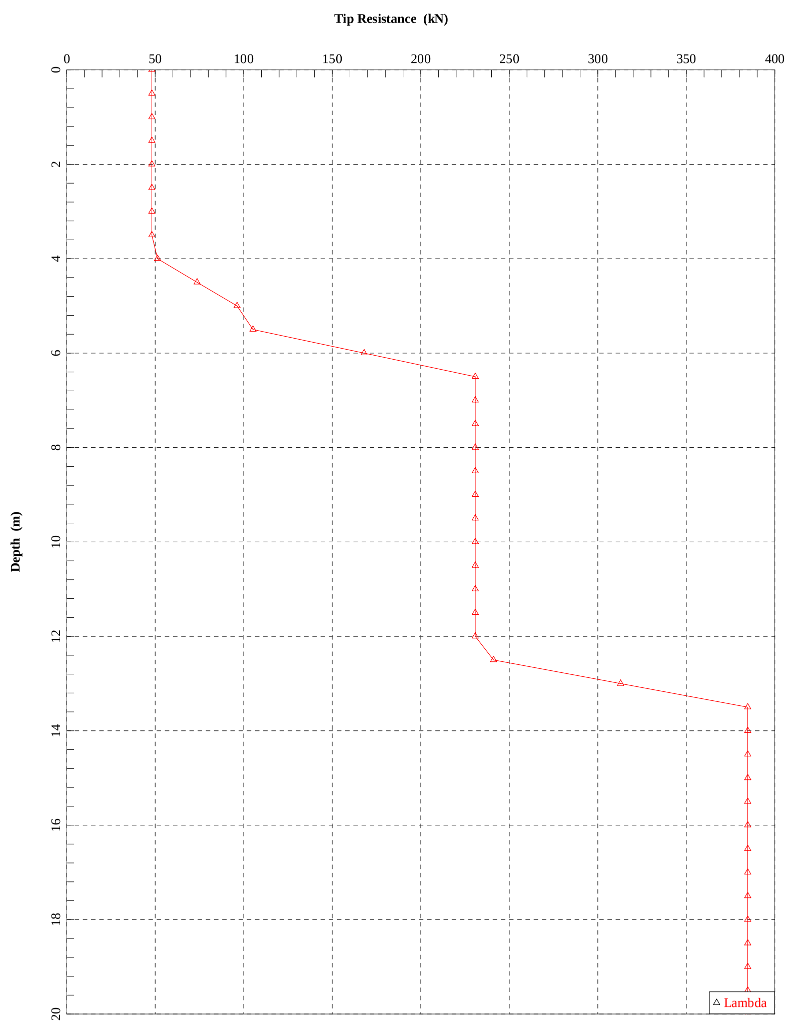


UV Disinfection, Filtration and Chlorination Facilities - 406mm Octagonal PPC Pile

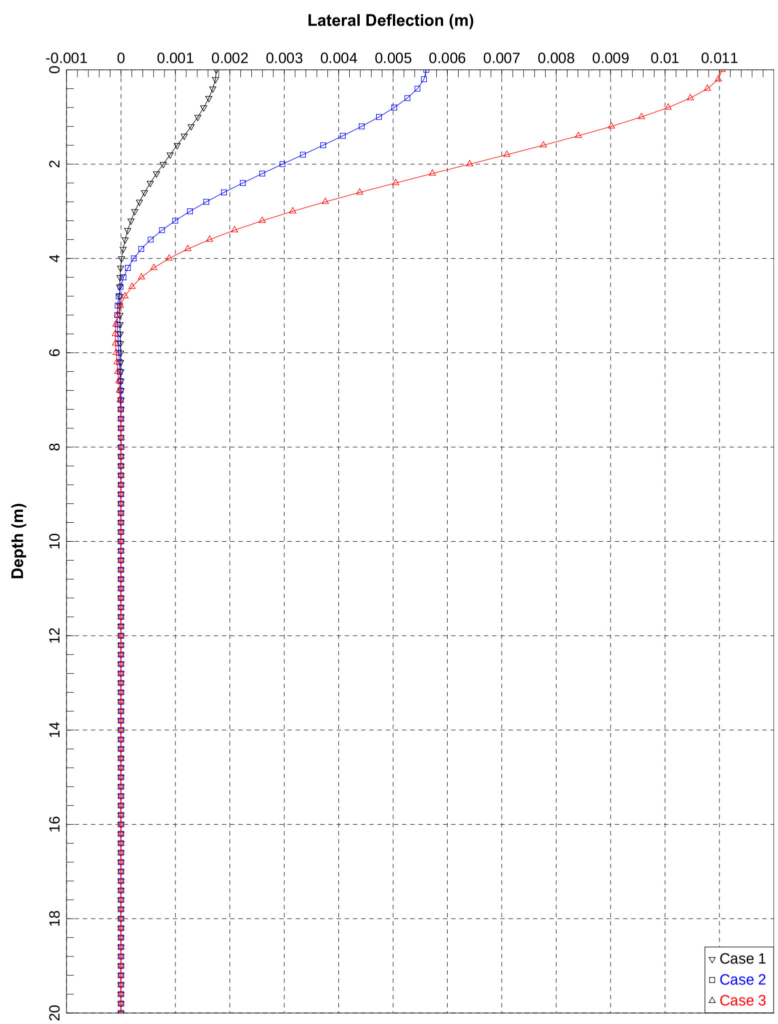


UV Disinfection, Filtration and Chlorination Facilities - 508mm Octagonal PPC Pile

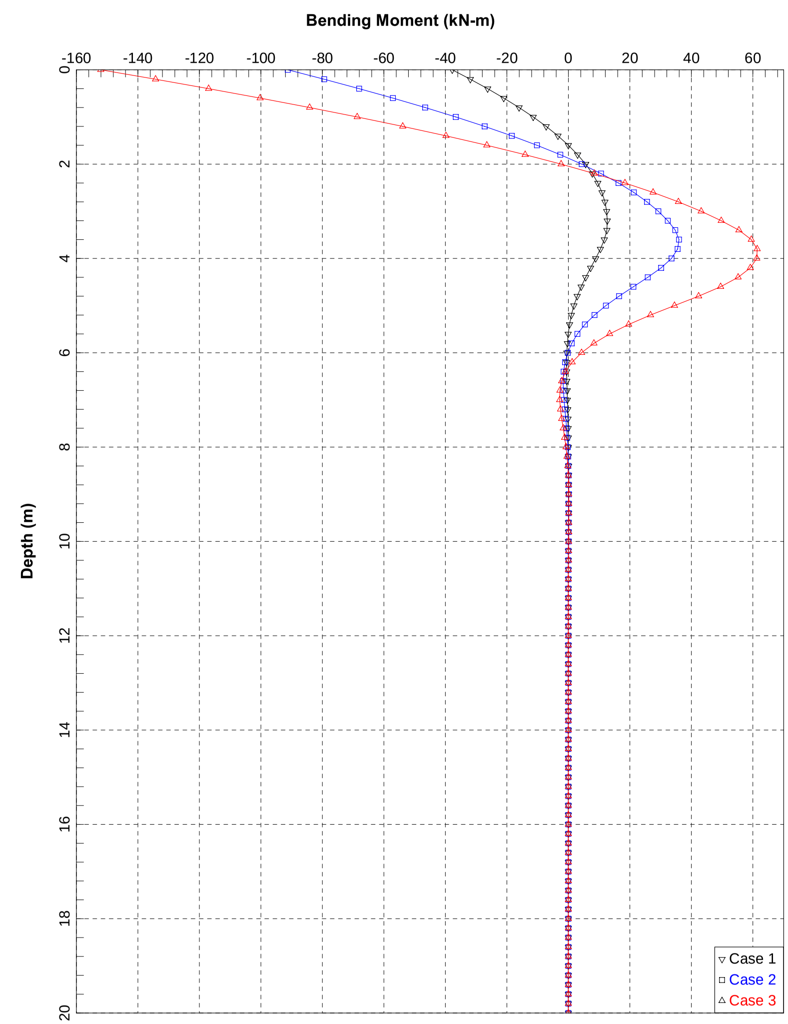
APPENDIX III



UV Disinfection, Filtration and Chlorination Facilities - 508mm Octagonal PPC Pile



Bioreactors and Screen Facility 400mm Octagonal PPC Pile Lateral Load 30kN/60kN/90kN



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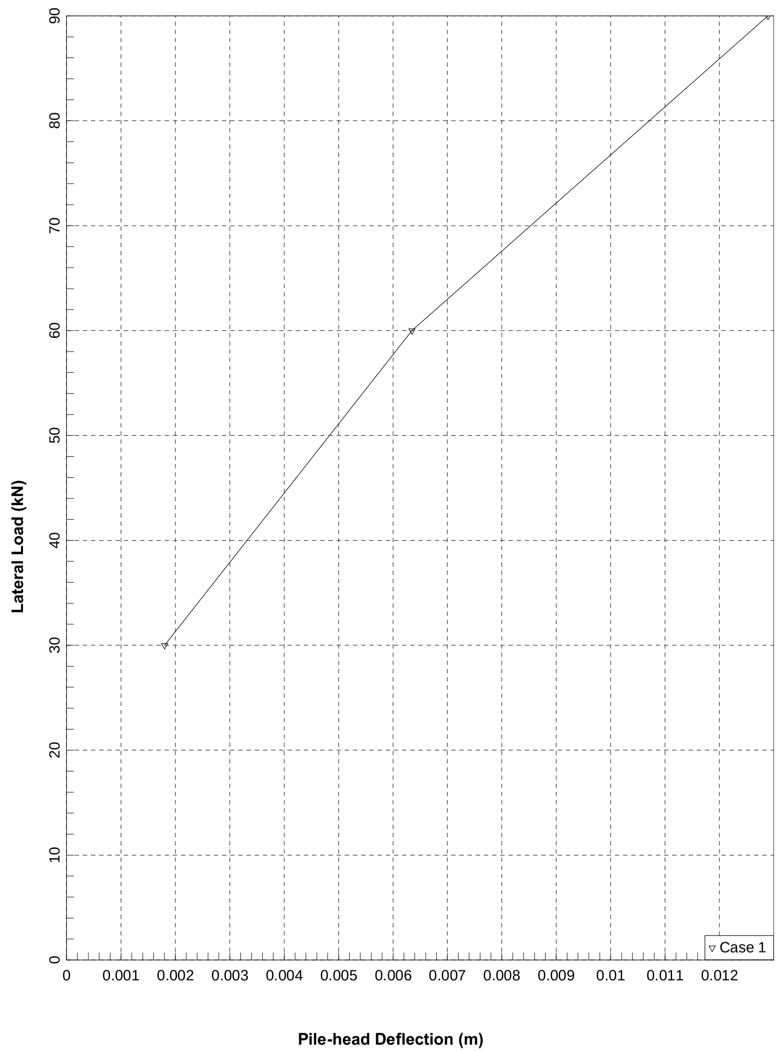
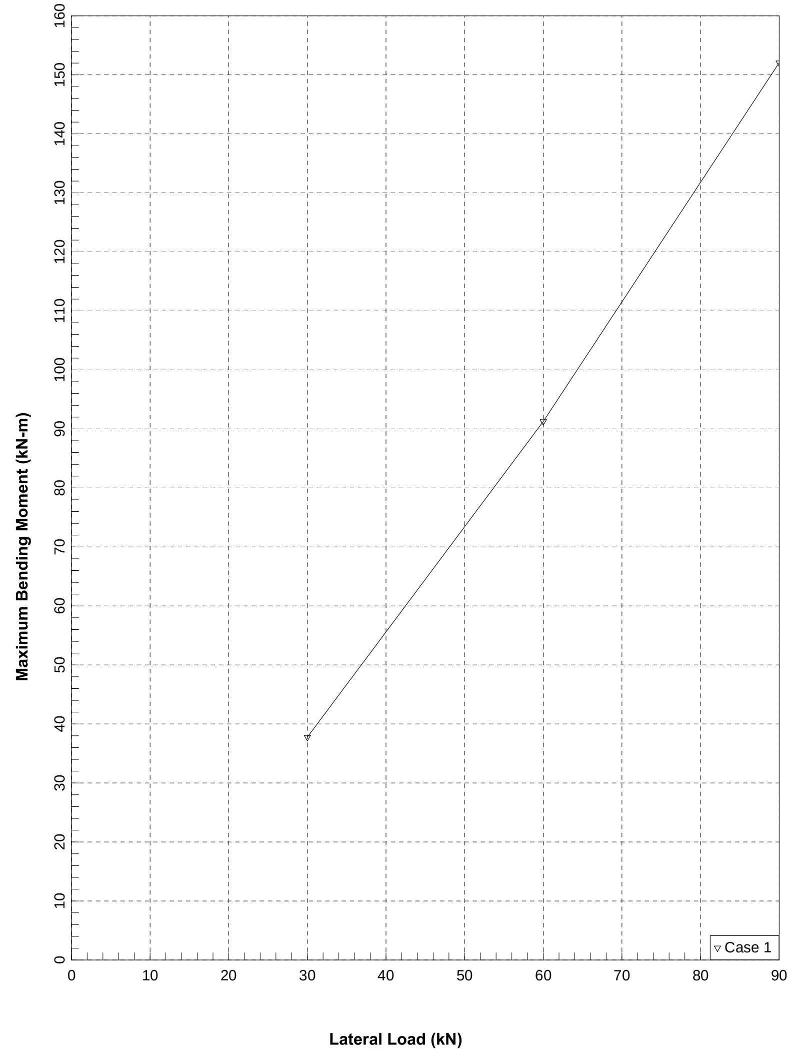
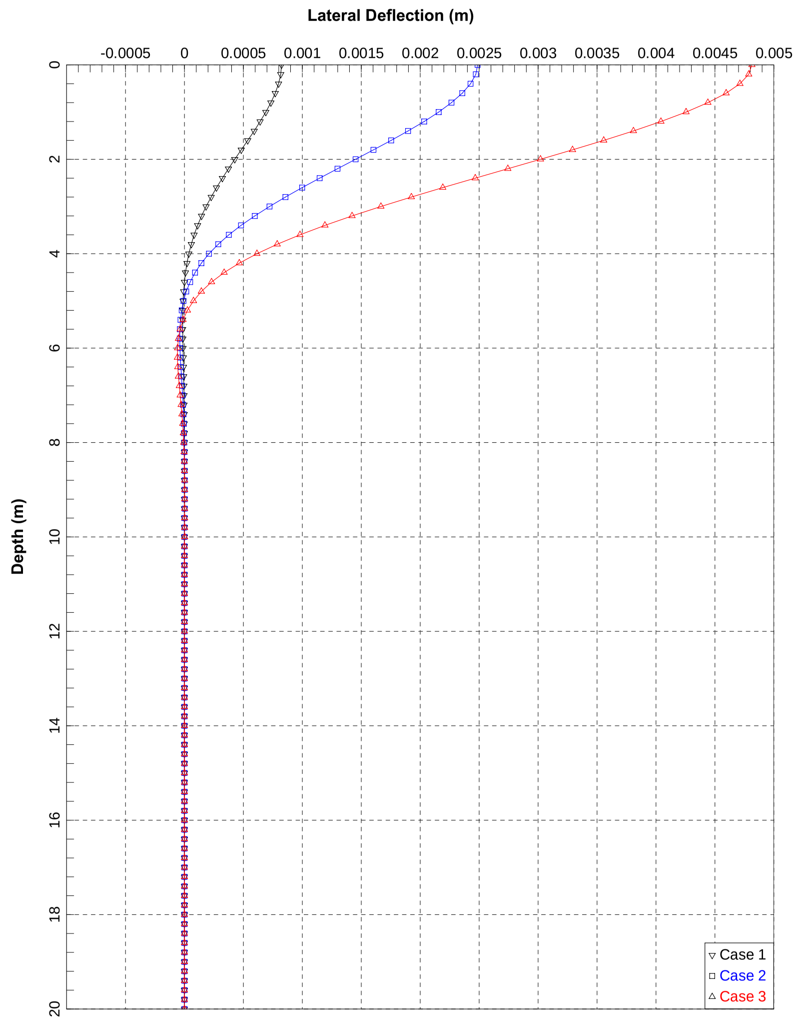


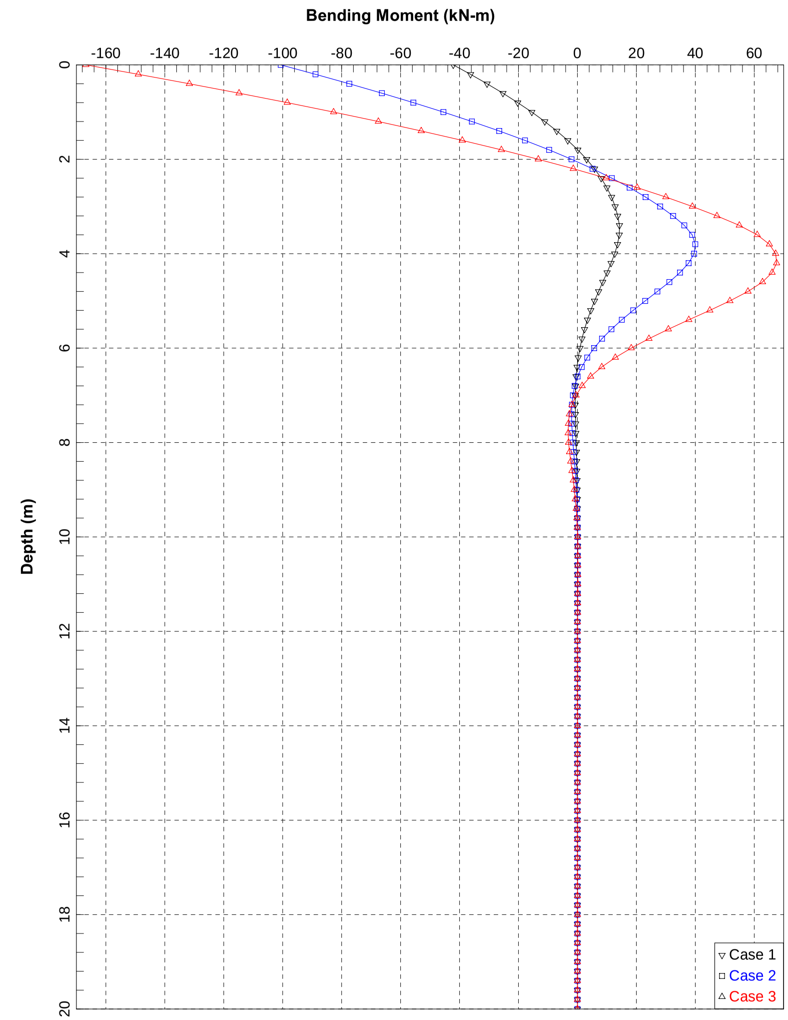
UV Disinfection, Filtration and Chlorination Facilities 406mm Octagonal PPC Pile Lateral Load 30kN/60kN/90kN



Bioreactors and Screen Facility 400mm Octagonal PPC Pile Lateral Load 30kN/60kN/90kN



Bioreactors and Screen Facility 500mm Octagonal PPC Pile Lateral Load 30kN/60kN/90kN



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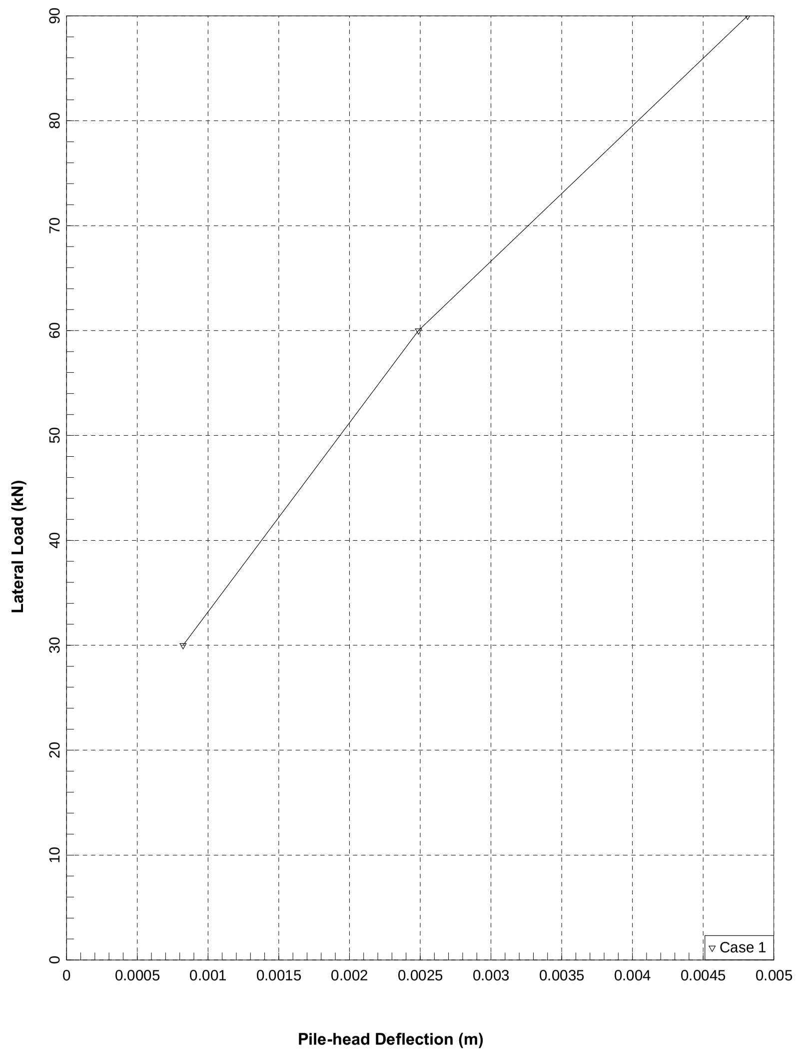
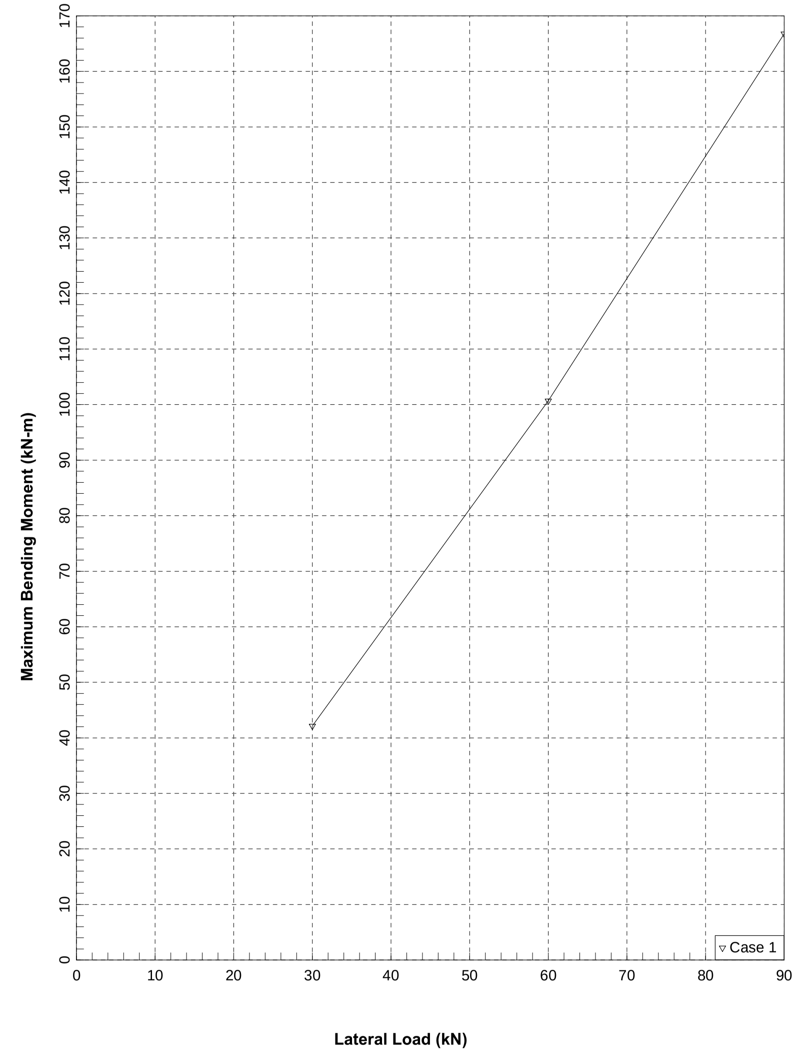
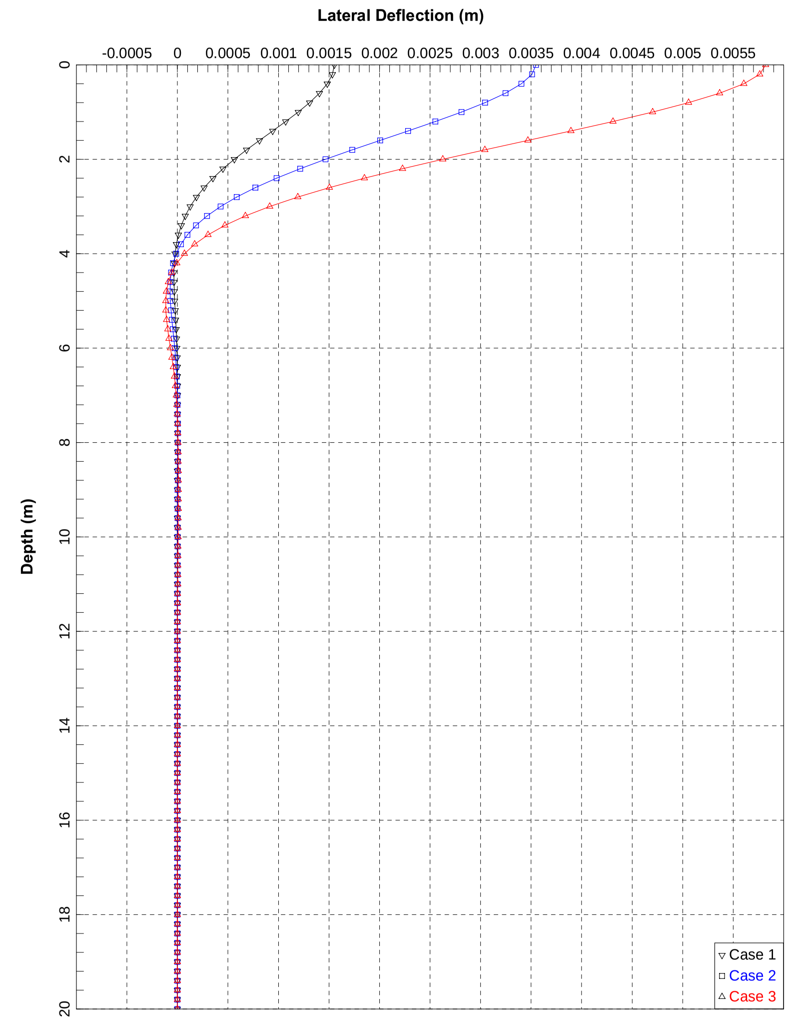


Bioreactors and Screen Facility 500mm Octagonal PPC Pile Lateral Load 30kN/60kN/90kN

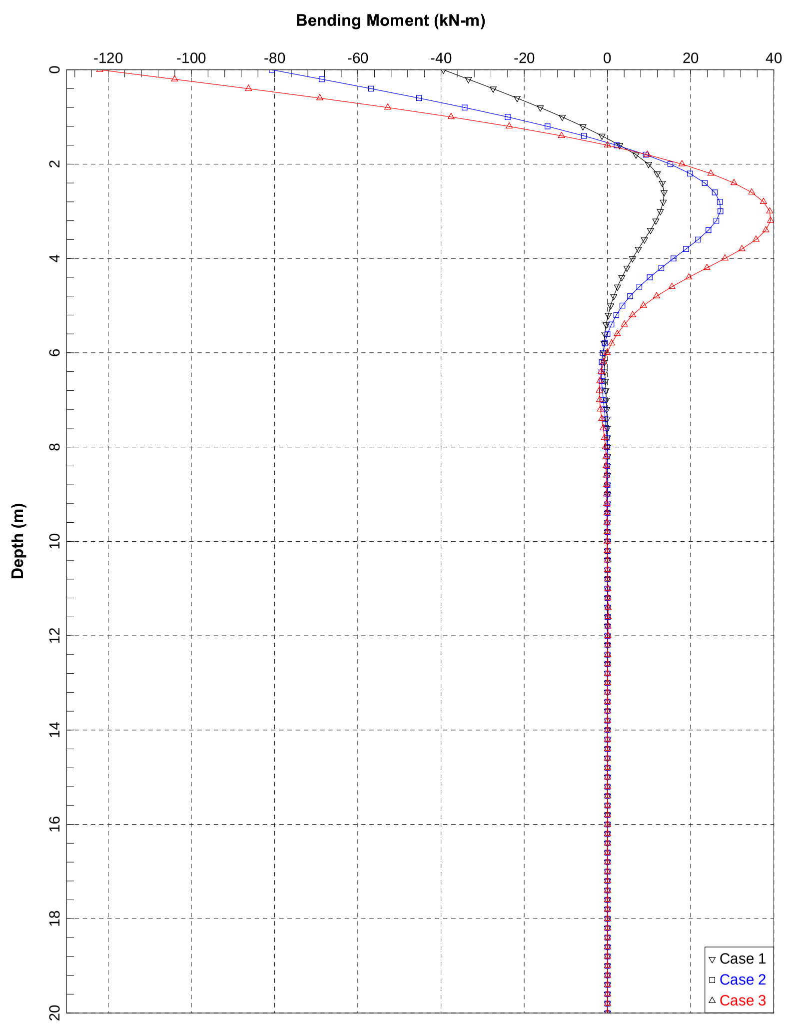


Bioreactors and Screen Facility 500mm Octagonal PPC Pile Lateral Load 30kN/60kN/90kN

APPENDIX IV



Grit Facility 400mm Octagonal PPC Pile Lateral Load 30kN/60kN/90kN



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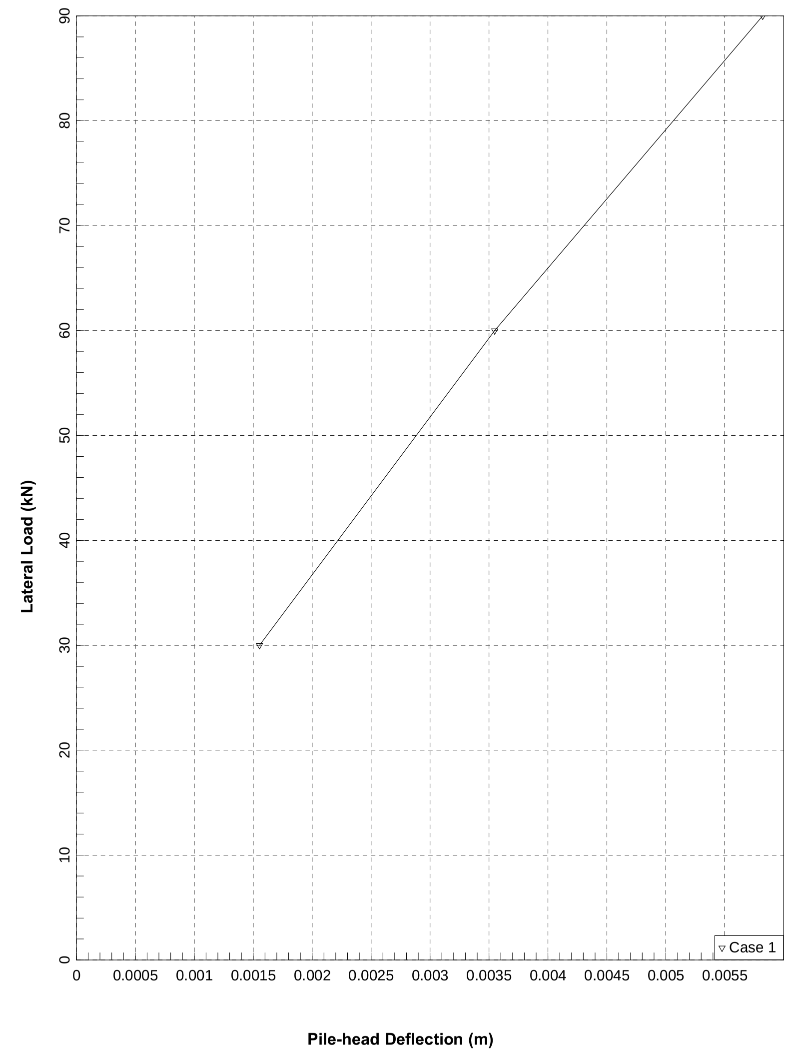

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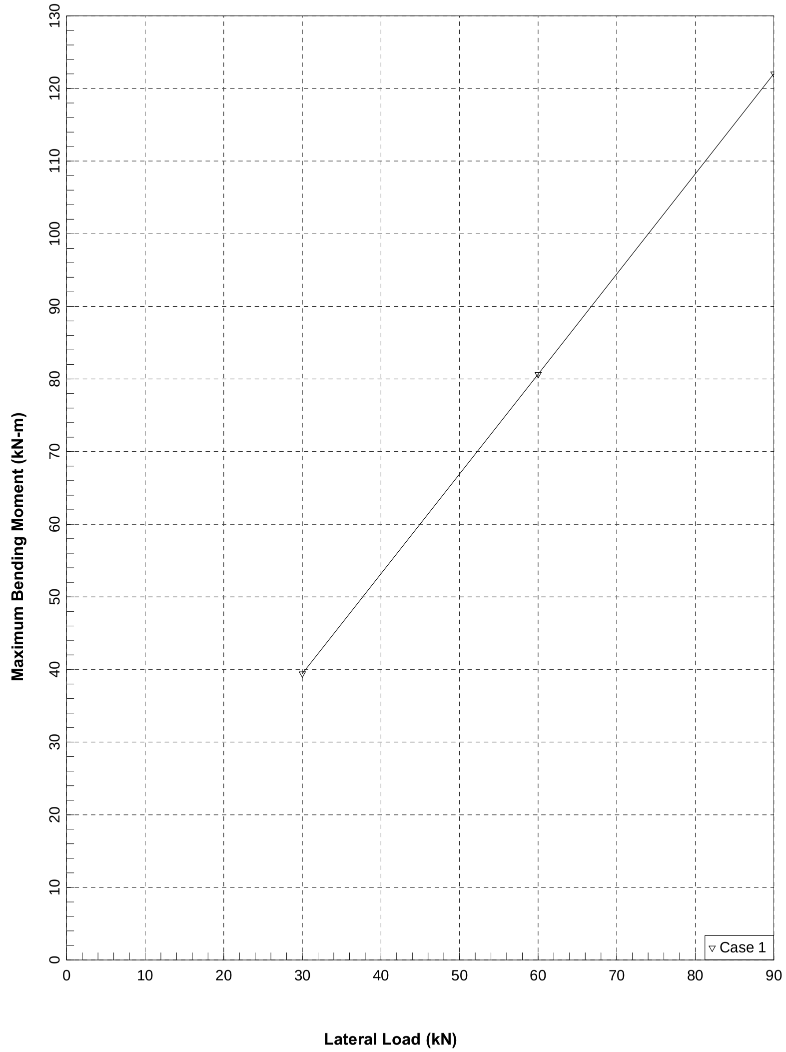

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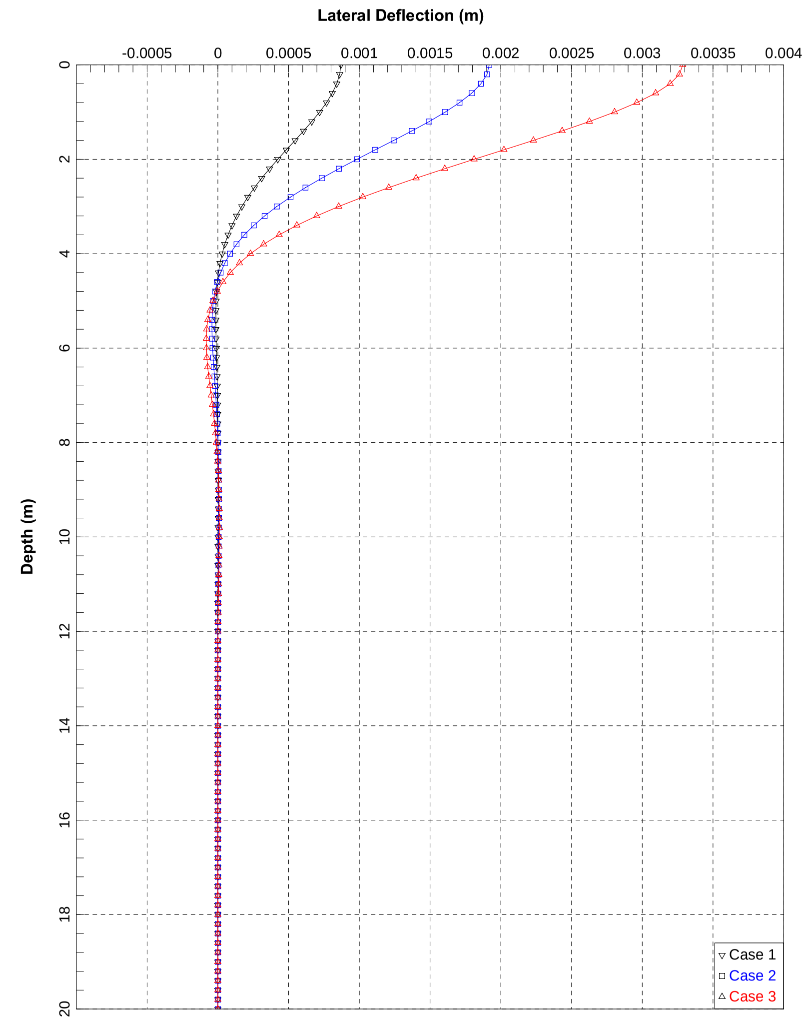
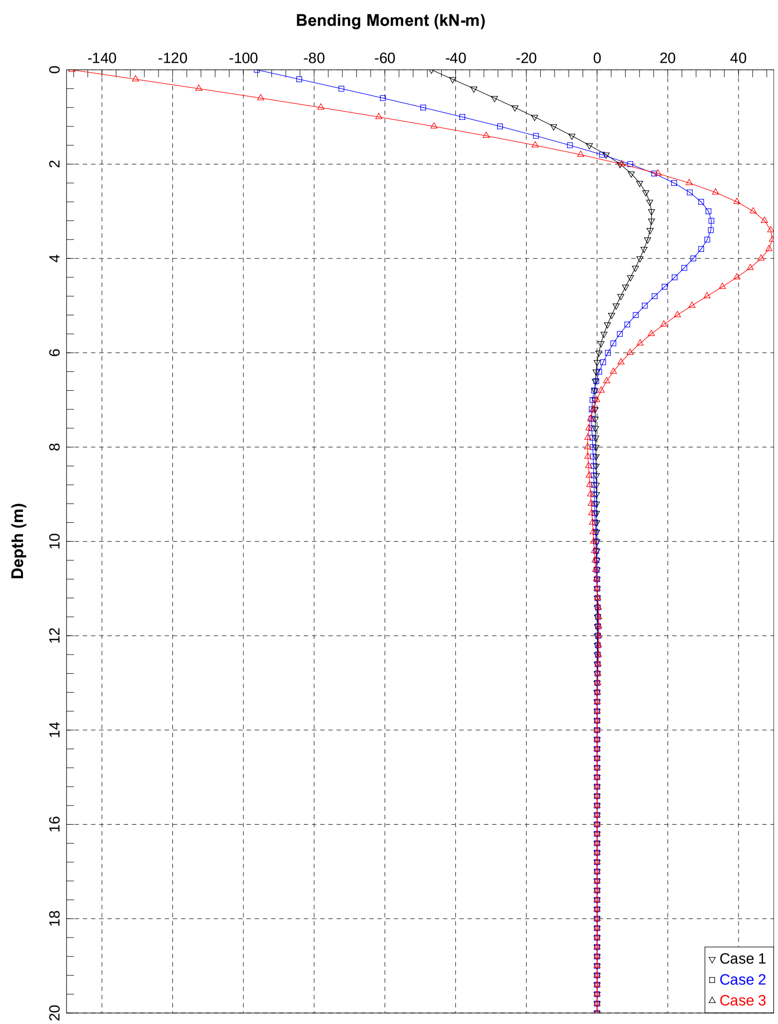


Grit Facility 500mm Octagonal PPC Pile Lateral Load 30kN/60kN/90kN



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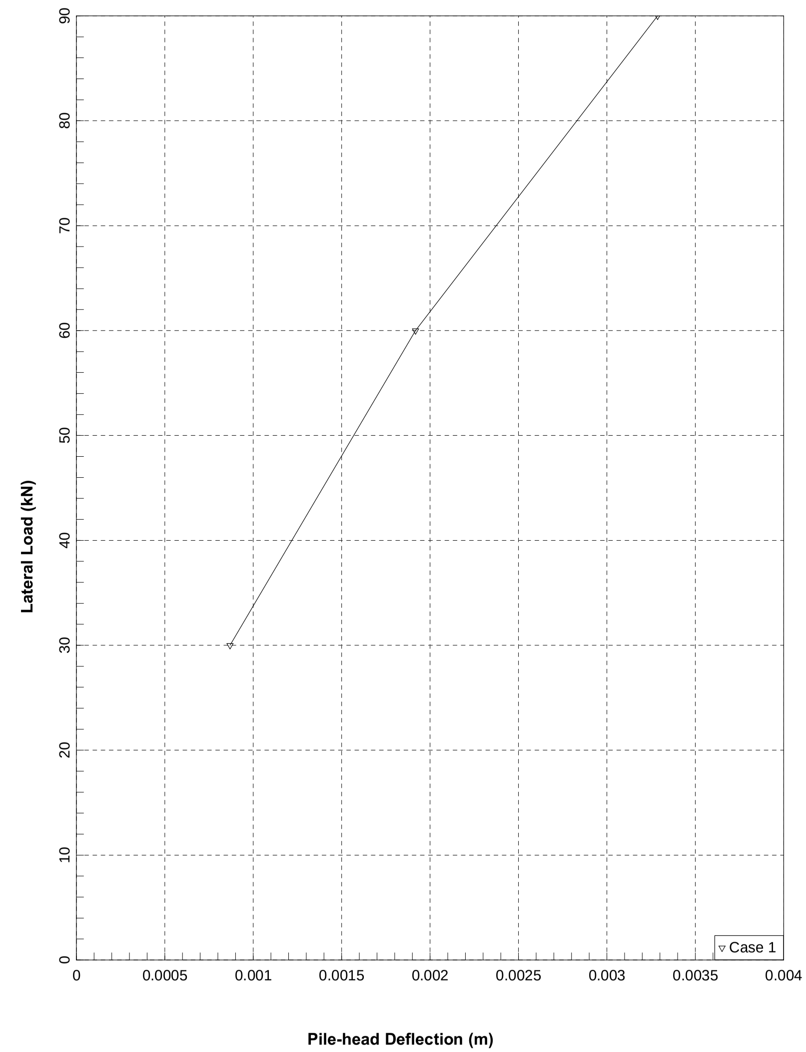
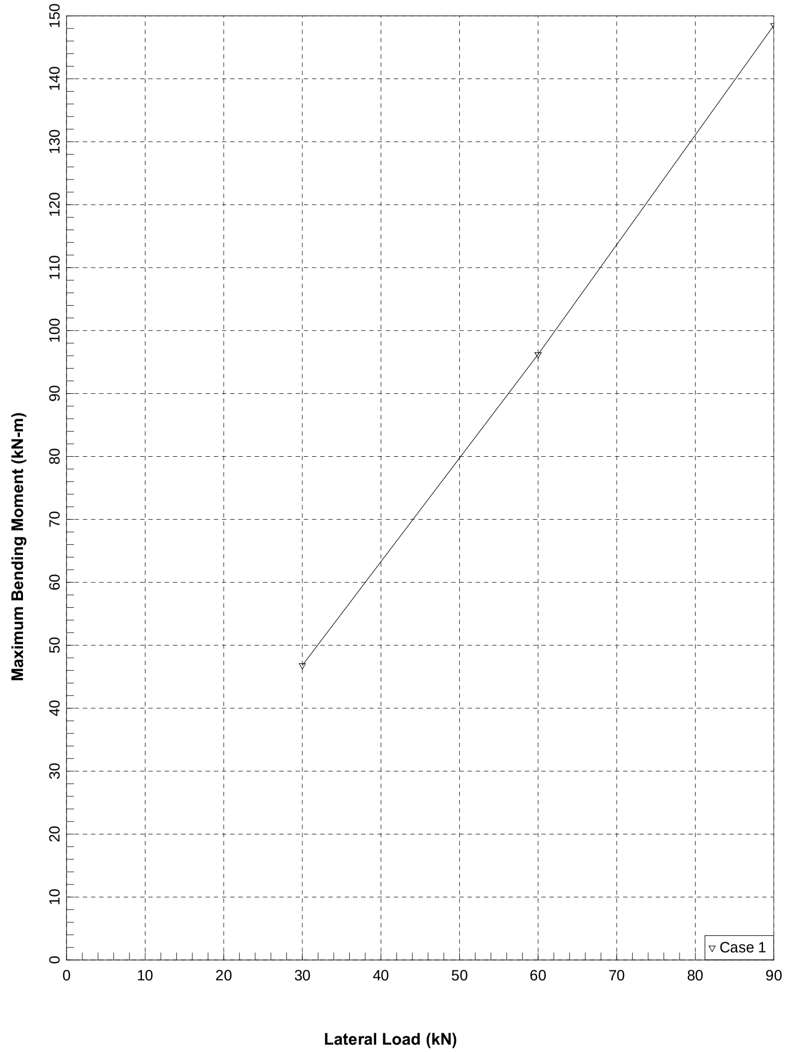
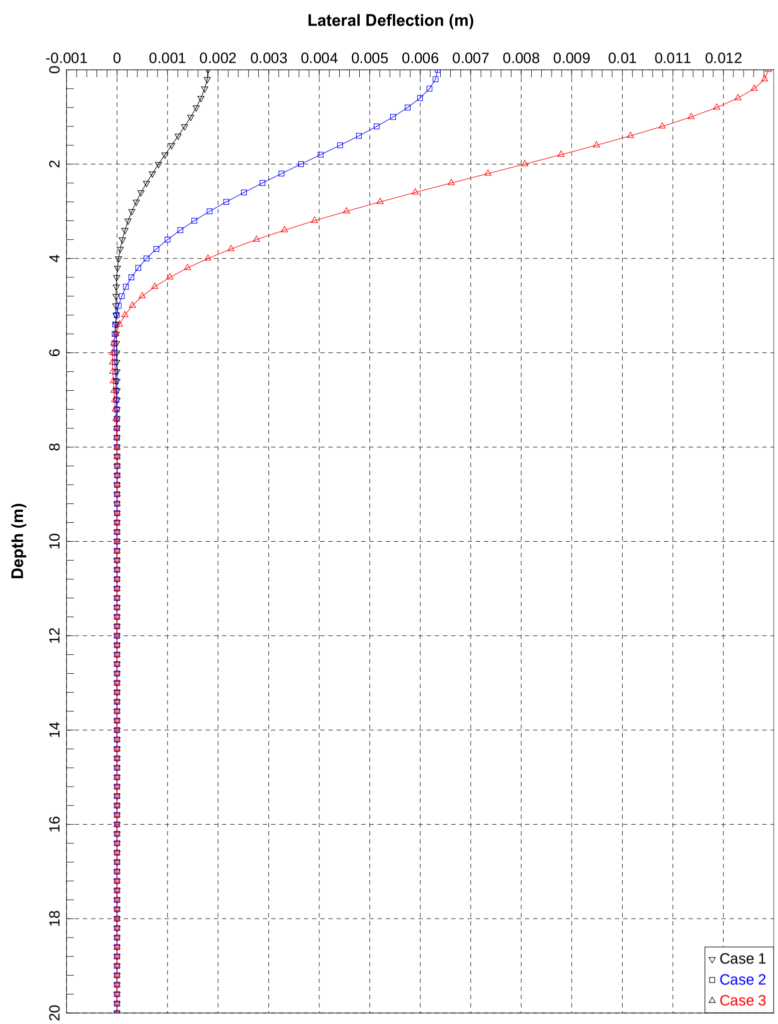


Grit Facility 500mm Octagonal PPC Pile Lateral Load 30kN/60kN/90kN

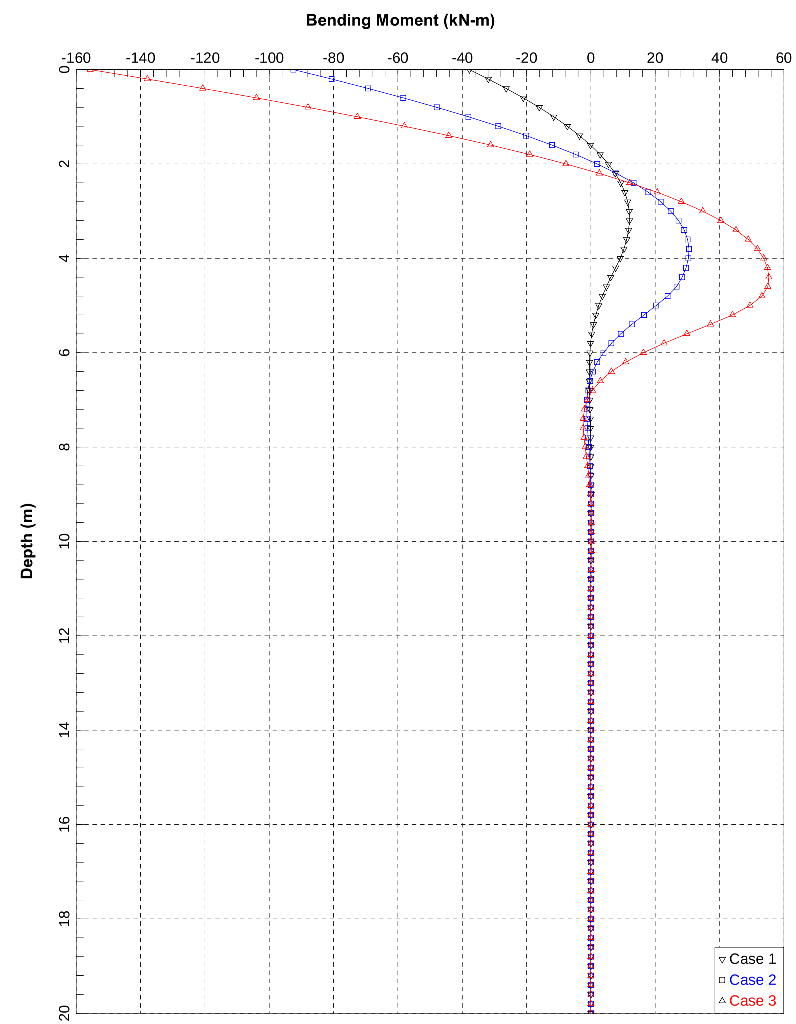
APPENDIX V



Grit Facility 500mm Octagonal PPC Pile Lateral Load 30kN/60kN/90kN



UV Disinfection, Filtration and Chlorination Facilities 406mm Octagonal PPC Pile Lateral Load 30kN/60kN/90kN



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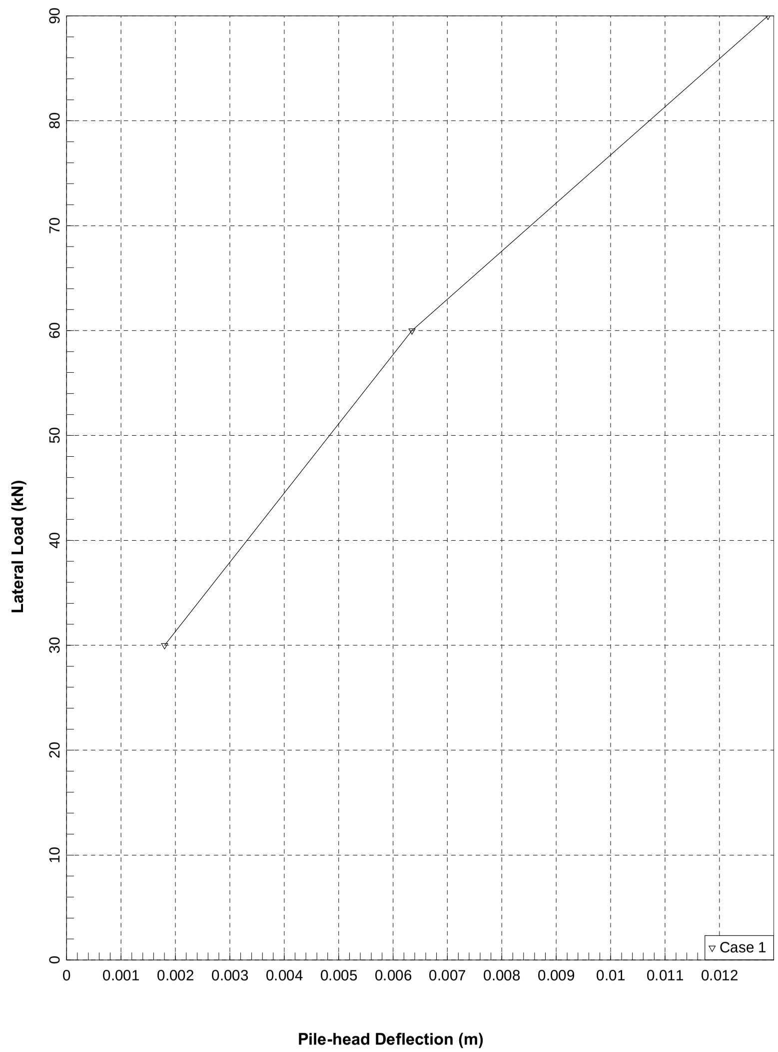
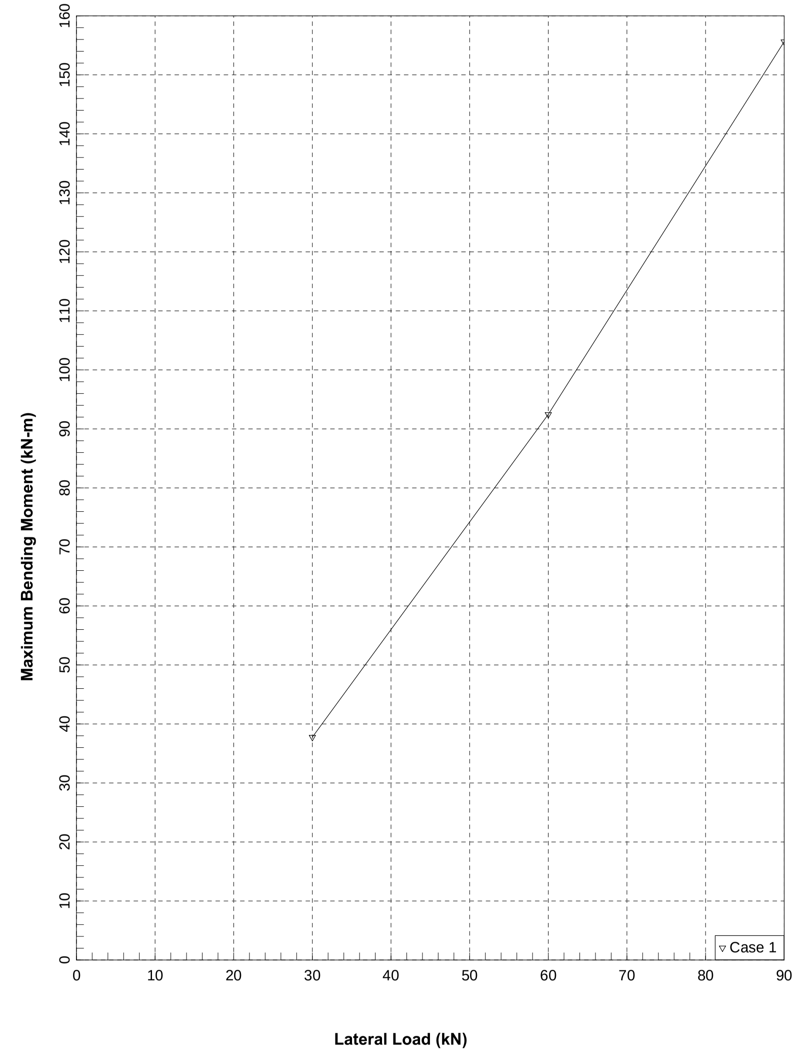
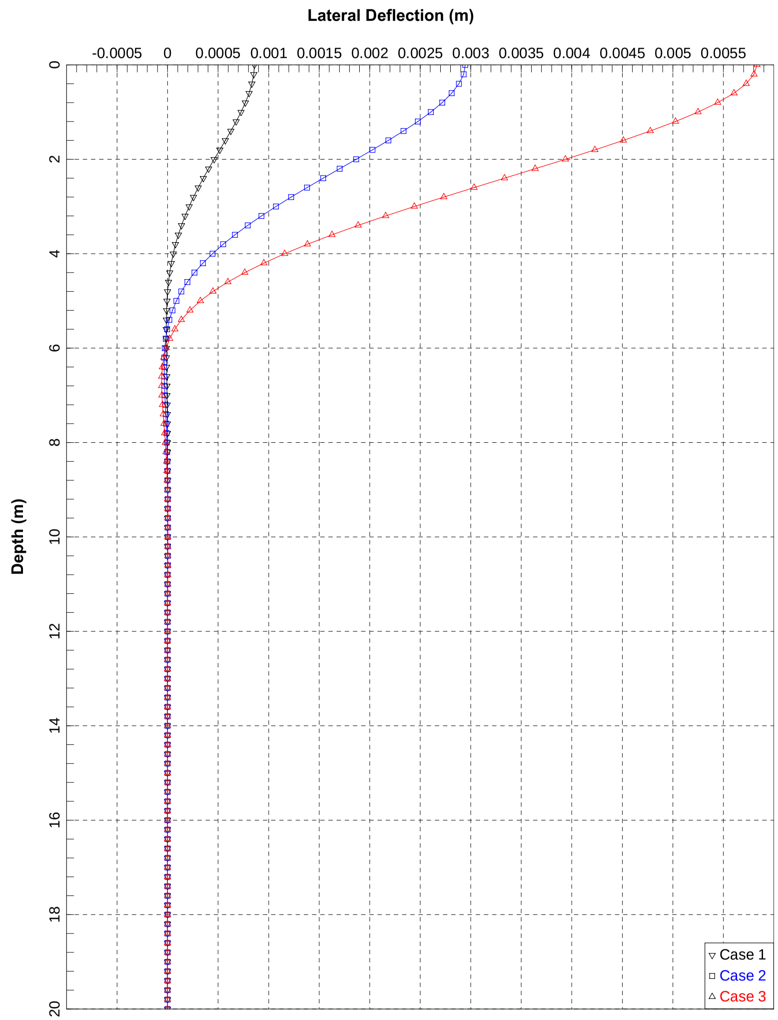


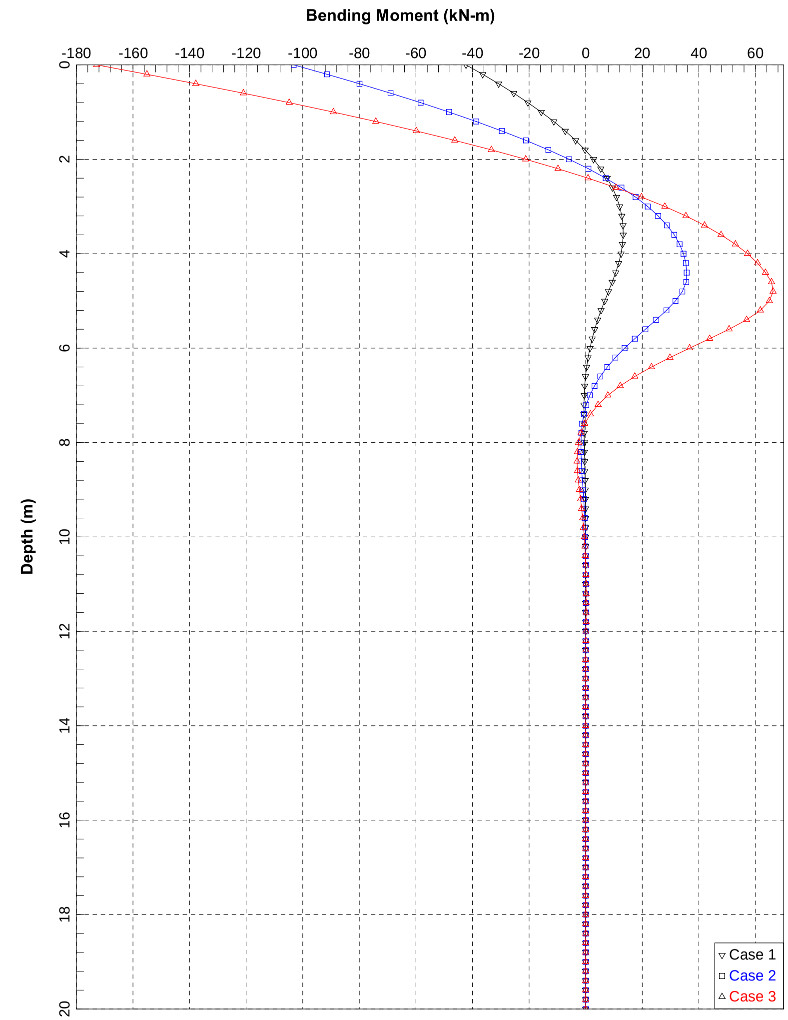
UV Disinfection, Filtration and Chlorination Facilities 406mm Octagonal PPC Pile Lateral Load 30kN/60kN/90kN



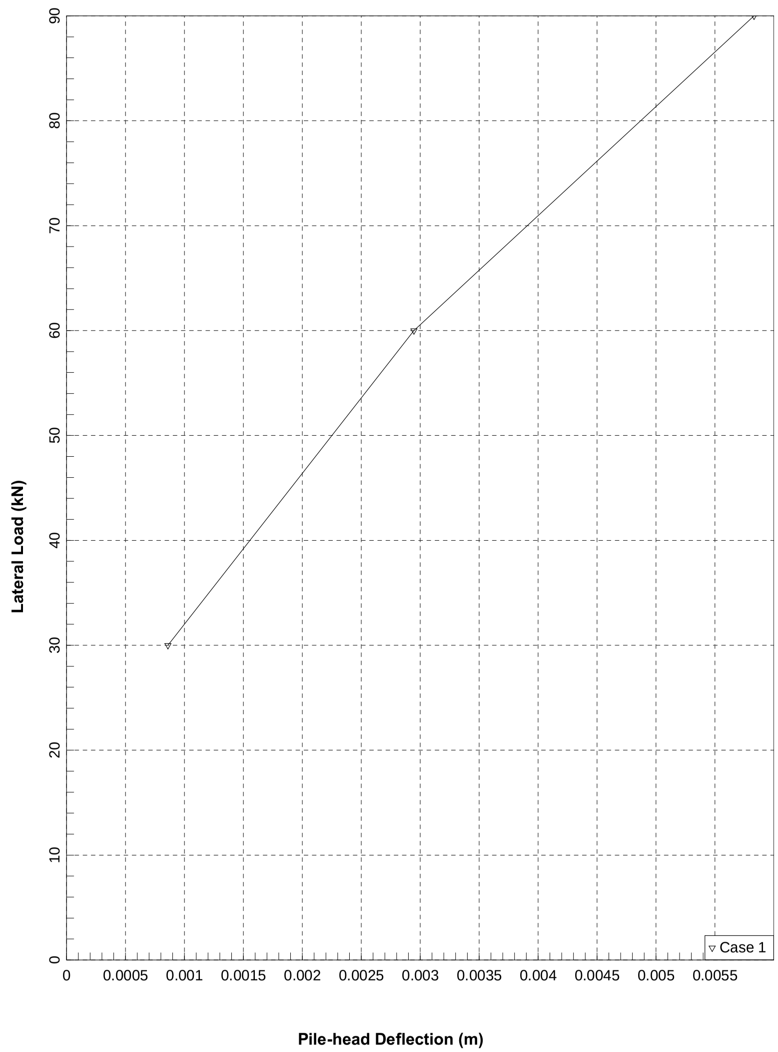
UV Disinfection, Filtration and Chlorination Facilities 406mm Octagonal PPC Pile Lateral Load 30kN/60kN/90kN



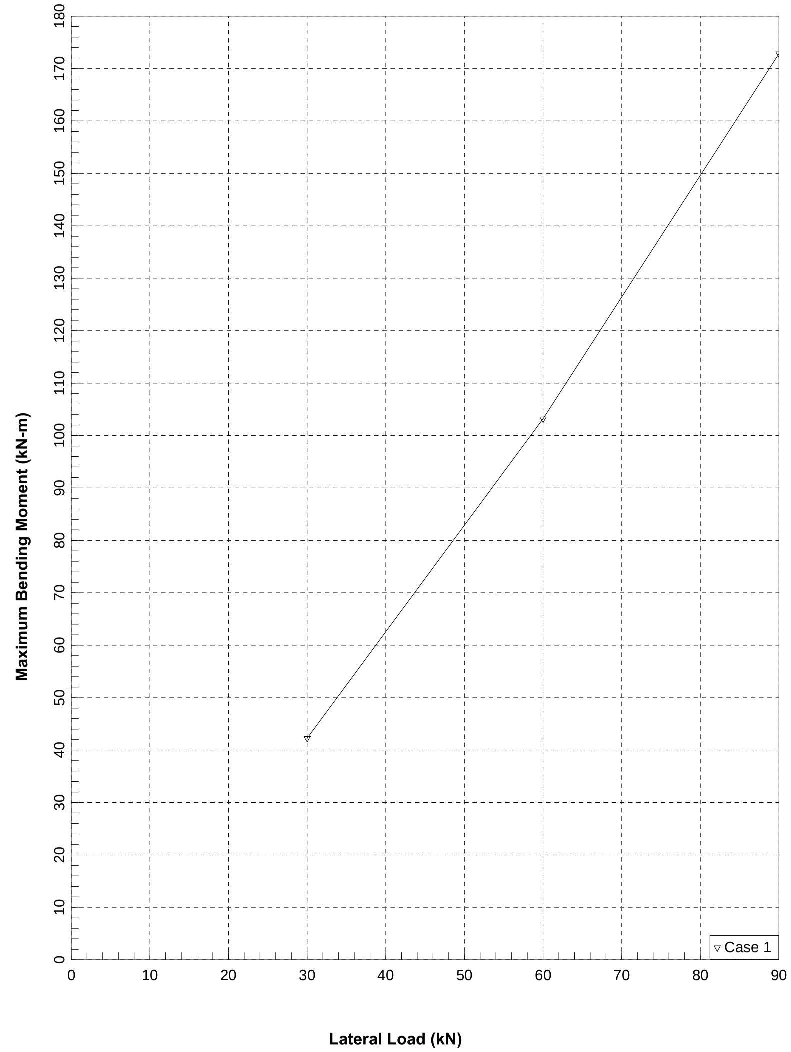
UV Disinfection, Filtration and Chlorination Facilities 500mm Octagonal PPC Pile Lateral Load 30kN/60kN/90kN



UV Disinfection, Filtration and Chlorination Facilities 500mm Octagonal PPC Pile Lateral Load 30kN/60kN/90kN



UV Disinfection, Filtration and Chlorination Facilities 500mm Octagonal PPC Pile Lateral Load 30kN/60kN/90kN



UV Disinfection, Filtration and Chlorination Facilities 500mm Octagonal PPC Pile Lateral Load 30kN/60kN/90kN

APPENDIX VI

ReWaRD		Page no	1
		Job no	
		Engineer	
		Revision	
		Date	8/12/2009
		Checked	
Document: C:\MyFiles\andrew docs\andrew calc\Reward Files\San Fernando WWTP\Clarifier Tanks.RWD		ReWaRD 2.5 Update 21	
Licensed to: Geotech Associates Ltd.		RWD884965393	
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Construction Stages

Name	Term	Objects present in this stage
Construction Stage 1	Short	Retaining Wall 1 On retained side: Ground Profile 1, Borehole 1, Water Table 1, On excavated side: Excavation 1, Borehole 1, Water Table 2, Prop 1,

Ground Profiles

Name	Type	Other Properties
Ground Profile 1	Horizontal Ground	

Excavations

Name	Type	Depth (m)	Plan length (m)	Plan breadth (m)	Other Properties
Excavation 1	Horizontal Excavation	6.10	60.0	70.0	

Soils

Name	Type	Class	State	Other Properties
Soil 1	Clay	High-plasticity	Firm	Soil is not fissured
Soil 3	Clay	High-plasticity	Firm	Soil is not fissured
Soil 4	Clay	High-plasticity	Very stiff	Soil is not fissured
Soil 2	Clay	High-plasticity	Firm	Soil is not fissured

Soil properties

Name	Wet weight kN/m^3	Dry weight kN/m^3	Failure state	Friction °	Cohesion kPa	Poisson's ratio
Soil 1	18.5	18.0	Peak	18.0	1.0	0.30
Soil 3	18.5	18.0	Peak	20.0	1.5	0.30
Soil 4	18.5	18.0	Peak	25.0	2.0	0.30
Soil 2	18.5	18.0	Peak	18.0	1.0	0.30

Soil properties (undrained)

Name	Strength kPa	Strength increase kN/m^3	From depth m
Soil 1	30.0	0.0	0.00
Soil 3	50.0	0.0	0.00
Soil 4	120.0	0.0	0.00
Soil 2	30.0	0.0	0.00

Job No		Revision		Page No	2
Engineer		Date	8/12/2009	Checked	
Document: C:\MyFiles\andrew docs\andrew calc\Reward Files\San Fernando WWTP\Clarifier Tanks.RWD				ReWaRD 2.5 Update 21	
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Layers

Name	Type	Thickness (m)	Soil	Dip (°)	OCR	Tension crack	
Layer 1	Undrained Layer	1.00	Soil 1	0.0	1.0	Flooded	Not rigid
Layer 2	Undrained Layer	3.60	Soil 2	0.0	1.0	Flooded	Not rigid
Layer 3	Undrained Layer	3.00	Soil 3	0.0	1.0	Flooded	Not rigid
Layer 4	Undrained Layer	20.00	Soil 4	0.0	1.0	Flooded	Not rigid

Boreholes

Name	Depth (m)	Contains layers:
Borehole 1	27.6	Layer 1; Layer 2; Layer 3; Layer 4;

Water Tables

Name	Type	Depth (m)	Gradient (kN/m^3)	Other Properties
Water Table 1	Hydrostatic Water Table	1.00	9.81	Hydraulically connected to overlying water
Water Table 2	Hydrostatic Water Table	6.10	9.81	Hydraulically connected to overlying water

Retaining Walls

Name	Type	Depth of toe m	Upstand m	Material	Density kg/m^3	E GPa
Retaining Wall 1	Sheet Pile Wall	20.00	0.00	Steel	7800	210.0

Retaining Wall sections

Name	Section	Sectional area cm^2/m	Moment of inertia cm^4/m	Section modulus cm^3/m
Retaining Wall 1	Sheet pile section = 3N	175	23885	1688

Sheet pile sections

Section	b mm	h mm	d mm	t mm	f mm	A cm^2/m	m/L kg/m	m/A kg/m^2	I cm^4/m	Z cm^3/m
3N	483	283	11.7	8.9	89	175	66.2	137.1	23885	1688

Props

Name	Type	Depth (m)	Horizontal spacing (m)	Inclination (°)	Pre-stress (kN/prop)	L/EA (m/kN)	
Prop 1	Horizontal Prop	1.00	1.00	0.0	0.00	0.00	Permanent

Job No		Revision		Page No	3
Engineer		Date	8/12/2009	Checked	
Document: C:\MyFiles\andrew docs\andrew calc\Reward Files\San Fernando WWTP\Clarifier Tanks.RWD				ReWaRD 2.5 Update 21	
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Design Standard

Type = British Standard 8002
Earth pressure coefficients
Type = Kerisel & Absi
Tension crack limited to the retained height
Cantilever toe-in = 20%

Equilibrium calculated at the minimum safe embedment (with designated safety factors)

Unfavourable
Permanent (G) = 1.00
Variable (Q) = 1.00
Accidental (A) = 1.00
Favourable
Permanent (G) = 1.00
Variable (Q) = 1.00
Accidental (A) = 1.00
Minimum surcharge = 10 kPa

On shearing resistance = 1.20
On effective cohesion = 1.20
On undrained strength = 1.50

On effective earth pressures = 1.00
On total earth pressures = 1.00
Safety factor on resistance applied via: Gross passive pressures
Minimum active pressure = 0.00 kN/m^3

Unplanned excavation = 10% of clear height, but minimum of 0.5m
Softened formation = 0 m

On bending moments = 1.00
On shear forces = 1.00
On prop forces
Short-term = 1.00/1.00
Long-term = 1/1

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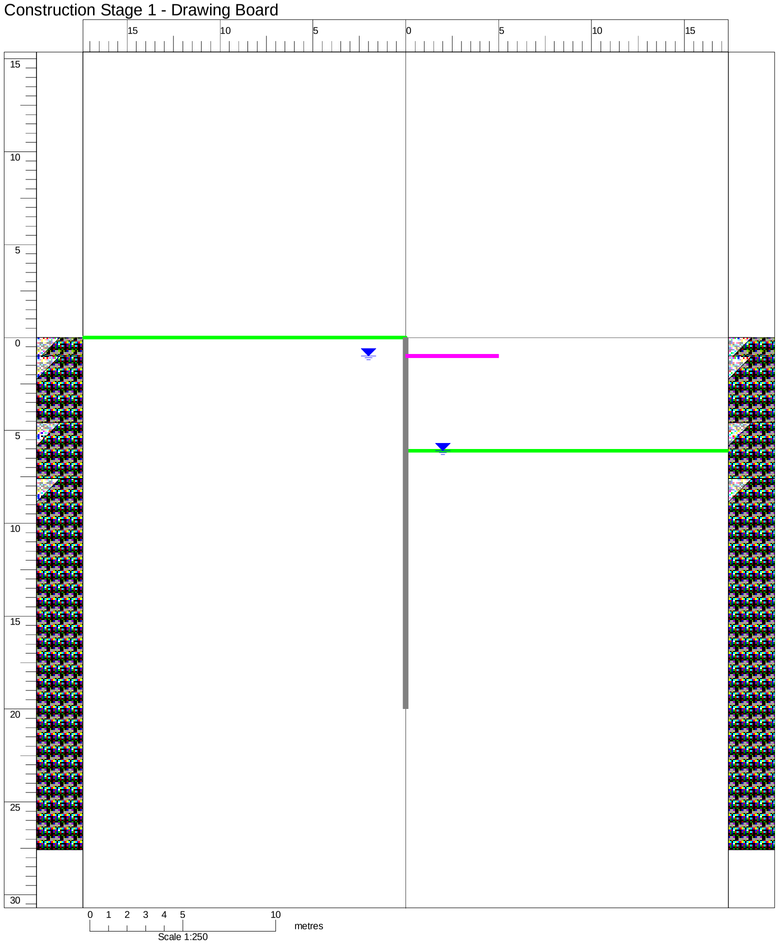
Construction Stage 1 - Drawing Board



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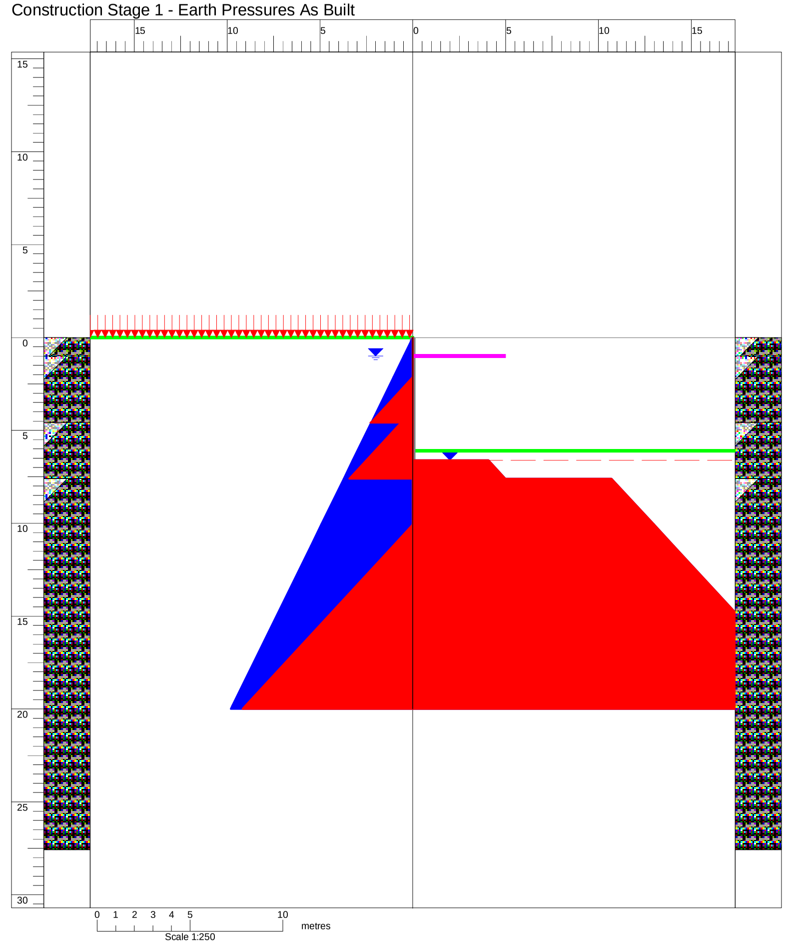
Construction Stage 1 - Earth Pressures As Built



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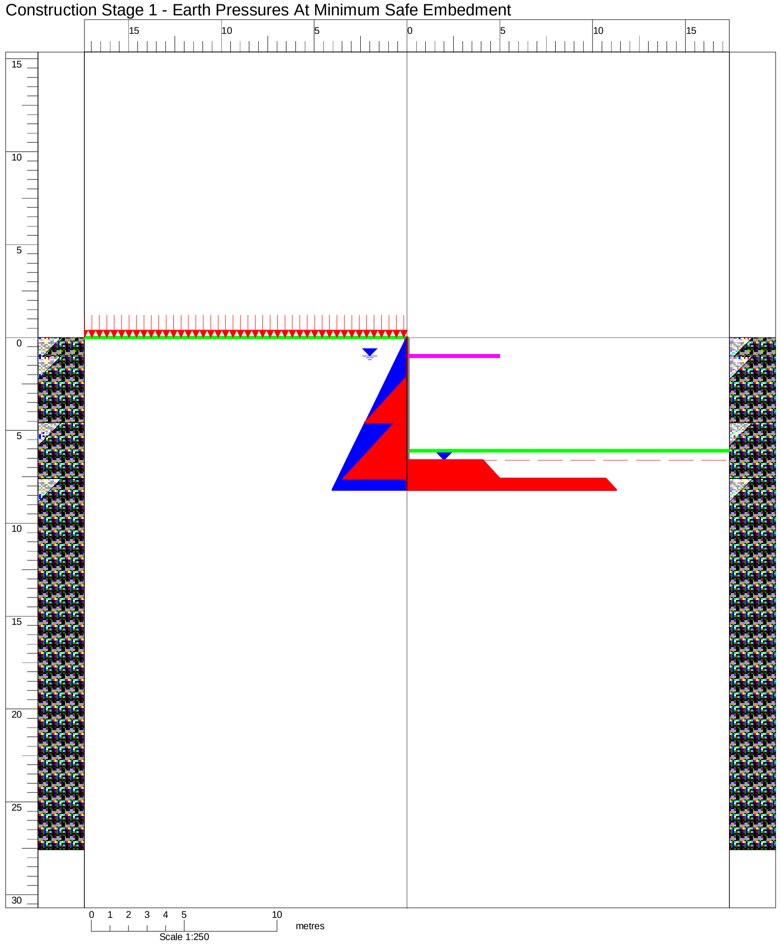
Construction Stage 1 - Earth Pressures At Minimum Safe Embedment



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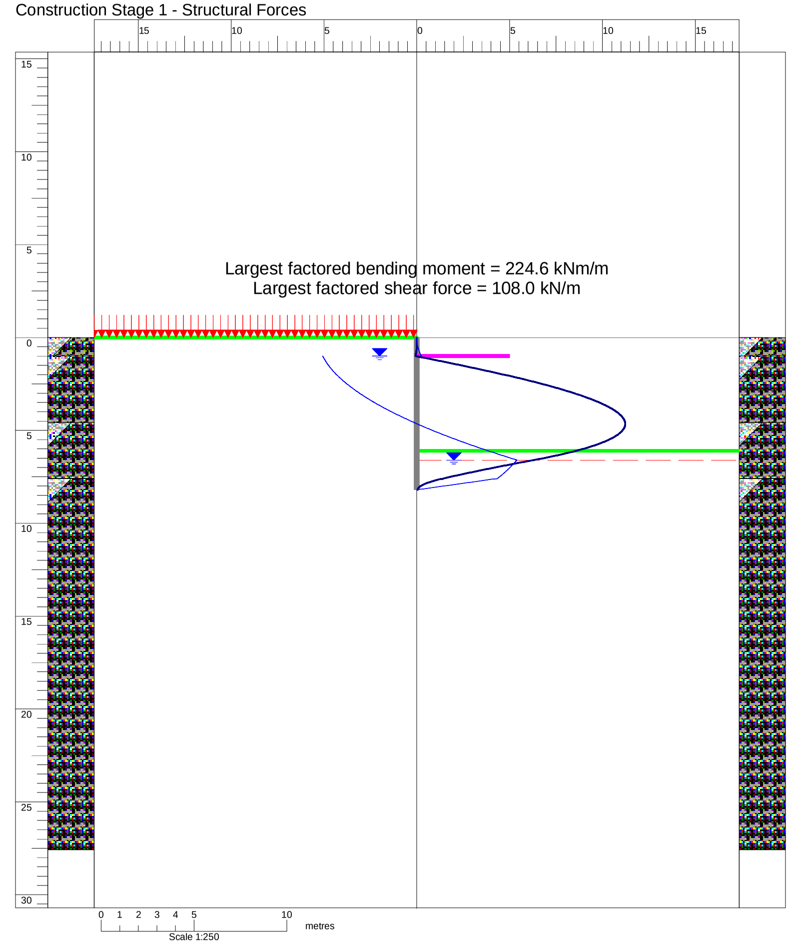
Construction Stage 1 - Structural Forces



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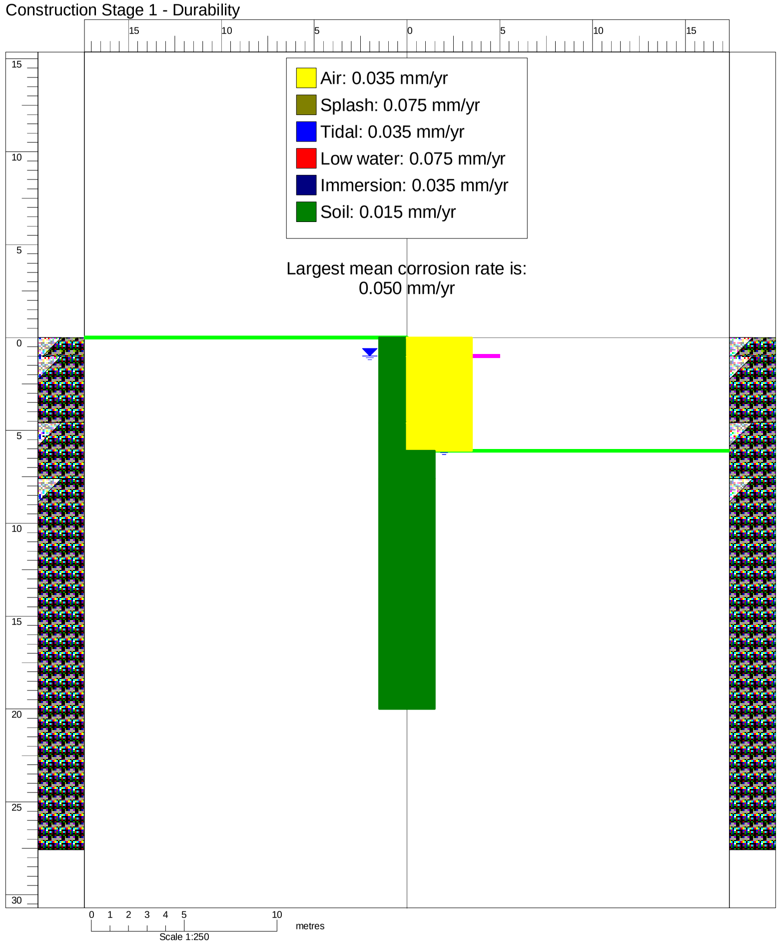
Construction Stage 1 - Durability



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Construction Stage 1 - Earth Pressures As Built

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
2.13	0.00	20.93	20.93	0.00	0.00	0.00
2.13	0.00	20.93	20.93	0.00	0.00	0.00
4.54	44.55	0.00	44.55	0.00	0.00	0.00
4.54	44.55	0.00	44.55	0.00	0.00	0.00
4.60	45.61	0.00	45.61	0.00	0.00	0.00
4.60	12.95	32.16	45.11	0.00	0.00	0.00
6.61	50.14	14.69	64.82	0.00	0.00	0.00
6.61	50.14	14.69	64.82	81.65	0.00	81.65
7.60	68.45	6.08	74.53	99.96	0.00	99.96
7.60	0.00	74.53	74.53	214.27	0.00	214.27
10.08	0.00	98.84	98.84	260.13	0.00	260.13
10.08	0.00	98.84	98.84	260.13	0.00	260.13
11.24	21.43	88.77	110.20	281.56	0.00	281.56
11.24	21.43	88.77	110.20	281.56	0.00	281.56
19.83	180.40	14.07	194.47	440.53	0.00	440.53
19.83	180.40	14.07	194.47	440.53	0.00	440.53
20.00	183.54	12.59	196.13	443.67	0.00	443.67

Construction Stage 1 - Earth Pressures At Minimum Safe Embedment

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
2.13	0.00	20.93	20.93	0.00	0.00	0.00
2.13	0.00	20.93	20.93	0.00	0.00	0.00
4.54	44.55	0.00	44.55	0.00	0.00	0.00
4.54	44.55	0.00	44.55	0.00	0.00	0.00
4.60	45.61	0.00	45.61	0.00	0.00	0.00
4.60	12.95	32.16	45.11	0.00	0.00	0.00
6.61	50.14	14.69	64.82	0.00	0.00	0.00
6.61	50.14	14.69	64.82	81.65	0.00	81.65
7.60	68.45	6.08	74.53	99.96	0.00	99.96
7.60	0.00	74.53	74.53	214.27	0.00	214.27
8.21	0.00	80.53	80.53	225.59	0.00	225.59

Construction Stage 1 - Required Embedment As Built
Results of earth pressure calculation

Retaining Wall
  Name = Prototype: Retaining Wall 1
  Retained height = 6.61 m
Depth of toe = 20.00 m
Partial factors
  Factors on actions
    Unfavourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Favourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Minimum surcharge = 10 kPa
  Factors on material properties
    On shearing resistance = 1.20
    On effective cohesion = 1.20
    On undrained strength = 1.50
  Factors on resistance
    On effective earth pressures = 1.00
    On total earth pressures = 1.00
    Safety factor on resistance applied via: Gross passive pressures
    Minimum active pressure = 0.00 kN/m^3
  Safety margins on geometry
    Unplanned excavation = 10% of clear height, but minimum of 0.5m
    Softened formation = 0 m
  Factors on structural forces
    On bending moments = 1.00
    On shear forces = 1.00
    On prop forces
      Short-term = 1.00/1.00
      Long-term = 1/1
Moments
  Overturning = 24190 kNm/m
  Restoring = 55704 kNm/m
  Out-of-balance = -31515 kNm/m
  Restoring/Overturning = 230 %

Construction Stage 1 - Required Embedment At Minimum Safe Embedment
Results of earth pressure calculation

Retaining Wall
  Name = Prototype: Retaining Wall 1
  Retained height = 6.61 m
Depth of toe = 8.21 m
Partial factors
  Factors on actions
    Unfavourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Favourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Minimum surcharge = 10 kPa
  Factors on material properties
    On shearing resistance = 1.20
    On effective cohesion = 1.20
    On undrained strength = 1.50
  Factors on resistance
    On effective earth pressures = 1.00
    On total earth pressures = 1.00
    Safety factor on resistance applied via: Gross passive pressures
    Minimum active pressure = 0.00 kN/m^3
  Safety margins on geometry
    Unplanned excavation = 10% of clear height, but minimum of 0.5m
    Softened formation = 0 m
  Factors on structural forces
    On bending moments = 1.00
    On shear forces = 1.00
    On prop forces
      Short-term = 1.00/1.00
      Long-term = 1/1
Moments
  Overturning = 1479 kNm/m
  Restoring = 1479 kNm/m
  Out-of-balance = 0 kNm/m
  Restoring/Overturning = 100 %
  The wall is in equilibrium

Construction Stage 1: Structural Forces

Depth (m)	Bending Moment (kNm/m)	Shear Force (kN/m)	Prop Force (kN/m)	Notes
1.00	-1.6	-101.4	106.3	
4.66	224.6	0.2	See above	Maximum bending moment
6.61	126.2	108.0	See above	Maximum shear force

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Construction Stage 1: BaseStability

H/B	B/L	Beta	Nc	Avg Cu kPa	Fbh
0.09	1.17	1.00	6.28	70.0	3.34

APPENDIX VII

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Construction Stages

Name	Term	Objects present in this stage
Construction Stage 1	Short	Retaining Wall 1 On retained side: Ground Profile 1, Borehole 1, Water Table 1, On excavated side: Excavation 1, Borehole 1, Water Table 2, Prop 1,

Ground Profiles

Name	Type	Other Properties
Ground Profile 1	Horizontal Ground	

Excavations

Name	Type	Depth (m)	Plan length (m)	Plan breadth (m)	Other Properties
Excavation 1	Horizontal Excavation	4.00	100.0	75.0	

Soils

Name	Type	Class	State	Other Properties
Soil 1	Clay	High-plasticity	Firm	Soil is not fissured
Soil 3	Clay	High-plasticity	Firm	Soil is not fissured
Soil 4	Clay	High-plasticity	Very stiff	Soil is not fissured
Soil 2	Clay	High-plasticity	Firm	Soil is not fissured

Soil properties

Name	Wet weight kN/m^3	Dry weight kN/m^3	Failure state	Friction °	Cohesion kPa	Poisson's ratio
Soil 1	18.5	18.0	Peak	18.0	1.0	0.30
Soil 3	18.5	18.0	Peak	20.0	1.5	0.30
Soil 4	18.5	18.0	Peak	25.0	2.0	0.30
Soil 2	18.5	18.0	Peak	18.0	1.0	0.30

Soil properties (undrained)

Name	Strength kPa	Strength increase kN/m^3	From depth m
Soil 1	30.0	0.0	0.00
Soil 3	50.0	0.0	0.00
Soil 4	120.0	0.0	0.00
Soil 2	30.0	0.0	0.00

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Layers

Name	Type	Thickness (m)	Soil	Dip (°)	OCR	Tension crack	
Layer 1	Undrained Layer	1.00	Soil 1	0.0	1.0	Flooded	Not rigid
Layer 2	Undrained Layer	3.60	Soil 2	0.0	1.0	Flooded	Not rigid
Layer 3	Undrained Layer	3.00	Soil 3	0.0	1.0	Flooded	Not rigid
Layer 4	Undrained Layer	20.00	Soil 4	0.0	1.0	Flooded	Not rigid

Boreholes

Name	Depth (m)	Contains layers:
Borehole 1	27.6	Layer 1; Layer 2; Layer 3; Layer 4;

Water Tables

Name	Type	Depth (m)	Gradient (kN/m^3)	Other Properties
Water Table 1	Hydrostatic Water Table	1.00	9.81	Hydraulically connected to overlying water
Water Table 2	Hydrostatic Water Table	4.00	9.81	Hydraulically connected to overlying water

Retaining Walls

Name	Type	Depth of toe m	Upstand m	Material	Density kg/m^3	E GPa
Retaining Wall 1	Sheet Pile Wall	20.00	0.00	Steel	7800	210.0

Retaining Wall sections

Name	Section	Sectional area cm^2/m	Moment of inertia cm^4/m	Section modulus cm^3/m
Retaining Wall 1	Sheet pile section = 3N	175	23885	1688

Sheet pile sections

Section	b mm	h mm	d mm	t mm	f mm	A cm^2/m	m/L kg/m	m/A kg/m^2	I cm^4/m	Z cm^3/m
3N	483	283	11.7	8.9	89	175	66.2	137.1	23885	1688

Props

Name	Type	Depth (m)	Horizontal spacing (m)	Inclination (°)	Pre-stress (kN/prop)	L/EA (m/kN)	
Prop 1	Horizontal Prop	1.00	1.00	0.0	0.00	0.00	Permanent

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Design Standard

Type = British Standard 8002
Earth pressure coefficients
   Type = Kerisel & Absi
Tension crack limited to the retained height
Cantilever toe-in = 20%

Equilibrium calculated at the minimum safe embedment (with designated safety factors)

Unfavourable
   Permanent (G) = 1.00
   Variable (Q) = 1.00
   Accidental (A) = 1.00
Favourable
   Permanent (G) = 1.00
   Variable (Q) = 1.00
   Accidental (A) = 1.00
Minimum surcharge = 10 kPa

On shearing resistance = 1.20
On effective cohesion = 1.20
On undrained strength = 1.50

On effective earth pressures = 1.00
On total earth pressures = 1.00
Safety factor on resistance applied via: Gross passive pressures
Minimum active pressure = 0.00 kN/m^3

Unplanned excavation = 10% of clear height, but minimum of 0.5m
Softened formation = 0 m

On bending moments = 1.00
On shear forces = 1.00
On prop forces
   Short-term = 1.00/1.00
   Long-term = 1/1

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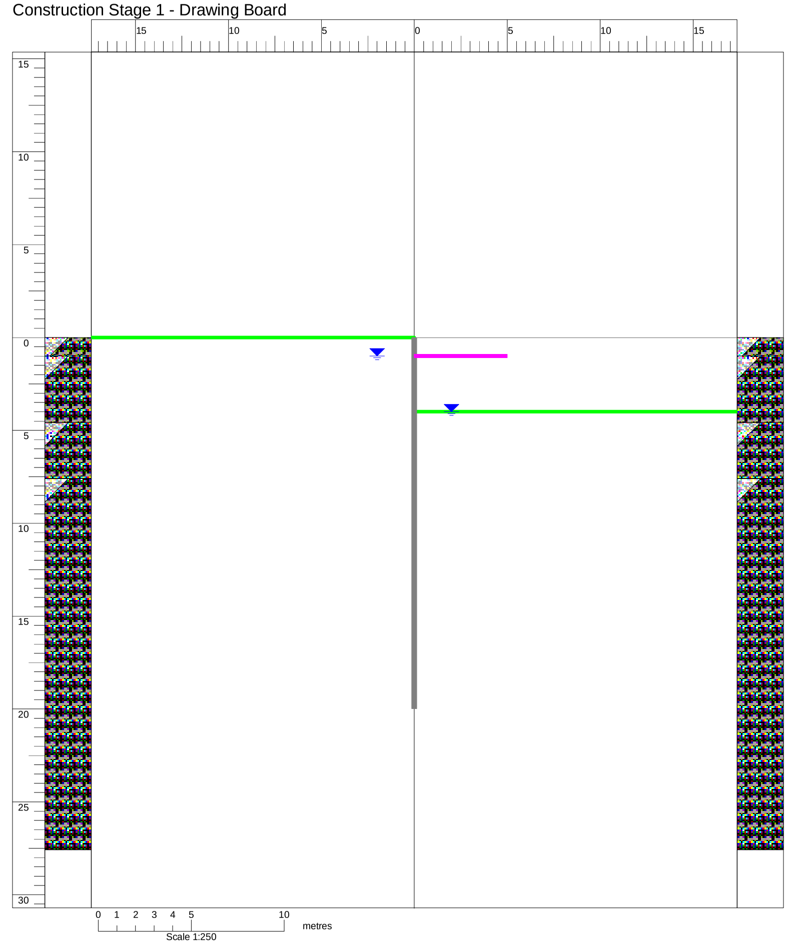
Construction Stage 1 - Drawing Board



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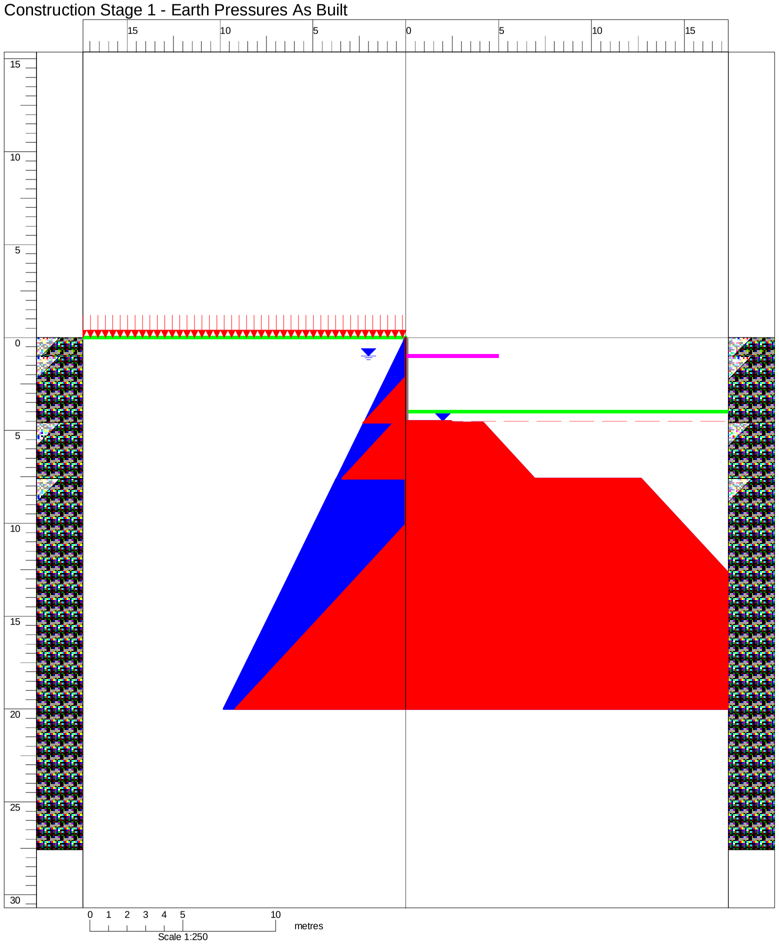
Construction Stage 1 - Earth Pressures As Built



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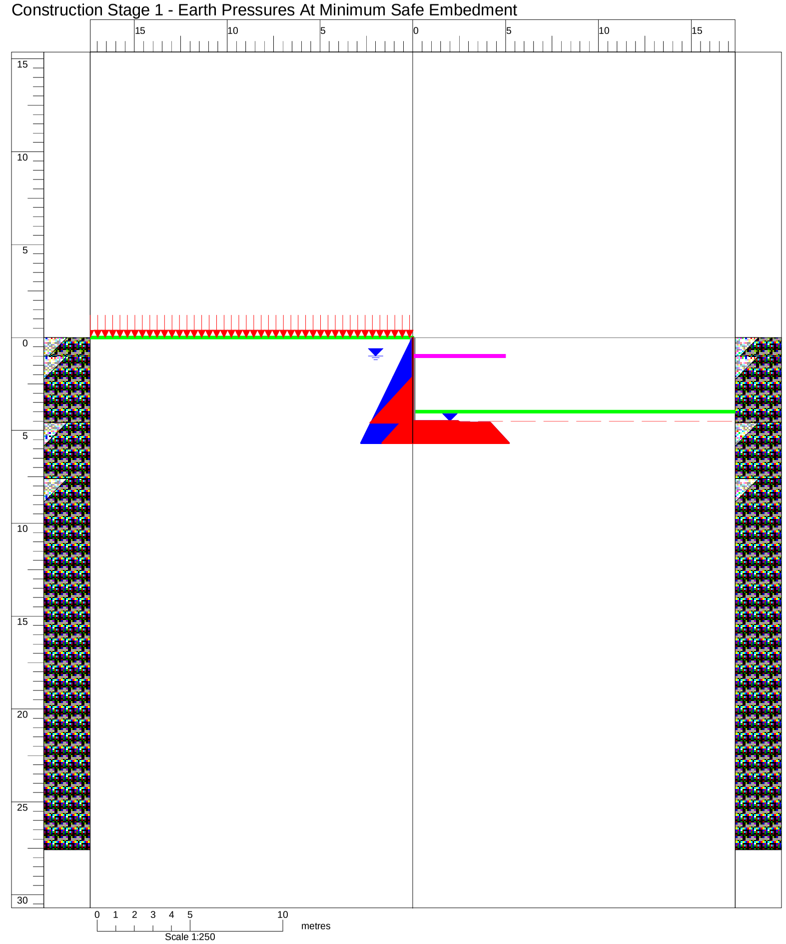
Construction Stage 1 - Earth Pressures At Minimum Safe Embedment



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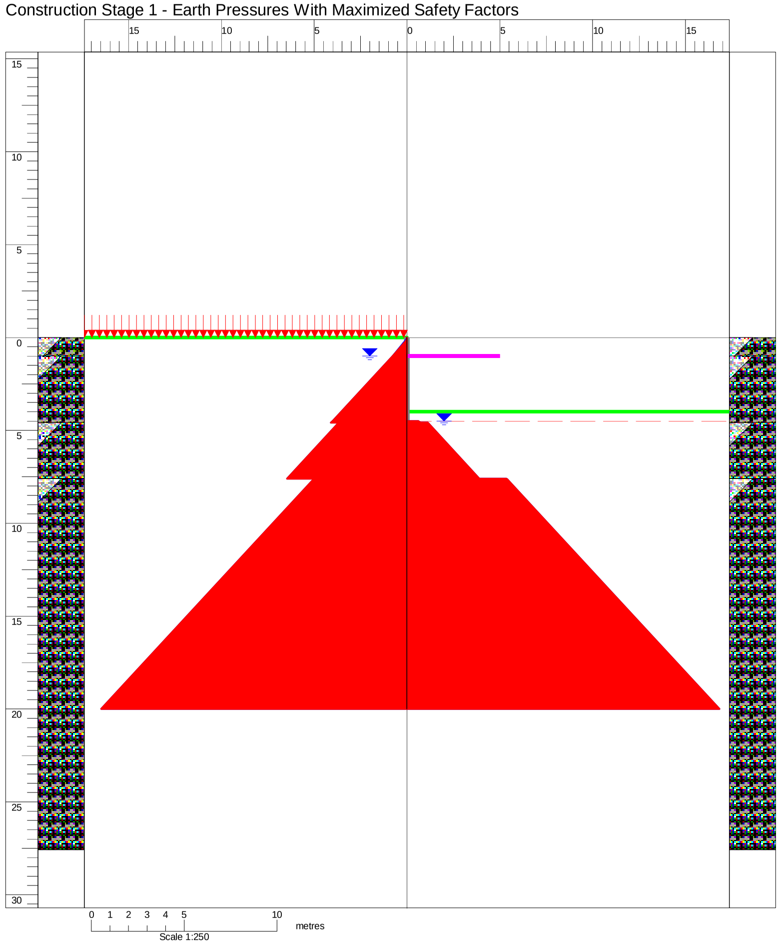
Construction Stage 1 - Earth Pressures With Maximized Safety Factors



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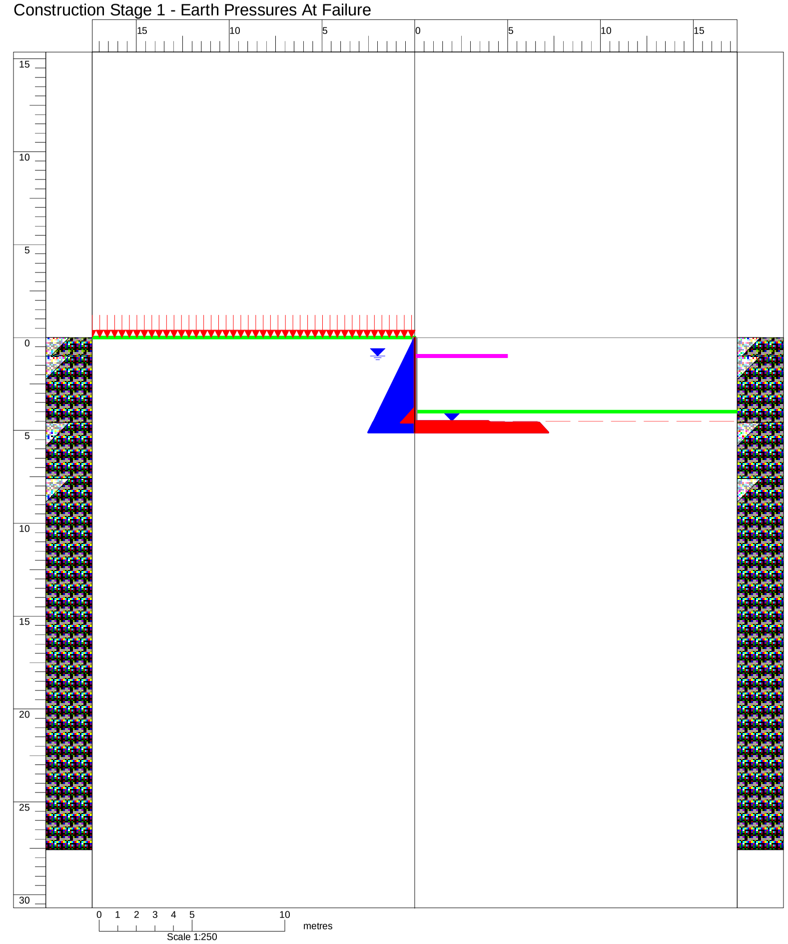
Construction Stage 1 - Earth Pressures At Failure



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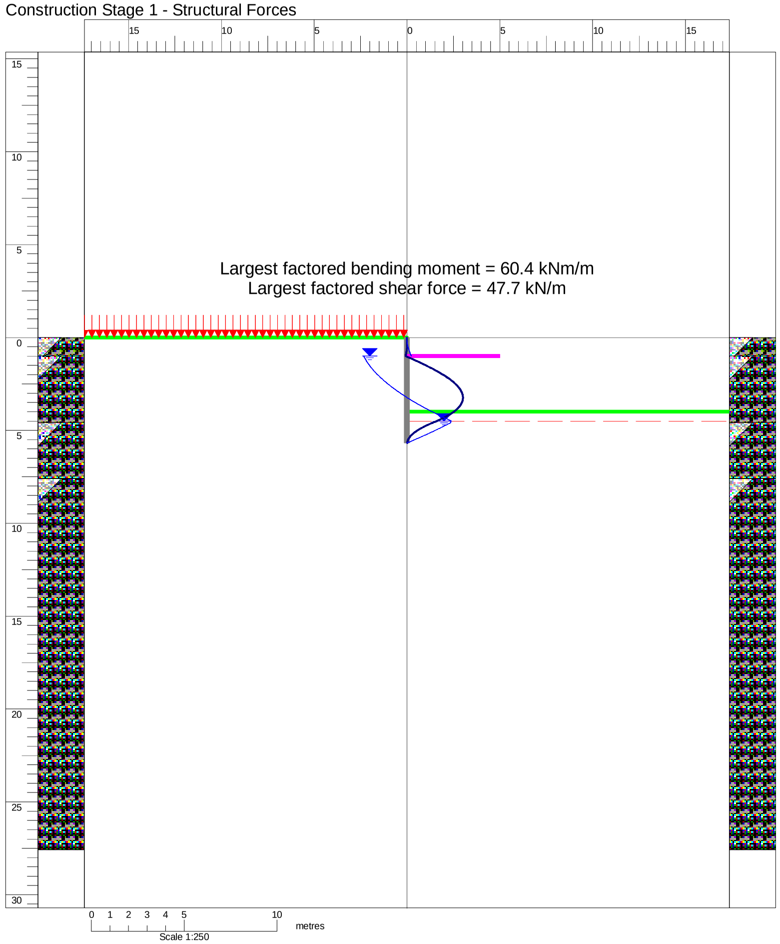
Construction Stage 1 - Structural Forces



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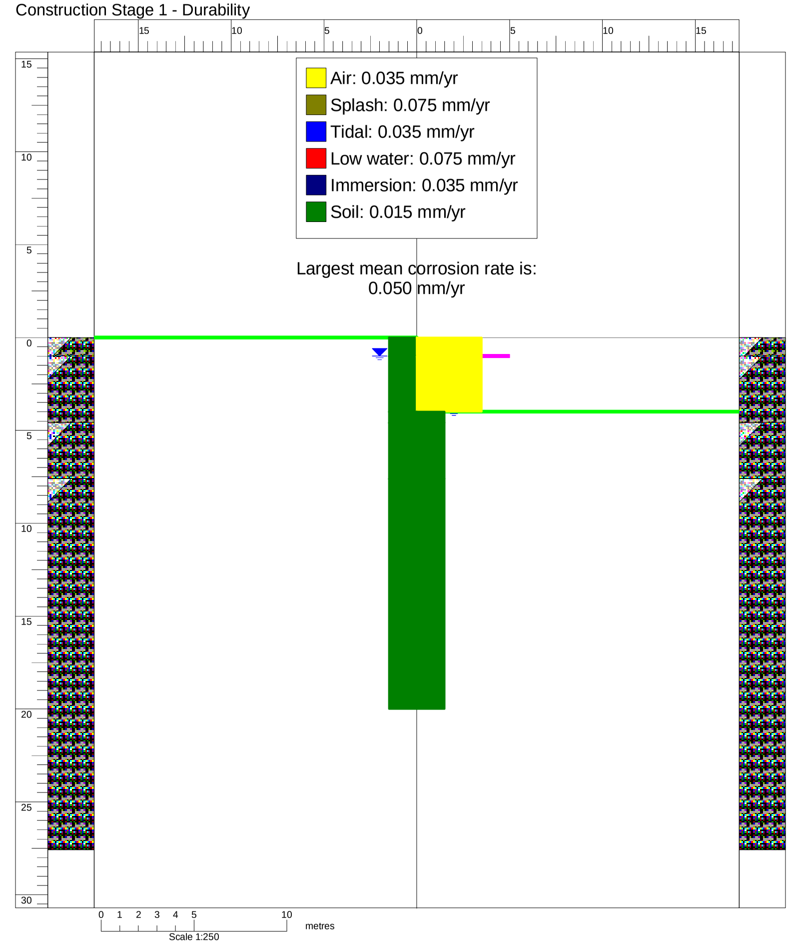
Construction Stage 1 - Durability



Construction Stage 1 - Earth Pressures As Built

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
2.13	0.00	20.93	20.93	0.00	0.00	0.00
2.13	0.00	20.93	20.93	0.00	0.00	0.00
4.50	43.76	0.37	44.13	0.00	0.00	0.00
4.50	43.76	0.37	44.13	48.99	0.00	48.99
4.54	44.55	0.00	44.55	49.78	0.00	49.78
4.54	44.55	0.00	44.55	49.78	0.00	49.78
4.60	45.61	0.00	45.61	50.84	0.00	50.84
4.60	12.95	32.16	45.11	83.50	0.00	83.50
7.60	68.45	6.08	74.53	139.00	0.00	139.00
7.60	0.00	74.53	74.53	253.31	0.00	253.31
7.65	0.00	75.02	75.02	254.23	0.00	254.23
7.65	0.00	75.02	75.02	254.23	0.00	254.23
10.08	0.00	98.84	98.84	299.17	0.00	299.17
10.08	0.00	98.84	98.84	299.17	0.00	299.17
13.50	63.29	69.10	132.39	362.46	0.00	362.46
13.50	63.29	69.10	132.39	362.46	0.00	362.46
20.00	183.54	12.59	196.13	482.71	0.00	482.71

Construction Stage 1 - Earth Pressures At Minimum Safe Embedment

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
2.13	0.00	20.93	20.93	0.00	0.00	0.00
2.13	0.00	20.93	20.93	0.00	0.00	0.00
4.50	43.76	0.37	44.13	0.00	0.00	0.00
4.50	43.76	0.37	44.13	48.99	0.00	48.99
4.54	44.55	0.00	44.55	49.78	0.00	49.78
4.54	44.55	0.00	44.55	49.78	0.00	49.78
4.60	45.61	0.00	45.61	50.84	0.00	50.84
4.60	12.95	32.16	45.11	83.50	0.00	83.50
5.69	33.19	22.65	55.84	103.74	0.00	103.74

Construction Stage 1 - Earth Pressures With Maximized Safety Factors

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.14	0.00	1.37	1.37	0.00	0.00	0.00
0.14	0.00	1.37	1.37	0.00	0.00	0.00
0.31	3.00	1.10	4.11	0.00	0.00	0.00
0.31	3.00	1.10	4.11	0.00	0.00	0.00

Construction Stage 1 - Earth Pressures With Maximized Safety Factors [Continued]

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
1.00	15.49	0.00	15.49	0.00	0.00	0.00
1.00	15.49	0.00	15.49	0.00	0.00	0.00
4.50	80.24	0.00	80.24	0.00	0.00	0.00
4.50	80.24	0.00	80.24	12.51	0.00	12.51
4.60	82.09	0.00	82.09	14.36	0.00	14.36
4.60	73.75	0.00	73.75	22.70	0.00	22.70
7.60	129.25	0.00	129.25	78.20	0.00	78.20
7.60	100.06	0.00	100.06	107.39	0.00	107.39
7.65	100.99	0.00	100.99	108.31	0.00	108.31
7.65	100.99	0.00	100.99	108.31	0.00	108.31
13.50	209.21	0.00	209.21	216.54	0.00	216.54
13.50	209.21	0.00	209.21	216.54	0.00	216.54
20.00	329.46	0.00	329.46	336.79	0.00	336.79

Construction Stage 1 - Earth Pressures At Failure

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
3.78	0.00	37.04	37.04	0.00	0.00	0.00
3.78	0.00	37.04	37.04	0.00	0.00	0.00
4.50	13.38	30.75	44.13	0.00	0.00	0.00
4.50	13.38	30.75	44.13	79.37	0.00	79.37
4.60	15.23	29.88	45.11	81.22	0.00	81.22
4.60	0.00	45.11	45.11	134.14	0.00	134.14
5.13	0.00	50.28	50.28	143.88	0.00	143.88

Construction Stage 1 - Required Embedment As Built
Results of earth pressure calculation

Retaining Wall
  Name = Prototype: Retaining Wall 1
  Retained height = 4.50 m
Depth of toe = 20.00 m
Partial factors
  Factors on actions
    Unfavourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Favourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Minimum surcharge = 10 kPa
  Factors on material properties
    On shearing resistance = 1.20
    On effective cohesion = 1.20
    On undrained strength = 1.50
  Factors on resistance
    On effective earth pressures = 1.00
    On total earth pressures = 1.00
    Safety factor on resistance applied via: Gross passive pressures
    Minimum active pressure = 0.00 kN/m^3
  Safety margins on geometry
    Unplanned excavation = 10% of clear height, but minimum of 0.5m
    Softened formation = 0 m
  Factors on structural forces
    On bending moments = 1.00
    On shear forces = 1.00
    On prop forces
      Short-term = 1.00/1.00
      Long-term = 1/1
Moments
  Overturning = 24190 kNm/m
  Restoring = 63111 kNm/m
  Out-of-balance = -38921 kNm/m
  Restoring/Overturning = 261 %

Construction Stage 1 - Required Embedment At Minimum Safe Embedment
Results of earth pressure calculation

Retaining Wall
  Name = Prototype: Retaining Wall 1
  Retained height = 4.50 m
Depth of toe = 5.69 m
Partial factors
  Factors on actions
    Unfavourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Favourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Minimum surcharge = 10 kPa
  Factors on material properties
    On shearing resistance = 1.20
    On effective cohesion = 1.20
    On undrained strength = 1.50
  Factors on resistance
    On effective earth pressures = 1.00
    On total earth pressures = 1.00
    Safety factor on resistance applied via: Gross passive pressures
    Minimum active pressure = 0.00 kN/m^3
  Safety margins on geometry
    Unplanned excavation = 10% of clear height, but minimum of 0.5m
    Softened formation = 0 m
  Factors on structural forces
    On bending moments = 1.00
    On shear forces = 1.00
    On prop forces
      Short-term = 1.00/1.00
      Long-term = 1/1
Moments
  Overturning = 445 kNm/m
  Restoring = 445 kNm/m
  Out-of-balance = 0 kNm/m
  Restoring/Overturning = 100 %
  The wall is in equilibrium

Construction Stage 1 - Required Embedment With Maximized Safety Factors
Results of earth pressure calculation

Retaining Wall
  Name = Prototype: Retaining Wall 1
  Retained height = 4.50 m
Depth of toe = 20.00 m
Partial factors
  Factors on actions
    Unfavourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Favourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Minimum surcharge = 10 kPa
  Factors on material properties
    On shearing resistance = 2.65
    On effective cohesion = 2.65
    On undrained strength = 5.13
  Factors on resistance
    On effective earth pressures = 1.00
    On total earth pressures = 1.00
    Safety factor on resistance applied via: Gross passive pressures
    Minimum active pressure = 0.00 kN/m^3
  Safety margins on geometry
    Unplanned excavation = 10% of clear height, but minimum of 0.5m
    Softened formation = 0 m
  Factors on structural forces
    On bending moments = 1.00
    On shear forces = 1.00
    On prop forces
      Short-term = 1.00/1.00
      Long-term = 1/1
  Safety reserve = 8.27
Moments
  Overturning = 39007 kNm/m
  Restoring = 39007 kNm/m
  Out-of-balance = 0 kNm/m
  Restoring/Overturning = 100 %
  The wall is in equilibrium

Construction Stage 1 - Required Embedment At Failure
Results of earth pressure calculation

Retaining Wall
  Name = Prototype: Retaining Wall 1
  Retained height = 4.50 m
Depth of toe = 5.13 m
Partial factors
  Factors on actions
    Unfavourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Favourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Minimum surcharge = 10 kPa
  Factors on material properties
    On shearing resistance = 1.00
    On effective cohesion = 1.00
    On undrained strength = 1.00
  Factors on resistance
    On effective earth pressures = 1.00
    On total earth pressures = 1.00
    Safety factor on resistance applied via: Gross passive pressures
    Minimum active pressure = 0.00 kN/m^3
  Safety margins on geometry
    Unplanned excavation = None
    Softened formation = 0 m
  Factors on structural forces
    On bending moments = 1.00
    On shear forces = 1.00
    On prop forces
      Short-term = 1.00/1.00
      Long-term = 1/1
Moments
  Overturning = 312 kNm/m
  Restoring = 312 kNm/m
  Out-of-balance = 0 kNm/m
  Restoring/Overturning = 100 %
  The wall is in equilibrium

Construction Stage 1: Structural Forces

Depth (m)	Bending Moment (kNm/m)	Shear Force (kN/m)	Prop Force (kN/m)	Notes
1.00	-1.6	-46.7	51.6	
3.25	60.4	0.2	See above	Maximum bending moment
4.50	32.5	47.7	See above	Maximum shear force

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Construction Stage 1: BaseStability

H/B	B/L	Beta	Nc	Avg Cu kPa	Fbh
0.06	0.75	1.00	5.82	33.7	2.11

APPENDIX VIII

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Construction Stages

Name	Term	Objects present in this stage
Construction Stage 1	Short	Retaining Wall 1 On retained side: Ground Profile 1, Borehole 1, Water Table 1, On excavated side: Excavation 1, Borehole 1, Water Table 2, Prop 1,

Ground Profiles

Name	Type	Other Properties
Ground Profile 1	Horizontal Ground	

Excavations

Name	Type	Depth (m)	Plan length (m)	Plan breadth (m)	Other Properties
Excavation 1	Horizontal Excavation	6.60	15.0	12.0	

Soils

Name	Type	Class	State	Other Properties
Soil 1	Clay	High-plasticity	Firm	Soil is not fissured
Soil 3	Clay	High-plasticity	Firm	Soil is not fissured
Soil 4	Clay	High-plasticity	Very stiff	Soil is not fissured
Soil 2	Clay	High-plasticity	Firm	Soil is not fissured

Soil properties

Name	Wet weight kN/m^3	Dry weight kN/m^3	Failure state	Friction °	Cohesion kPa	Poisson's ratio
Soil 1	18.5	18.0	Peak	18.0	1.0	0.30
Soil 3	18.5	18.0	Peak	20.0	1.5	0.30
Soil 4	18.5	18.0	Peak	25.0	2.0	0.30
Soil 2	18.5	18.0	Peak	18.0	1.0	0.30

Soil properties (undrained)

Name	Strength kPa	Strength increase kN/m^3	From depth m
Soil 1	30.0	0.0	0.00
Soil 3	50.0	0.0	0.00
Soil 4	120.0	0.0	0.00
Soil 2	30.0	0.0	0.00

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Layers

Name	Type	Thickness (m)	Soil	Dip (°)	OCR	Tension crack	
Layer 1	Undrained Layer	1.00	Soil 1	0.0	1.0	Flooded	Not rigid
Layer 2	Undrained Layer	3.60	Soil 2	0.0	1.0	Flooded	Not rigid
Layer 3	Undrained Layer	3.00	Soil 3	0.0	1.0	Flooded	Not rigid
Layer 4	Undrained Layer	20.00	Soil 4	0.0	1.0	Flooded	Not rigid

Boreholes

Name	Depth (m)	Contains layers:
Borehole 1	27.6	Layer 1; Layer 2; Layer 3; Layer 4;

Water Tables

Name	Type	Depth (m)	Gradient (kN/m^3)	Other Properties
Water Table 1	Hydrostatic Water Table	1.00	9.81	Hydraulically connected to overlying water
Water Table 2	Hydrostatic Water Table	6.60	9.81	Hydraulically connected to overlying water

Retaining Walls

Name	Type	Depth of toe m	Upstand m	Material	Density kg/m^3	E GPa
Retaining Wall 1	Sheet Pile Wall	20.00	0.00	Steel	7800	210.0

Retaining Wall sections

Name	Section	Sectional area cm^2/m	Moment of inertia cm^4/m	Section modulus cm^3/m
Retaining Wall 1	Sheet pile section = 3N	175	23885	1688

Sheet pile sections

Section	b mm	h mm	d mm	t mm	f mm	A cm^2/m	m/L kg/m	m/A kg/m^2	I cm^4/m	Z cm^3/m
3N	483	283	11.7	8.9	89	175	66.2	137.1	23885	1688

Props

Name	Type	Depth (m)	Horizontal spacing (m)	Inclination (°)	Pre-stress (kN/prop)	L/EA (m/kN)	
Prop 1	Horizontal Prop	1.00	1.00	0.0	0.00	0.00	Permanent

Design Standard

Type = British Standard 8002
Earth pressure coefficients
Type = Kerisel & Absi
Tension crack limited to the retained height
Cantilever toe-in = 20%

Equilibrium calculated at the minimum safe embedment (with designated safety factors)

Unfavourable
Permanent (G) = 1.00
Variable (Q) = 1.00
Accidental (A) = 1.00
Favourable
Permanent (G) = 1.00
Variable (Q) = 1.00
Accidental (A) = 1.00
Minimum surcharge = 10 kPa

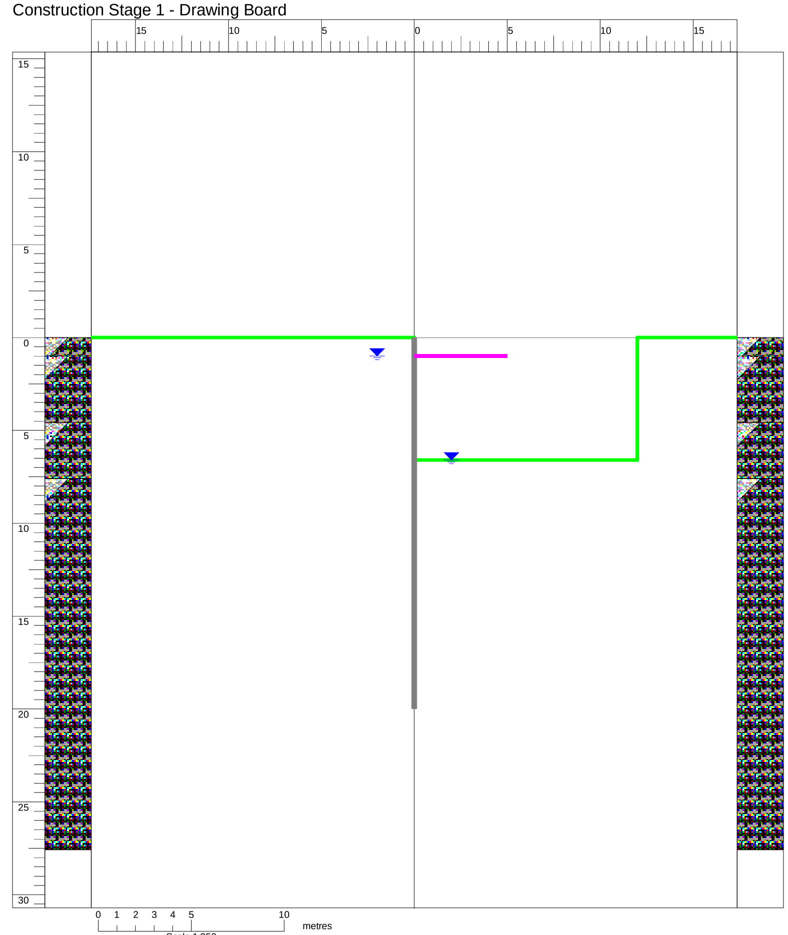
On shearing resistance = 1.20
On effective cohesion = 1.20
On undrained strength = 1.50

On effective earth pressures = 1.00
On total earth pressures = 1.00
Safety factor on resistance applied via: Gross passive pressures
Minimum active pressure = 0.00 kN/m^3

Unplanned excavation = 10% of clear height, but minimum of 0.5m
Softened formation = 0 m

On bending moments = 1.00
On shear forces = 1.00
On prop forces
Short-term = 1.00/1.00
Long-term = 1/1

Construction Stage 1 - Drawing Board



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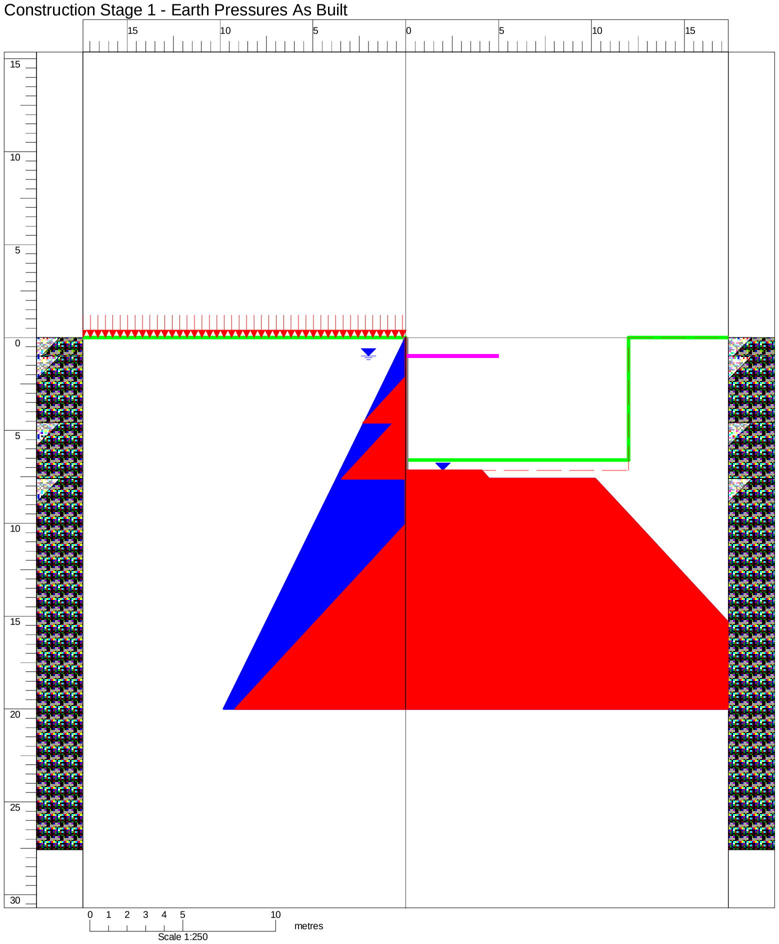
Construction Stage 1 - Earth Pressures As Built



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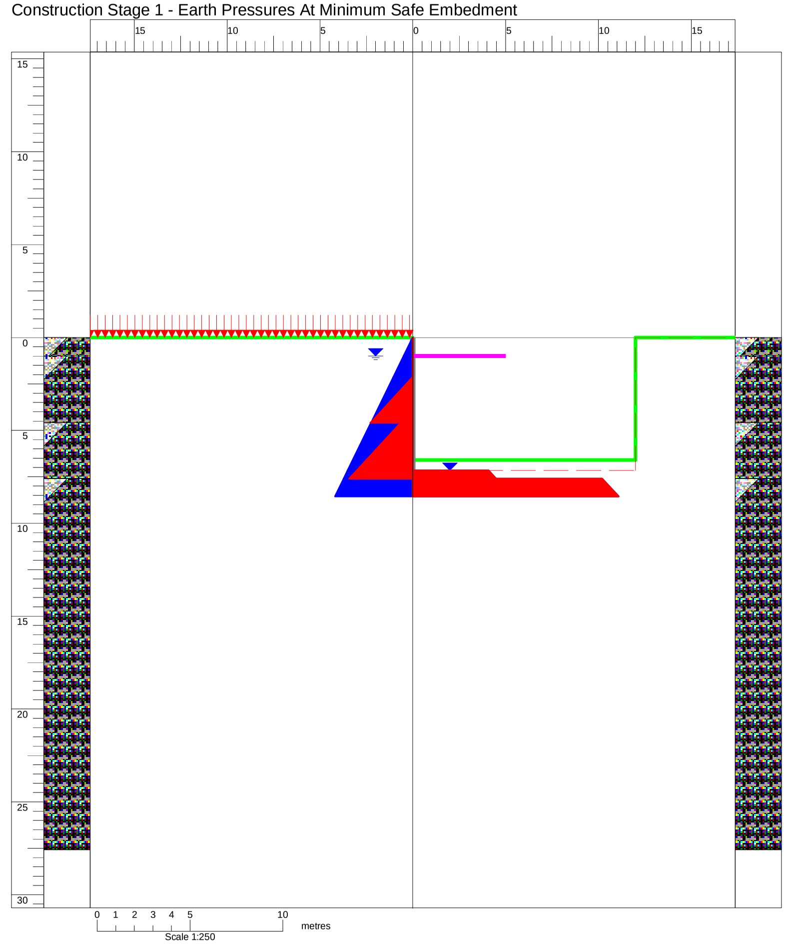
Construction Stage 1 - Earth Pressures At Minimum Safe Embedment



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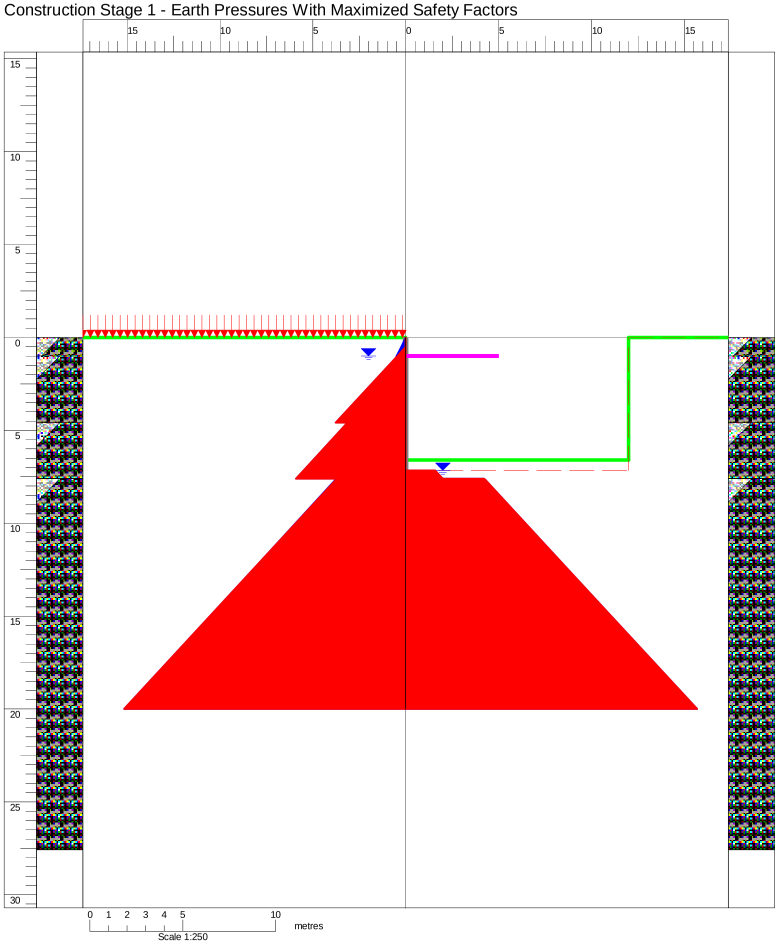
Construction Stage 1 - Earth Pressures With Maximized Safety Factors



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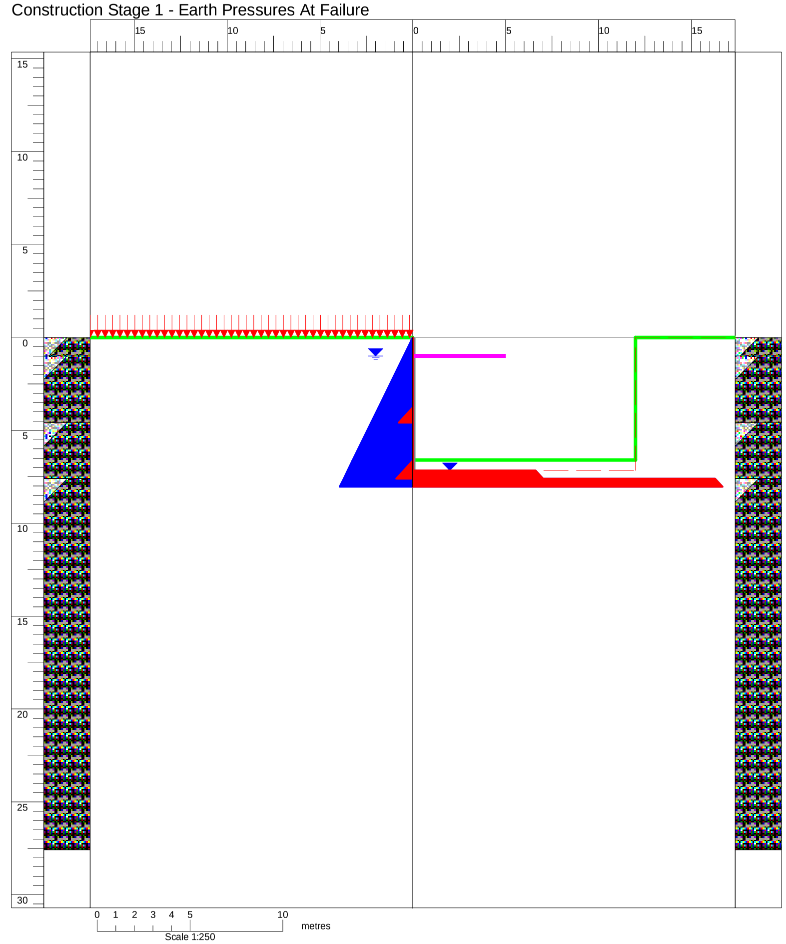
Construction Stage 1 - Earth Pressures At Failure



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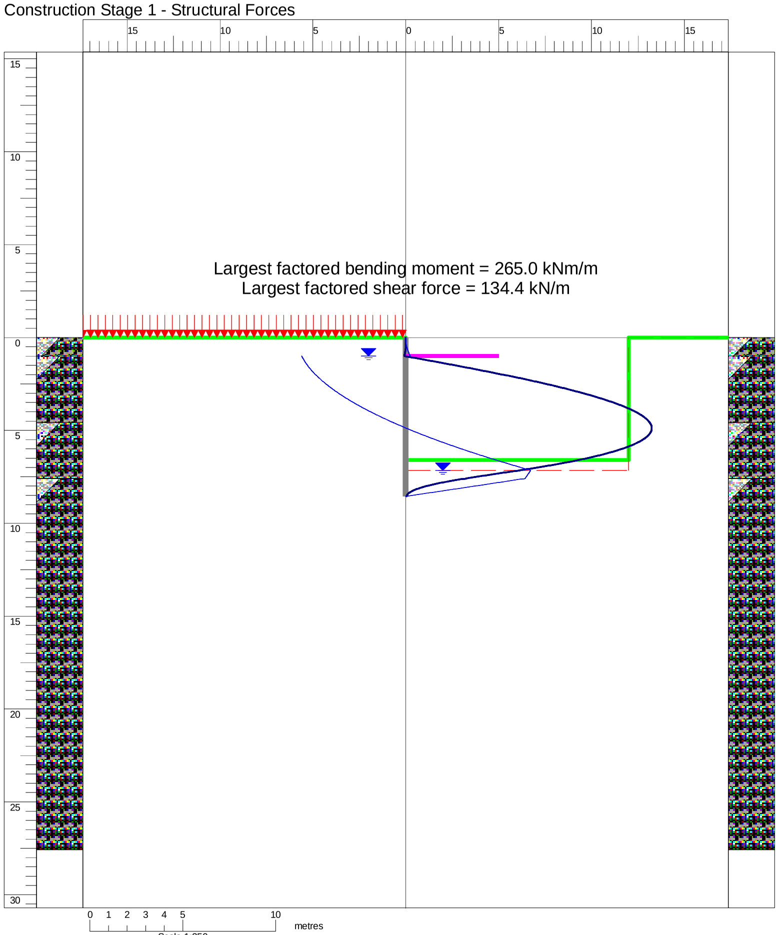
Construction Stage 1 - Structural Forces



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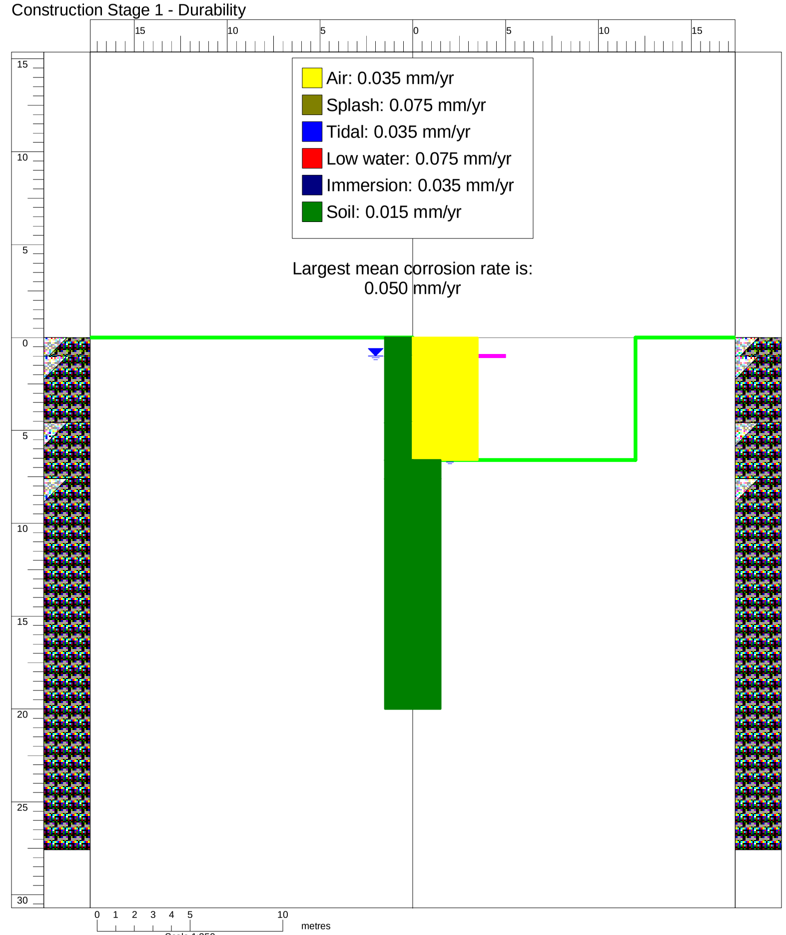
Construction Stage 1 - Durability



Construction Stage 1 - Earth Pressures As Built

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
2.13	0.00	20.93	20.93	0.00	0.00	0.00
2.13	0.00	20.93	20.93	0.00	0.00	0.00
4.54	44.55	0.00	44.55	0.00	0.00	0.00
4.54	44.55	0.00	44.55	0.00	0.00	0.00
4.60	45.61	0.00	45.61	0.00	0.00	0.00
4.60	12.95	32.16	45.11	0.00	0.00	0.00
7.16	60.31	9.91	70.22	0.00	0.00	0.00
7.16	60.31	9.91	70.22	81.65	0.00	81.65
7.60	68.45	6.08	74.53	89.79	0.00	89.79
7.60	0.00	74.53	74.53	204.10	0.00	204.10
10.08	0.00	98.84	98.84	249.96	0.00	249.96
10.08	0.00	98.84	98.84	249.96	0.00	249.96
12.17	38.72	80.64	119.37	288.68	0.00	288.68
12.17	38.72	80.64	119.37	288.68	0.00	288.68
20.00	183.54	12.59	196.13	433.50	0.00	433.50

Construction Stage 1 - Earth Pressures At Minimum Safe Embedment

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
2.13	0.00	20.93	20.93	0.00	0.00	0.00
2.13	0.00	20.93	20.93	0.00	0.00	0.00
4.54	44.55	0.00	44.55	0.00	0.00	0.00
4.54	44.55	0.00	44.55	0.00	0.00	0.00
4.60	45.61	0.00	45.61	0.00	0.00	0.00
4.60	12.95	32.16	45.11	0.00	0.00	0.00
7.16	60.31	9.91	70.22	0.00	0.00	0.00
7.16	60.31	9.91	70.22	81.65	0.00	81.65
7.60	68.45	6.08	74.53	89.79	0.00	89.79
7.60	0.00	74.53	74.53	204.10	0.00	204.10
8.56	0.00	83.96	83.96	221.88	0.00	221.88

Construction Stage 1 - Earth Pressures With Maximized Safety Factors

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.50	0.00	4.94	4.94	0.00	0.00	0.00
0.50	0.00	4.94	4.94	0.00	0.00	0.00
1.00	8.93	0.87	9.81	0.00	0.00	0.00
1.00	8.93	0.87	9.81	0.00	0.00	0.00

Construction Stage 1 - Earth Pressures With Maximized Safety Factors [Continued]

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
1.10	10.79	0.00	10.79	0.00	0.00	0.00
1.10	10.79	0.00	10.79	0.00	0.00	0.00
4.60	75.53	0.00	75.53	0.00	0.00	0.00
4.60	62.82	0.00	62.82	0.00	0.00	0.00
7.16	110.18	0.00	110.18	0.00	0.00	0.00
7.16	110.18	0.00	110.18	31.78	0.00	31.78
7.60	118.32	0.00	118.32	39.92	0.00	39.92
7.60	73.84	0.69	74.53	84.40	0.00	84.40
7.68	75.31	0.68	75.99	85.88	0.00	85.88
7.68	75.31	0.68	75.99	85.88	0.00	85.88
12.17	158.42	0.00	158.42	168.98	0.00	168.98
12.17	158.42	0.00	158.42	168.98	0.00	168.98
20.00	303.24	0.00	303.24	313.80	0.00	313.80

Construction Stage 1 - Earth Pressures At Failure

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
3.78	0.00	37.04	37.04	0.00	0.00	0.00
3.78	0.00	37.04	37.04	0.00	0.00	0.00
4.60	15.23	29.88	45.11	0.00	0.00	0.00
4.60	0.00	45.11	45.11	0.00	0.00	0.00
6.64	0.00	65.09	65.09	0.00	0.00	0.00
6.64	0.00	65.09	65.09	0.00	0.00	0.00
7.16	9.67	60.54	70.22	0.00	0.00	0.00
7.16	9.67	60.54	70.22	132.29	0.00	132.29
7.60	17.81	56.72	74.53	140.43	0.00	140.43
7.60	0.00	74.53	74.53	325.63	0.00	325.63
8.05	0.00	78.90	78.90	333.87	0.00	333.87

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Construction Stage 1 - Required Embedment As Built
Results of earth pressure calculation

Retaining Wall
  Name = Prototype: Retaining Wall 1
  Retained height = 7.16 m
Depth of toe = 20.00 m
Partial factors
  Factors on actions
    Unfavourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Favourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Minimum surcharge = 10 kPa
  Factors on material properties
    On shearing resistance = 1.20
    On effective cohesion = 1.20
    On undrained strength = 1.50
  Factors on resistance
    On effective earth pressures = 1.00
    On total earth pressures = 1.00
    Safety factor on resistance applied via: Gross passive pressures
    Minimum active pressure = 0.00 kN/m^3
  Safety margins on geometry
    Unplanned excavation = 10% of clear height, but minimum of 0.5m
    Softened formation = 0 m
  Factors on structural forces
    On bending moments = 1.00
    On shear forces = 1.00
    On prop forces
      Short-term = 1.00/1.00
      Long-term = 1/1
Moments
  Overturning = 24190 kNm/m
  Restoring = 53780 kNm/m
  Out-of-balance = -29590 kNm/m
  Restoring/Overturning = 222 %

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Construction Stage 1 - Required Embedment At Minimum Safe Embedment
Results of earth pressure calculation

Retaining Wall
  Name = Prototype: Retaining Wall 1
  Retained height = 7.16 m
Depth of toe = 8.56 m
Partial factors
  Factors on actions
    Unfavourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Favourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Minimum surcharge = 10 kPa
  Factors on material properties
    On shearing resistance = 1.20
    On effective cohesion = 1.20
    On undrained strength = 1.50
  Factors on resistance
    On effective earth pressures = 1.00
    On total earth pressures = 1.00
    Safety factor on resistance applied via: Gross passive pressures
    Minimum active pressure = 0.00 kN/m^3
  Safety margins on geometry
    Unplanned excavation = 10% of clear height, but minimum of 0.5m
    Softened formation = 0 m
  Factors on structural forces
    On bending moments = 1.00
    On shear forces = 1.00
    On prop forces
      Short-term = 1.00/1.00
      Long-term = 1/1
Moments
  Overturning = 1692 kNm/m
  Restoring = 1692 kNm/m
  Out-of-balance = 0 kNm/m
  Restoring/Overturning = 100 %
  The wall is in equilibrium

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Construction Stage 1 - Required Embedment With Maximized Safety Factors
Results of earth pressure calculation

Retaining Wall
  Name = Prototype: Retaining Wall 1
  Retained height = 7.16 m
Depth of toe = 20.00 m
Partial factors
  Factors on actions
    Unfavourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Favourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Minimum surcharge = 10 kPa
  Factors on material properties
    On shearing resistance = 1.99
    On effective cohesion = 1.99
    On undrained strength = 3.47
  Factors on resistance
    On effective earth pressures = 1.00
    On total earth pressures = 1.00
    Safety factor on resistance applied via: Gross passive pressures
    Minimum active pressure = 0.00 kN/m^3
  Safety margins on geometry
    Unplanned excavation = 10% of clear height, but minimum of 0.5m
    Softened formation = 0 m
  Factors on structural forces
    On bending moments = 1.00
    On shear forces = 1.00
    On prop forces
      Short-term = 1.00/1.00
      Long-term = 1/1
  Safety reserve = 4.94
Moments
  Overturning = 34648 kNm/m
  Restoring = 34642 kNm/m
  Out-of-balance = 7 kNm/m
  Restoring/Overturning = 100 %
  The wall is in equilibrium

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Construction Stage 1 - Required Embedment At Failure
Results of earth pressure calculation

Retaining Wall
  Name = Prototype: Retaining Wall 1
  Retained height = 7.16 m
Depth of toe = 8.05 m
Partial factors
  Factors on actions
    Unfavourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Favourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Minimum surcharge = 10 kPa
  Factors on material properties
    On shearing resistance = 1.00
    On effective cohesion = 1.00
    On undrained strength = 1.00
  Factors on resistance
    On effective earth pressures = 1.00
    On total earth pressures = 1.00
    Safety factor on resistance applied via: Gross passive pressures
    Minimum active pressure = 0.00 kN/m^3
  Safety margins on geometry
    Unplanned excavation = None
    Softened formation = 0 m
  Factors on structural forces
    On bending moments = 1.00
    On shear forces = 1.00
    On prop forces
      Short-term = 1.00/1.00
      Long-term = 1/1
Moments
  Overturning = 1385 kNm/m
  Restoring = 1385 kNm/m
  Out-of-balance = 0 kNm/m
  Restoring/Overturning = 100 %
  The wall is in equilibrium

Construction Stage 1: Structural Forces

Depth (m)	Bending Moment (kNm/m)	Shear Force (kN/m)	Prop Force (kN/m)	Notes
1.00	-1.6	-112.0	116.9	
4.89	265.0	0.3	See above	Maximum bending moment
7.16	122.9	134.4	See above	Maximum shear force

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Construction Stage 1: BaseStability

H/B	B/L	Beta	Nc	Avg Cu kPa	Fbh
0.60	0.80	1.00	6.49	75.9	3.47

APPENDIX IX

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Construction Stages

Name	Term	Objects present in this stage
Construction Stage 1	Short	Retaining Wall 1 On retained side: Ground Profile 1, Borehole 1, Water Table 1, On excavated side: Excavation 1, Borehole 1, Water Table 2, Prop 1,

Ground Profiles

Name	Type	Other Properties
Ground Profile 1	Horizontal Ground	

Excavations

Name	Type	Depth (m)	Plan length (m)	Plan breadth (m)	Other Properties
Excavation 1	Horizontal Excavation	2.10	32.0	17.0	

Soils

Name	Type	Class	State	Other Properties
Soil 1	Clay	High-plasticity	Soft	Soil is not fissured
Soil 3	Clay	High-plasticity	Firm	Soil is not fissured
Soil 4	Clay	High-plasticity	Very stiff	Soil is not fissured
Soil 2	Clay	High-plasticity	Soft	Soil is not fissured

Soil properties

Name	Wet weight kN/m^3	Dry weight kN/m^3	Failure state	Friction °	Cohesion kPa	Poisson's ratio
Soil 1	18.5	18.0	Peak	17.0	1.0	0.30
Soil 3	18.5	18.0	Peak	20.0	1.5	0.30
Soil 4	18.5	18.0	Peak	25.0	2.0	0.30
Soil 2	18.5	18.0	Peak	17.0	1.0	0.30

Soil properties (undrained)

Name	Strength kPa	Strength increase kN/m^3	From depth m
Soil 1	18.0	0.0	0.00
Soil 3	50.0	0.0	0.00
Soil 4	120.0	0.0	0.00
Soil 2	18.0	0.0	0.00

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Layers

Name	Type	Thickness (m)	Soil	Dip (°)	OCR	Tension crack	
Layer 1	Undrained Layer	1.00	Soil 1	0.0	1.0	Flooded	Not rigid
Layer 2	Undrained Layer	1.60	Soil 2	0.0	1.0	Flooded	Not rigid
Layer 3	Undrained Layer	3.00	Soil 3	0.0	1.0	Flooded	Not rigid
Layer 4	Undrained Layer	20.00	Soil 4	0.0	1.0	Flooded	Not rigid

Boreholes

Name	Depth (m)	Contains layers:
Borehole 1	25.6	Layer 1; Layer 2; Layer 3; Layer 4;

Water Tables

Name	Type	Depth (m)	Gradient (kN/m^3)	Other Properties
Water Table 1	Hydrostatic Water Table	1.00	9.81	Hydraulically connected to overlying water
Water Table 2	Hydrostatic Water Table	2.10	9.81	Hydraulically connected to overlying water

Retaining Walls

Name	Type	Depth of toe m	Upstand m	Material	Density kg/m^3	E GPa
Retaining Wall 1	Sheet Pile Wall	20.00	0.00	Steel	7800	210.0

Retaining Wall sections

Name	Section	Sectional area cm^2/m	Moment of inertia cm^4/m	Section modulus cm^3/m
Retaining Wall 1	Sheet pile section = 3N	175	23885	1688

Sheet pile sections

Section	b mm	h mm	d mm	t mm	f mm	A cm^2/m	m/L kg/m	m/A kg/m^2	I cm^4/m	Z cm^3/m
3N	483	283	11.7	8.9	89	175	66.2	137.1	23885	1688

Props

Name	Type	Depth (m)	Horizontal spacing (m)	Inclination (°)	Pre-stress (kN/prop)	L/EA (m/kN)	
Prop 1	Horizontal Prop	1.00	1.00	0.0	0.00	0.00	Permanent

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Design Standard

Type = British Standard 8002
Earth pressure coefficients
Type = Kerisel & Absi
Tension crack limited to the retained height
Cantilever toe-in = 20%

Equilibrium calculated at the minimum safe embedment (with designated safety factors)

Unfavourable
Permanent (G) = 1.00
Variable (Q) = 1.00
Accidental (A) = 1.00
Favourable
Permanent (G) = 1.00
Variable (Q) = 1.00
Accidental (A) = 1.00
Minimum surcharge = 10 kPa

On shearing resistance = 1.20
On effective cohesion = 1.20
On undrained strength = 1.50

On effective earth pressures = 1.00
On total earth pressures = 1.00
Safety factor on resistance applied via: Gross passive pressures
Minimum active pressure = 0.00 kN/m^3

Unplanned excavation = 10% of clear height, but minimum of 0.5m
Softened formation = 0 m

On bending moments = 1.00
On shear forces = 1.00
On prop forces
Short-term = 1.00/1.00
Long-term = 1/1

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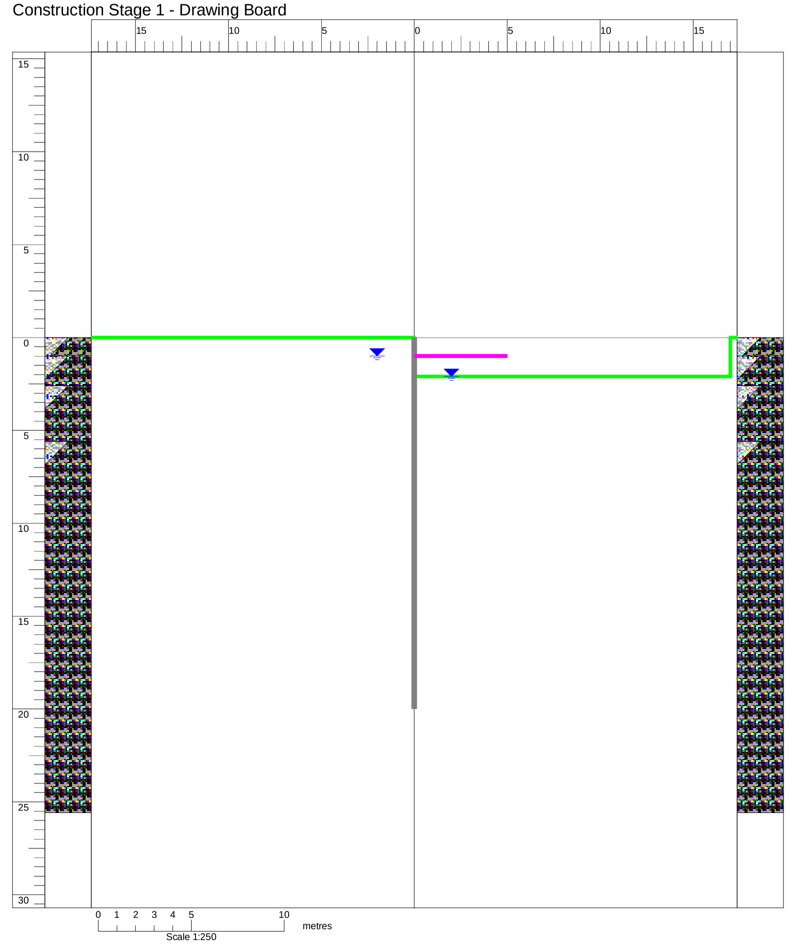
Construction Stage 1 - Drawing Board



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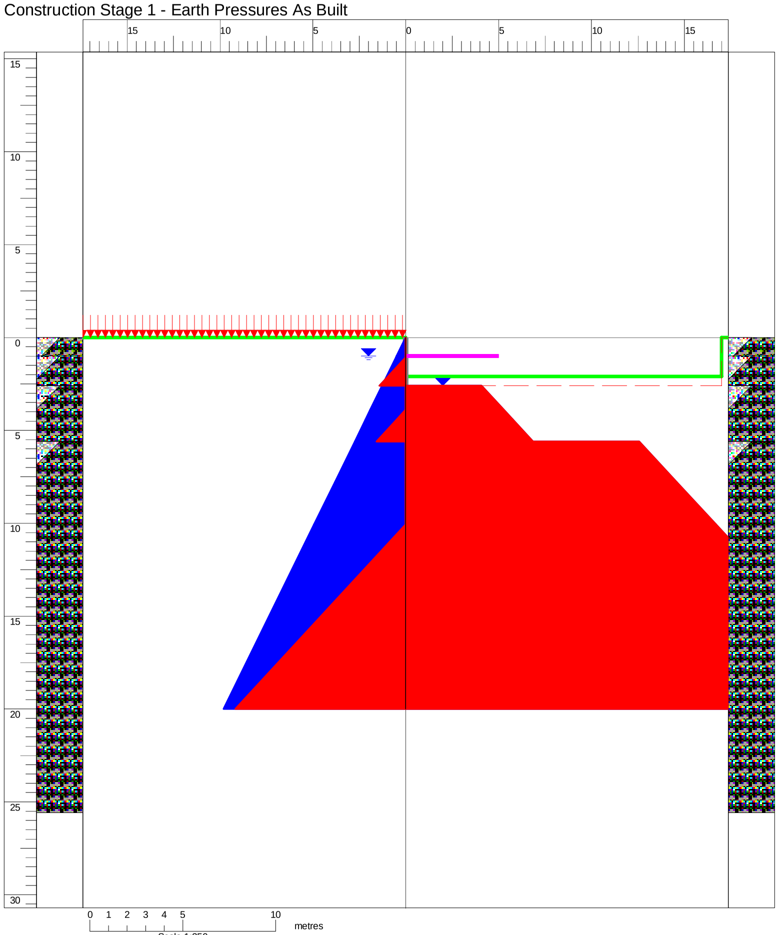
Construction Stage 1 - Earth Pressures As Built



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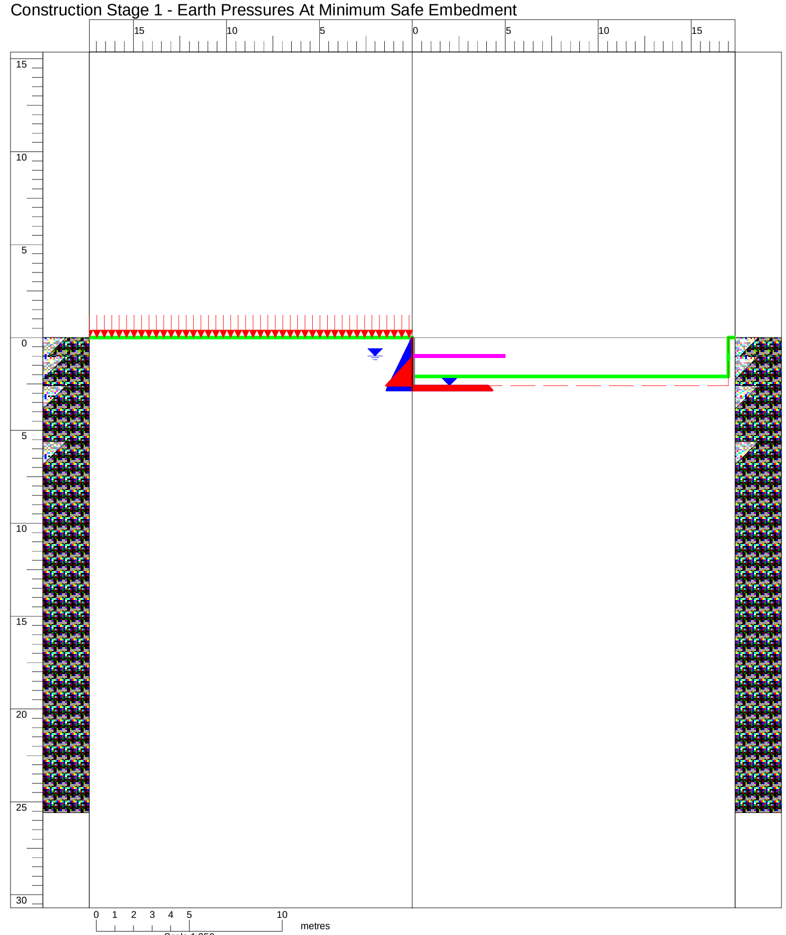
Construction Stage 1 - Earth Pressures At Minimum Safe Embedment



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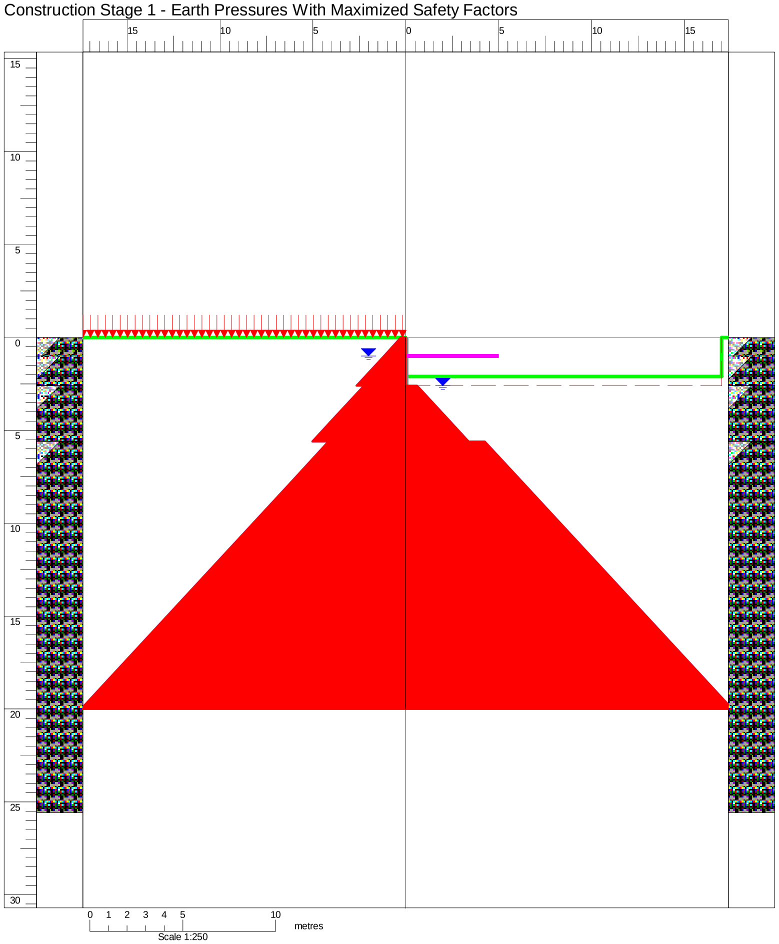
Construction Stage 1 - Earth Pressures With Maximized Safety Factors



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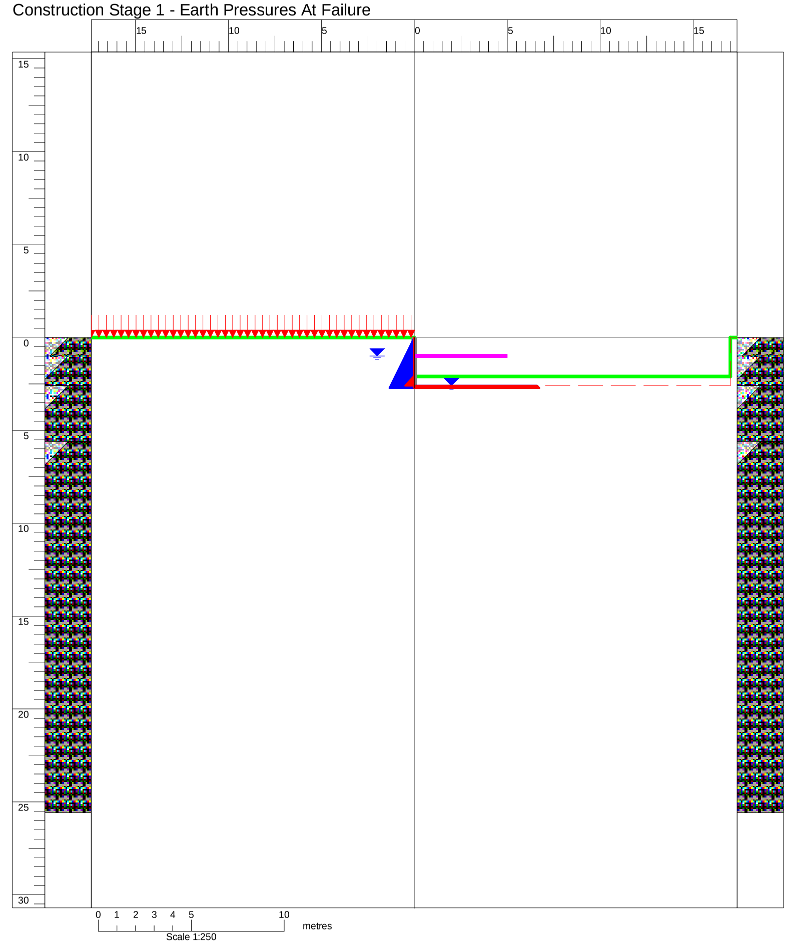
Construction Stage 1 - Earth Pressures At Failure



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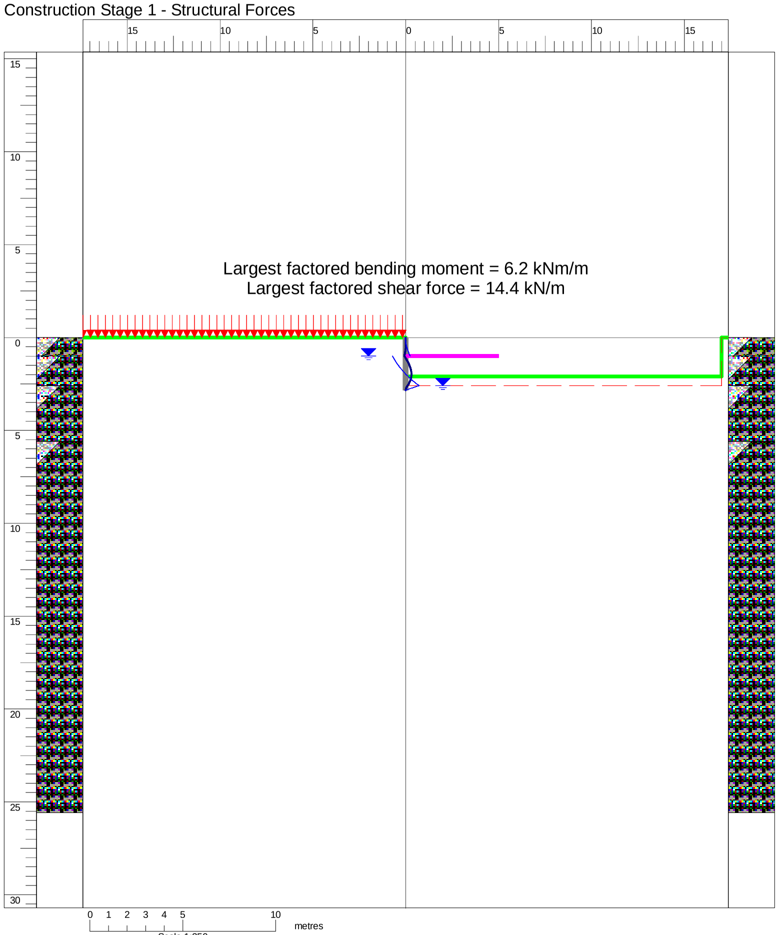
Construction Stage 1 - Structural Forces



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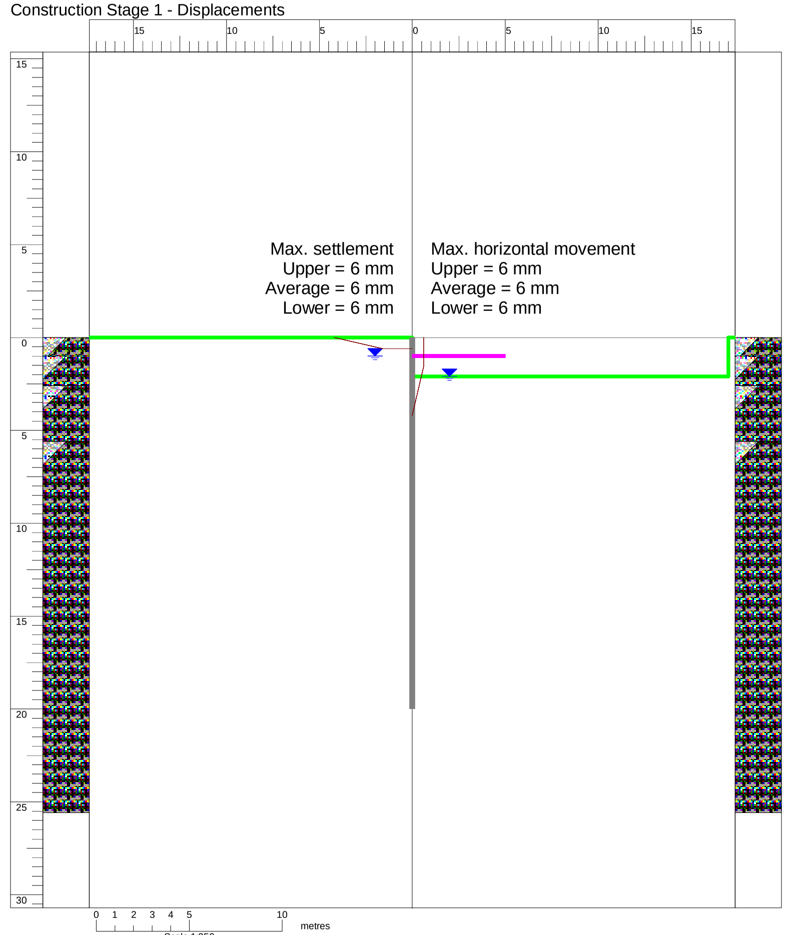
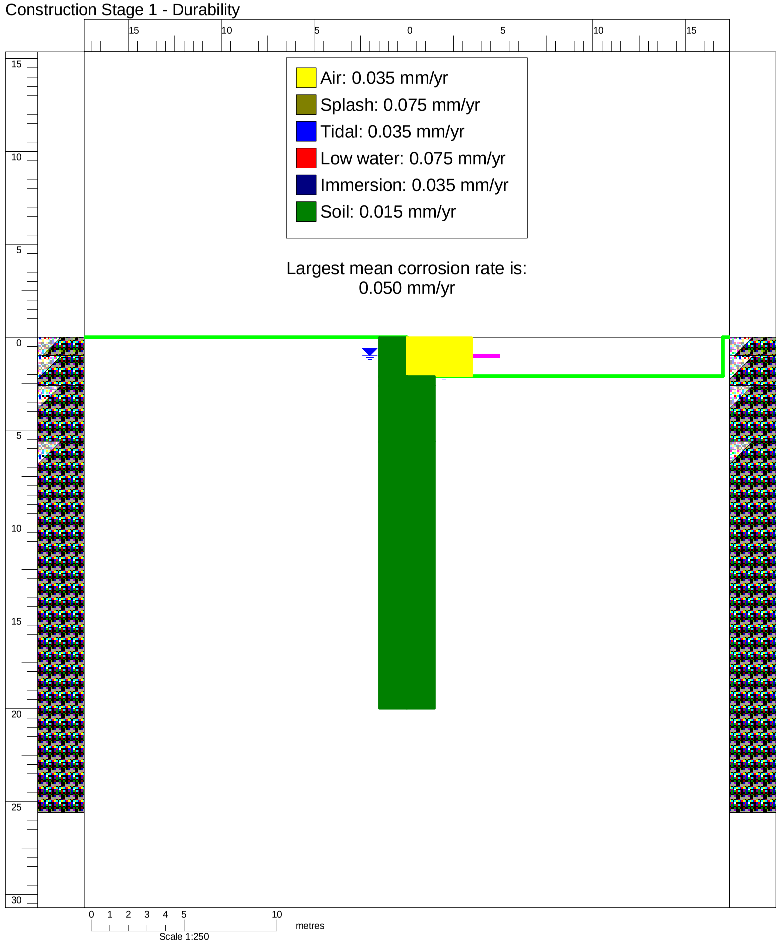
Construction Stage 1 - Displacements



Construction Stage 1 - Durability



Construction Stage 1 - Earth Pressures As Built

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
1.08	0.00	10.55	10.55	0.00	0.00	0.00
1.08	0.00	10.55	10.55	0.00	0.00	0.00
2.29	22.44	0.00	22.44	0.00	0.00	0.00
2.29	22.44	0.00	22.44	0.00	0.00	0.00
2.60	28.21	0.00	28.21	0.00	0.00	0.00
2.60	0.00	25.50	25.50	81.65	0.00	81.65
3.90	0.00	38.25	38.25	105.70	0.00	105.70
3.90	0.00	38.25	38.25	105.70	0.00	105.70
4.42	9.62	33.73	43.35	115.32	0.00	115.32
4.42	9.62	33.73	43.35	115.32	0.00	115.32
5.60	31.45	23.47	54.92	137.15	0.00	137.15
5.60	0.00	54.92	54.92	251.46	0.00	251.46
7.80	0.00	76.49	76.49	292.16	0.00	292.16
7.80	0.00	76.49	76.49	292.16	0.00	292.16
10.08	0.00	98.84	98.84	334.32	0.00	334.32
10.08	0.00	98.84	98.84	334.32	0.00	334.32
20.00	183.54	12.59	196.13	517.86	0.00	517.86

Construction Stage 1 - Earth Pressures At Minimum Safe Embedment

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
1.08	0.00	10.55	10.55	0.00	0.00	0.00
1.08	0.00	10.55	10.55	0.00	0.00	0.00
2.29	22.44	0.00	22.44	0.00	0.00	0.00
2.29	22.44	0.00	22.44	0.00	0.00	0.00
2.60	28.21	0.00	28.21	0.00	0.00	0.00
2.60	0.00	25.50	25.50	81.65	0.00	81.65
2.85	0.00	27.97	27.97	86.32	0.00	86.32

Construction Stage 1 - Earth Pressures With Maximized Safety Factors

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	5.52	0.00	5.52	0.00	0.00	0.00
1.00	23.52	0.00	23.52	0.00	0.00	0.00
1.00	23.52	0.00	23.52	0.00	0.00	0.00
2.60	53.12	0.00	53.12	0.00	0.00	0.00
2.60	45.17	0.00	45.17	12.43	0.00	12.43
4.42	78.84	0.00	78.84	46.10	0.00	46.10
4.42	78.84	0.00	78.84	46.10	0.00	46.10

Construction Stage 1 - Earth Pressures With Maximized Safety Factors [Continued]

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
5.60	100.67	0.00	100.67	67.93	0.00	67.93
5.60	83.26	0.00	83.26	85.34	0.00	85.34
7.80	123.96	0.00	123.96	126.04	0.00	126.04
7.80	123.96	0.00	123.96	126.04	0.00	126.04
20.00	349.66	0.00	349.66	351.74	0.00	351.74

Construction Stage 1 - Earth Pressures At Failure

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
2.06	0.00	20.21	20.21	0.00	0.00	0.00
2.06	0.00	20.21	20.21	0.00	0.00	0.00
2.60	9.98	15.52	25.50	0.00	0.00	0.00
2.60	0.00	25.50	25.50	132.29	0.00	132.29
2.74	0.00	26.83	26.83	134.80	0.00	134.80

Construction Stage 1 - Required Embedment As Built
Results of earth pressure calculation

Retaining Wall
  Name = Prototype: Retaining Wall 1
  Retained height = 2.60 m
Depth of toe = 20.00 m
Partial factors
  Factors on actions
    Unfavourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Favourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Minimum surcharge = 10 kPa
  Factors on material properties
    On shearing resistance = 1.20
    On effective cohesion = 1.20
    On undrained strength = 1.50
  Factors on resistance
    On effective earth pressures = 1.00
    On total earth pressures = 1.00
    Safety factor on resistance applied via: Gross passive pressures
    Minimum active pressure = 0.00 kN/m^3
  Safety margins on geometry
    Unplanned excavation = 10% of clear height, but minimum of 0.5m
    Softened formation = 0 m
  Factors on structural forces
    On bending moments = 1.00
    On shear forces = 1.00
    On prop forces
      Short-term = 1.00/1.00
      Long-term = 1/1
Moments
  Overturning = 24190 kNm/m
  Restoring = 71024 kNm/m
  Out-of-balance = -46833 kNm/m
  Restoring/Overturning = 294 %

Construction Stage 1 - Required Embedment At Minimum Safe Embedment
Results of earth pressure calculation

Retaining Wall
  Name = Prototype: Retaining Wall 1
  Retained height = 2.60 m
Depth of toe = 2.85 m
Partial factors
  Factors on actions
    Unfavourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Favourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Minimum surcharge = 10 kPa
  Factors on material properties
    On shearing resistance = 1.20
    On effective cohesion = 1.20
    On undrained strength = 1.50
  Factors on resistance
    On effective earth pressures = 1.00
    On total earth pressures = 1.00
    Safety factor on resistance applied via: Gross passive pressures
    Minimum active pressure = 0.00 kN/m^3
  Safety margins on geometry
    Unplanned excavation = 10% of clear height, but minimum of 0.5m
    Softened formation = 0 m
  Factors on structural forces
    On bending moments = 1.00
    On shear forces = 1.00
    On prop forces
      Short-term = 1.00/1.00
      Long-term = 1/1
Moments
  Overturning = 37 kNm/m
  Restoring = 37 kNm/m
  Out-of-balance = 0 kNm/m
  Restoring/Overturning = 100 %
  The wall is in equilibrium

Construction Stage 1 - Required Embedment With Maximized Safety Factors
Results of earth pressure calculation

Retaining Wall
  Name = Prototype: Retaining Wall 1
  Retained height = 2.60 m
Depth of toe = 20.00 m
Partial factors
  Factors on actions
    Unfavourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Favourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Minimum surcharge = 10 kPa
  Factors on material properties
    On shearing resistance = 3.96
    On effective cohesion = 3.96
    On undrained strength = 8.39
  Factors on resistance
    On effective earth pressures = 1.00
    On total earth pressures = 1.00
    Safety factor on resistance applied via: Gross passive pressures
    Minimum active pressure = 0.00 kN/m^3
  Safety margins on geometry
    Unplanned excavation = 10% of clear height, but minimum of 0.5m
    Softened formation = 0 m
  Factors on structural forces
    On bending moments = 1.00
    On shear forces = 1.00
    On prop forces
      Short-term = 1.00/1.00
      Long-term = 1/1
  Safety reserve = 14.79
Moments
  Overturning = 42153 kNm/m
  Restoring = 42153 kNm/m
  Out-of-balance = 0 kNm/m
  Restoring/Overturning = 100 %
  The wall is in equilibrium

Construction Stage 1 - Required Embedment At Failure
Results of earth pressure calculation

Retaining Wall
  Name = Prototype: Retaining Wall 1
  Retained height = 2.60 m
Depth of toe = 2.74 m
Partial factors
  Factors on actions
    Unfavourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Favourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Minimum surcharge = 10 kPa
  Factors on material properties
    On shearing resistance = 1.00
    On effective cohesion = 1.00
    On undrained strength = 1.00
  Factors on resistance
    On effective earth pressures = 1.00
    On total earth pressures = 1.00
    Safety factor on resistance applied via: Gross passive pressures
    Minimum active pressure = 0.00 kN/m^3
  Safety margins on geometry
    Unplanned excavation = None
    Softened formation = 0 m
  Factors on structural forces
    On bending moments = 1.00
    On shear forces = 1.00
    On prop forces
      Short-term = 1.00/1.00
      Long-term = 1/1
Moments
  Overturning = 30 kNm/m
  Restoring = 30 kNm/m
  Out-of-balance = 0 kNm/m
  Restoring/Overturning = 100 %
  The wall has insufficient embedment for the specified safety factors

Construction Stage 1: Structural Forces

Depth (m)	Bending Moment (kNm/m)	Shear Force (kN/m)	Prop Force (kN/m)	Notes
1.00	-1.6	-14.2	19.1	
1.98	6.2	0.1	See above	Maximum bending moment
2.60	2.2	14.4	See above	Maximum shear force

Construction Stage 1: Displacements

Max horz Lower (mm)	Max horz Avg (mm)	Max horz Upper (mm)	Max sett Lower (mm)	Max sett Avg (mm)	Max sett Upper (mm)
6	6	6	6	6	6

Construction Stage 1: BaseStability

H/B	B/L	Beta	Nc	Avg Cu kPa	Fbh
0.15	0.53	1.00	5.70	33.3	3.30

Construction Stage 1: Messages
Validating the construction stage
Calculating earth pressures as built (for the specified wall length and safety factors)
Calculating earth pressures at the minimum safe embedment (with the specified safety factors)
Calculating structural forces
Calculating base stability
Calculating displacements
Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls
Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls
Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls
Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls
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Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls
Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls
Calculating durability
Calculating earth pressures with maximized safety factors (for the specified wall length)
Calculating earth pressures at failure (with safety factors set to 1)
Validating the construction stage
Calculating earth pressures as built (for the specified wall length and safety factors)
Calculating earth pressures at the minimum safe embedment (with the specified safety factors)
Calculating structural forces
Calculating base stability
Calculating displacements
Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls
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Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls
Calculating durability
Calculating earth pressures with maximized safety factors (for the specified wall length)
Calculating earth pressures at failure (with safety factors set to 1)
Validating the construction stage
Calculating earth pressures as built (for the specified wall length and safety factors)
Calculating earth pressures at the minimum safe embedment (with the specified safety factors)
Calculating structural forces
Calculating base stability
Calculating displacements
Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls

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Construction Stage 1: Messages [Continued]
Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls
Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls
Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls
Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls
Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls
Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls
Calculating durability
Calculating earth pressures with maximized safety factors (for the specified wall length)
Calculating earth pressures at failure (with safety factors set to 1)
Validating the construction stage
Calculating earth pressures as built (for the specified wall length and safety factors)
Calculating earth pressures at the minimum safe embedment (with the specified safety factors)
Calculating structural forces
Calculating base stability
Calculating displacements
Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls
Factor of safety against basal heave exceeds 3.0: a value of 3.0 has been used for Clough et al.'s wall movement chart
Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls
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Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls
Factor of safety against basal heave exceeds 3.0: a value of 3.0 has been used for Clough et al.'s wall movement chart
Prop spacing calculated using Fernie & Suckling's (1996) simplified equation for single propped walls
Calculating durability
Calculating earth pressures with maximized safety factors (for the specified wall length)
Calculating earth pressures at failure (with safety factors set to 1)

APPENDIX X

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Construction Stages

Name	Term	Objects present in this stage
Construction Stage 1	Short	Retaining Wall 1 On retained side: Ground Profile 1, Borehole 1, Water Table 1, On excavated side: Excavation 1, Borehole 1, Water Table 2, Prop 1,

Ground Profiles

Name	Type	Other Properties
Ground Profile 1	Horizontal Ground	

Excavations

Name	Type	Depth (m)	Plan length (m)	Plan breadth (m)	Other Properties
Excavation 1	Horizontal Excavation	3.10	46.0	16.0	

Soils

Name	Type	Class	State	Other Properties
Soil 1	Clay	High-plasticity	Soft	Soil is not fissured
Soil 3	Clay	High-plasticity	Firm	Soil is not fissured
Soil 4	Clay	High-plasticity	Very stiff	Soil is not fissured
Soil 2	Clay	High-plasticity	Soft	Soil is not fissured

Soil properties

Name	Wet weight kN/m^3	Dry weight kN/m^3	Failure state	Friction °	Cohesion kPa	Poisson's ratio
Soil 1	18.5	18.0	Peak	17.0	1.0	0.30
Soil 3	18.5	18.0	Peak	20.0	1.5	0.30
Soil 4	18.5	18.0	Peak	25.0	2.0	0.30
Soil 2	18.5	18.0	Peak	17.0	1.0	0.30

Soil properties (undrained)

Name	Strength kPa	Strength increase kN/m^3	From depth m
Soil 1	18.0	0.0	0.00
Soil 3	50.0	0.0	0.00
Soil 4	120.0	0.0	0.00
Soil 2	18.0	0.0	0.00

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Layers

Name	Type	Thickness (m)	Soil	Dip (°)	OCR	Tension crack	
Layer 1	Undrained Layer	1.00	Soil 1	0.0	1.0	Flooded	Not rigid
Layer 2	Undrained Layer	1.60	Soil 2	0.0	1.0	Flooded	Not rigid
Layer 3	Undrained Layer	3.00	Soil 3	0.0	1.0	Flooded	Not rigid
Layer 4	Undrained Layer	20.00	Soil 4	0.0	1.0	Flooded	Not rigid

Boreholes

Name	Depth (m)	Contains layers:
Borehole 1	25.6	Layer 1; Layer 2; Layer 3; Layer 4;

Water Tables

Name	Type	Depth (m)	Gradient (kN/m^3)	Other Properties
Water Table 1	Hydrostatic Water Table	1.00	9.81	Hydraulically connected to overlying water
Water Table 2	Hydrostatic Water Table	3.10	9.81	Hydraulically connected to overlying water

Retaining Walls

Name	Type	Depth of toe m	Upstand m	Material	Density kg/m^3	E GPa
Retaining Wall 1	Sheet Pile Wall	20.00	0.00	Steel	7800	210.0

Retaining Wall sections

Name	Section	Sectional area cm^2/m	Moment of inertia cm^4/m	Section modulus cm^3/m
Retaining Wall 1	Sheet pile section = 3N	175	23885	1688

Sheet pile sections

Section	b mm	h mm	d mm	t mm	f mm	A cm^2/m	m/L kg/m	m/A kg/m^2	I cm^4/m	Z cm^3/m
3N	483	283	11.7	8.9	89	175	66.2	137.1	23885	1688

Props

Name	Type	Depth (m)	Horizontal spacing (m)	Inclination (°)	Pre-stress (kN/prop)	L/EA (m/kN)	
Prop 1	Horizontal Prop	1.00	1.00	0.0	0.00	0.00	Permanent

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Design Standard

Type = British Standard 8002
Earth pressure coefficients
  Type = Kerisel & Absi
Tension crack limited to the retained height
Cantilever toe-in = 20%

Equilibrium calculated at the minimum safe embedment (with designated safety factors)

Unfavourable
  Permanent (G) = 1.00
  Variable (Q) = 1.00
  Accidental (A) = 1.00
Favourable
  Permanent (G) = 1.00
  Variable (Q) = 1.00
  Accidental (A) = 1.00
Minimum surcharge = 10 kPa

On shearing resistance = 1.20
On effective cohesion = 1.20
On undrained strength = 1.50

On effective earth pressures = 1.00
On total earth pressures = 1.00
Safety factor on resistance applied via: Gross passive pressures
Minimum active pressure = 0.00 kN/m^3

Unplanned excavation = 10% of clear height, but minimum of 0.5m
Softened formation = 0 m

On bending moments = 1.00
On shear forces = 1.00
On prop forces
  Short-term = 1.00/1.00
  Long-term = 1/1

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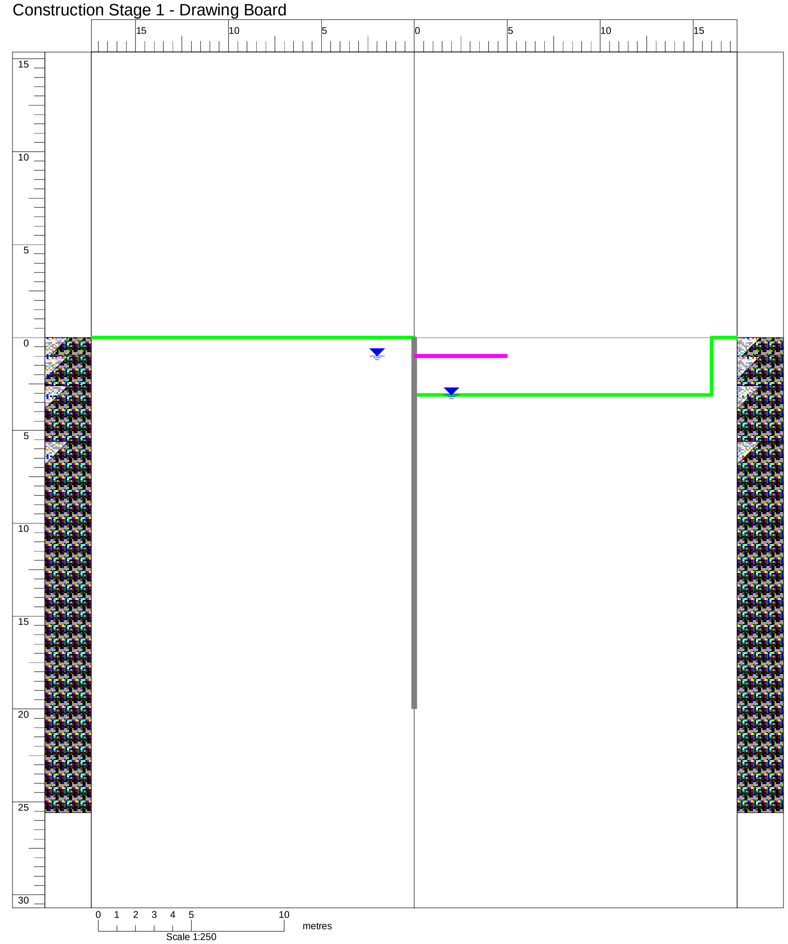
Construction Stage 1 - Drawing Board



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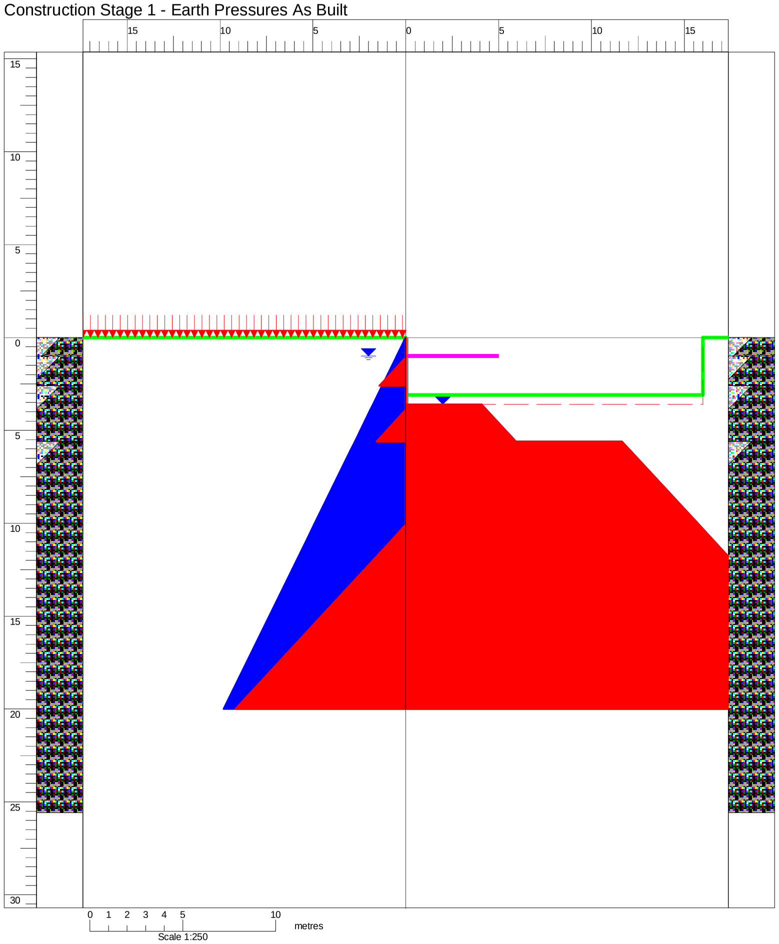
Construction Stage 1 - Earth Pressures As Built



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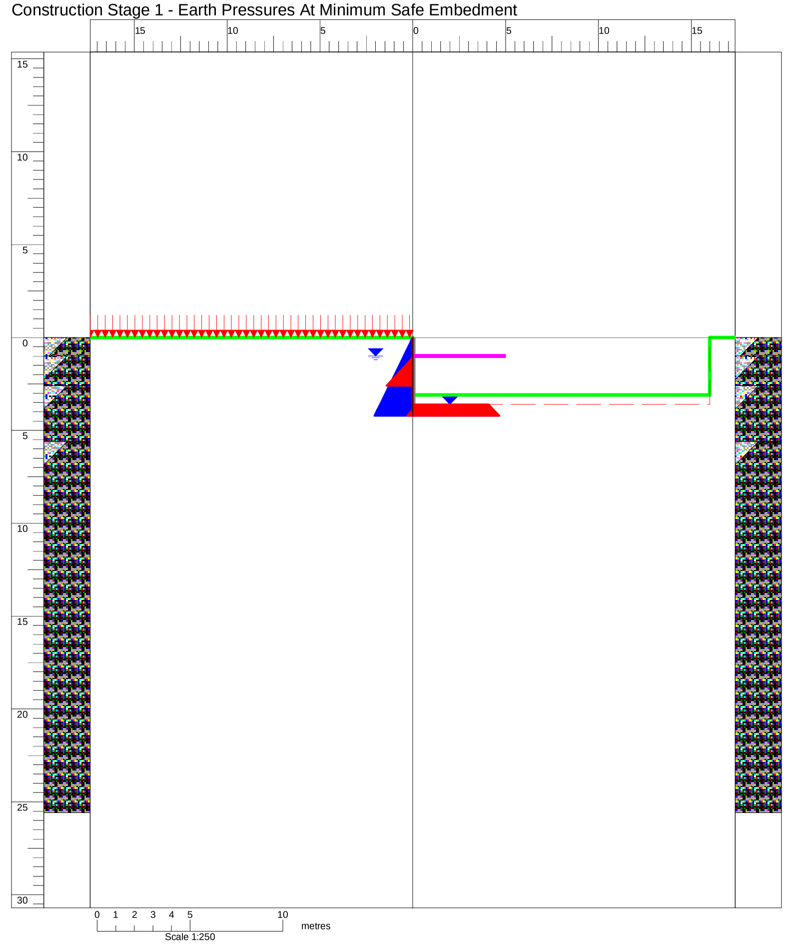
Construction Stage 1 - Earth Pressures At Minimum Safe Embedment



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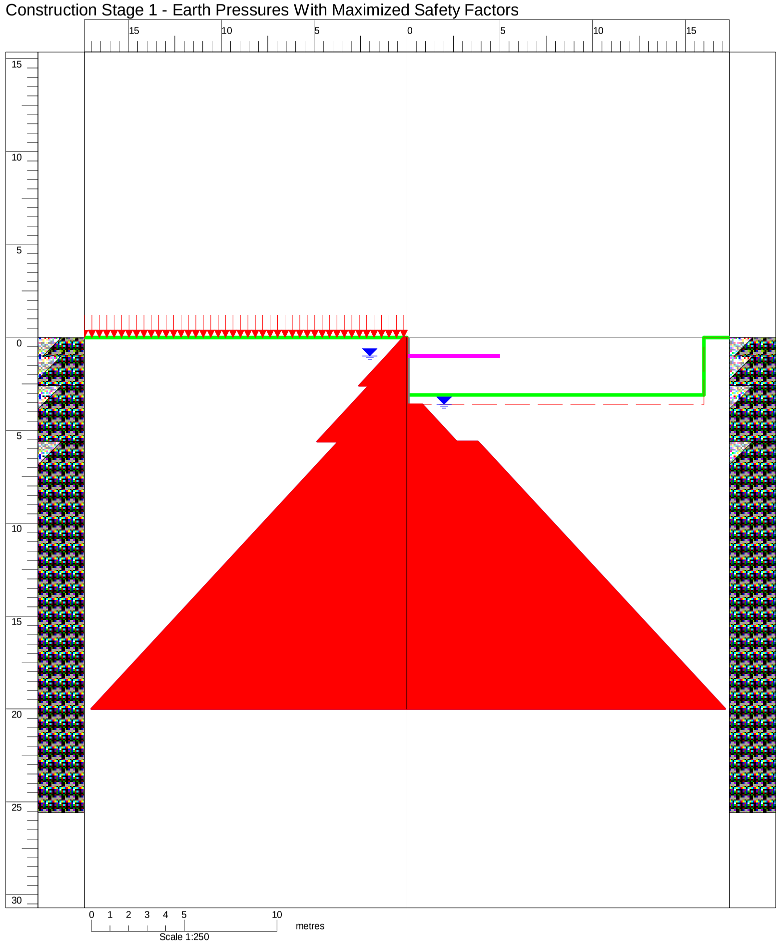
Construction Stage 1 - Earth Pressures With Maximized Safety Factors



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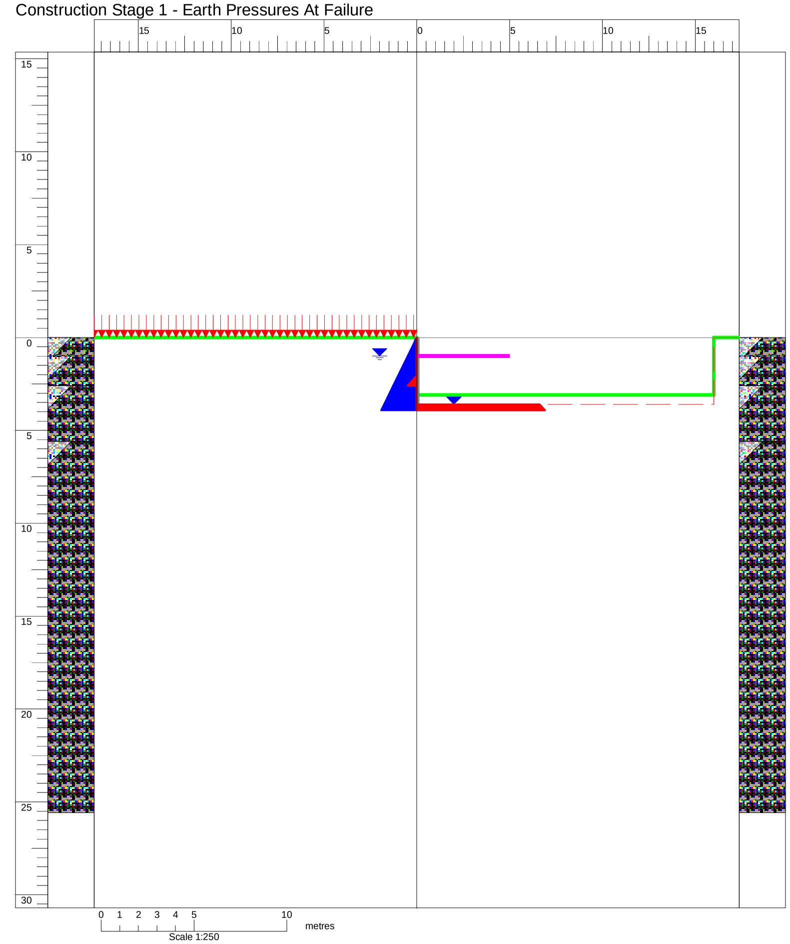
Construction Stage 1 - Earth Pressures At Failure



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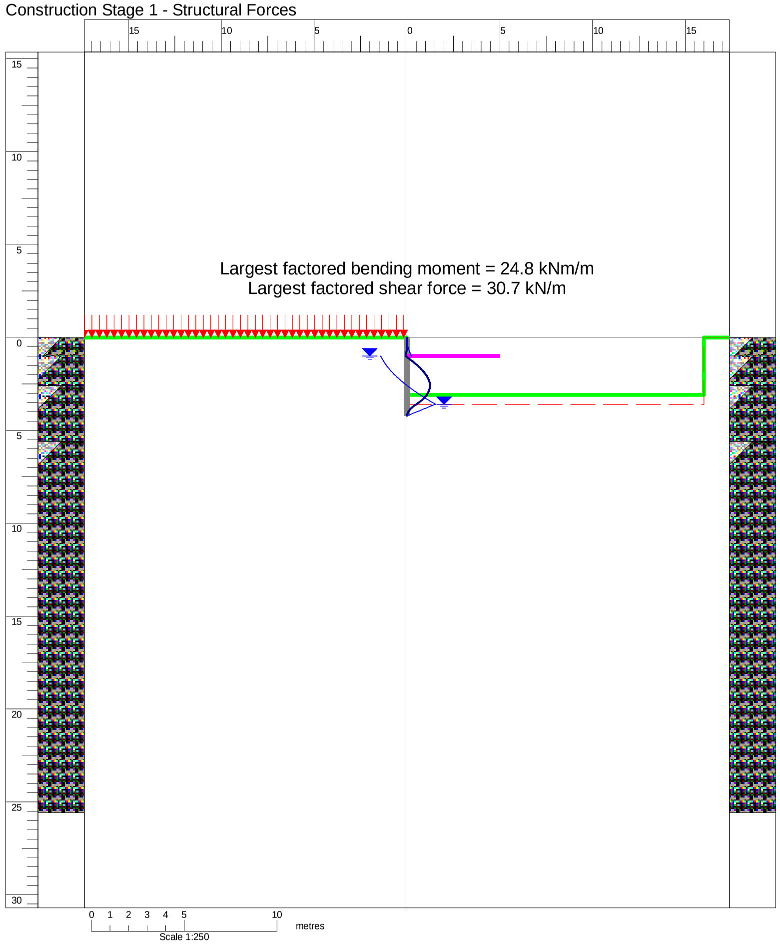
Construction Stage 1 - Structural Forces



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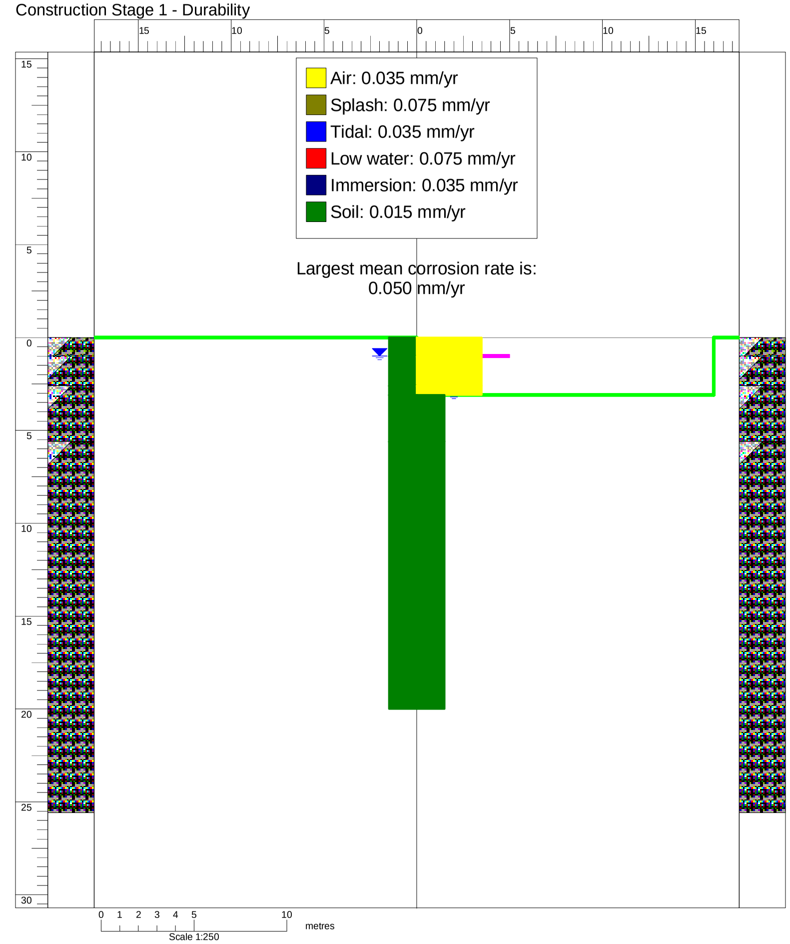
Construction Stage 1 - Durability



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Construction Stage 1 - Earth Pressures As Built

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
1.08	0.00	10.55	10.55	0.00	0.00	0.00
1.08	0.00	10.55	10.55	0.00	0.00	0.00
2.29	22.44	0.00	22.44	0.00	0.00	0.00
2.29	22.44	0.00	22.44	0.00	0.00	0.00
2.60	28.21	0.00	28.21	0.00	0.00	0.00
2.60	0.00	25.50	25.50	0.00	0.00	0.00
3.60	0.00	35.30	35.30	0.00	0.00	0.00
3.60	0.00	35.30	35.30	81.65	0.00	81.65
3.90	0.00	38.25	38.25	87.20	0.00	87.20
3.90	0.00	38.25	38.25	87.20	0.00	87.20
5.60	31.45	23.47	54.92	118.65	0.00	118.65
5.60	0.00	54.92	54.92	232.96	0.00	232.96
6.12	0.00	60.02	60.02	242.58	0.00	242.58
6.12	0.00	60.02	60.02	242.58	0.00	242.58
10.08	0.00	98.84	98.84	315.82	0.00	315.82
10.08	0.00	98.84	98.84	315.82	0.00	315.82
10.80	13.34	92.57	105.91	329.16	0.00	329.16
10.80	13.34	92.57	105.91	329.16	0.00	329.16
20.00	183.54	12.59	196.13	499.36	0.00	499.36

Construction Stage 1 - Earth Pressures At Minimum Safe Embedment

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
1.08	0.00	10.55	10.55	0.00	0.00	0.00
1.08	0.00	10.55	10.55	0.00	0.00	0.00
2.29	22.44	0.00	22.44	0.00	0.00	0.00
2.29	22.44	0.00	22.44	0.00	0.00	0.00
2.60	28.21	0.00	28.21	0.00	0.00	0.00
2.60	0.00	25.50	25.50	0.00	0.00	0.00
3.60	0.00	35.30	35.30	0.00	0.00	0.00
3.60	0.00	35.30	35.30	81.65	0.00	81.65
3.90	0.00	38.25	38.25	87.20	0.00	87.20
3.90	0.00	38.25	38.25	87.20	0.00	87.20
4.23	6.02	35.42	41.44	93.22	0.00	93.22

Construction Stage 1 - Earth Pressures With Maximized Safety Factors

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	4.09	0.00	4.09	0.00	0.00	0.00

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Construction Stage 1 - Earth Pressures With Maximized Safety Factors [Continued]

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
1.00	22.09	0.00	22.09	0.00	0.00	0.00
1.00	22.09	0.00	22.09	0.00	0.00	0.00
2.60	51.69	0.00	51.69	0.00	0.00	0.00
2.60	41.17	0.00	41.17	0.00	0.00	0.00
3.60	59.67	0.00	59.67	0.00	0.00	0.00
3.60	59.67	0.00	59.67	16.43	0.00	16.43
5.60	96.67	0.00	96.67	53.43	0.00	53.43
5.60	73.68	0.00	73.68	76.42	0.00	76.42
6.12	83.30	0.00	83.30	86.04	0.00	86.04
6.12	83.30	0.00	83.30	86.04	0.00	86.04
10.80	169.88	0.00	169.88	172.62	0.00	172.62
10.80	169.88	0.00	169.88	172.62	0.00	172.62
20.00	340.08	0.00	340.08	342.82	0.00	342.82

Construction Stage 1 - Earth Pressures At Failure

Depth	EarthPr	WaterPr	TotalPr	EarthPr	WaterPr	TotalPr
m	kPa	kPa	kPa	kPa	kPa	kPa
	Retained	Retained	Retained	Excavated	Excavated	Excavated
0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
1.00	0.00	9.81	9.81	0.00	0.00	0.00
2.06	0.00	20.21	20.21	0.00	0.00	0.00
2.06	0.00	20.21	20.21	0.00	0.00	0.00
2.60	9.98	15.52	25.50	0.00	0.00	0.00
2.60	0.00	25.50	25.50	0.00	0.00	0.00
3.60	0.00	35.30	35.30	0.00	0.00	0.00
3.60	0.00	35.30	35.30	132.29	0.00	132.29
3.93	0.00	38.51	38.51	138.34	0.00	138.34

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Construction Stage 1 - Required Embedment As Built
Results of earth pressure calculation

Retaining Wall
  Name = Prototype: Retaining Wall 1
  Retained height = 3.60 m
Depth of toe = 20.00 m
Partial factors
  Factors on actions
    Unfavourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Favourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Minimum surcharge = 10 kPa
  Factors on material properties
    On shearing resistance = 1.20
    On effective cohesion = 1.20
    On undrained strength = 1.50
  Factors on resistance
    On effective earth pressures = 1.00
    On total earth pressures = 1.00
    Safety factor on resistance applied via: Gross passive pressures
    Minimum active pressure = 0.00 kN/m^3
  Safety margins on geometry
    Unplanned excavation = 10% of clear height, but minimum of 0.5m
    Softened formation = 0 m
  Factors on structural forces
    On bending moments = 1.00
    On shear forces = 1.00
    On prop forces
      Short-term = 1.00/1.00
      Long-term = 1/1
Moments
  Overturning = 24190 kNm/m
  Restoring = 67555 kNm/m
  Out-of-balance = -43364 kNm/m
  Restoring/Overturning = 279 %

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Construction Stage 1 - Required Embedment At Minimum Safe Embedment
Results of earth pressure calculation

Retaining Wall
  Name = Prototype: Retaining Wall 1
  Retained height = 3.60 m
Depth of toe = 4.23 m
Partial factors
  Factors on actions
    Unfavourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Favourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Minimum surcharge = 10 kPa
  Factors on material properties
    On shearing resistance = 1.20
    On effective cohesion = 1.20
    On undrained strength = 1.50
  Factors on resistance
    On effective earth pressures = 1.00
    On total earth pressures = 1.00
    Safety factor on resistance applied via: Gross passive pressures
    Minimum active pressure = 0.00 kN/m^3
  Safety margins on geometry
    Unplanned excavation = 10% of clear height, but minimum of 0.5m
    Softened formation = 0 m
  Factors on structural forces
    On bending moments = 1.00
    On shear forces = 1.00
    On prop forces
      Short-term = 1.00/1.00
      Long-term = 1/1
Moments
  Overturning = 160 kNm/m
  Restoring = 160 kNm/m
  Out-of-balance = 0 kNm/m
  Restoring/Overturning = 100 %
  The wall is in equilibrium

Construction Stage 1 - Required Embedment With Maximized Safety Factors
Results of earth pressure calculation

Retaining Wall
  Name = Prototype: Retaining Wall 1
  Retained height = 3.60 m
Depth of toe = 20.00 m
Partial factors
  Factors on actions
    Unfavourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Favourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Minimum surcharge = 10 kPa
  Factors on material properties
    On shearing resistance = 3.17
    On effective cohesion = 3.17
    On undrained strength = 6.43
  Factors on resistance
    On effective earth pressures = 1.00
    On total earth pressures = 1.00
    Safety factor on resistance applied via: Gross passive pressures
    Minimum active pressure = 0.00 kN/m^3
  Safety margins on geometry
    Unplanned excavation = 10% of clear height, but minimum of 0.5m
    Softened formation = 0 m
  Factors on structural forces
    On bending moments = 1.00
    On shear forces = 1.00
    On prop forces
      Short-term = 1.00/1.00
      Long-term = 1/1
  Safety reserve = 10.87
Moments
  Overturning = 40487 kNm/m
  Restoring = 40487 kNm/m
  Out-of-balance = 0 kNm/m
  Restoring/Overturning = 100 %
  The wall is in equilibrium

Construction Stage 1 - Required Embedment At Failure
Results of earth pressure calculation

Retaining Wall
  Name = Prototype: Retaining Wall 1
  Retained height = 3.60 m
Depth of toe = 3.93 m
Partial factors
  Factors on actions
    Unfavourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Favourable
      Permanent (G) = 1.00
      Variable (Q) = 1.00
      Accidental (A) = 1.00
    Minimum surcharge = 10 kPa
  Factors on material properties
    On shearing resistance = 1.00
    On effective cohesion = 1.00
    On undrained strength = 1.00
  Factors on resistance
    On effective earth pressures = 1.00
    On total earth pressures = 1.00
    Safety factor on resistance applied via: Gross passive pressures
    Minimum active pressure = 0.00 kN/m^3
  Safety margins on geometry
    Unplanned excavation = None
    Softened formation = 0 m
  Factors on structural forces
    On bending moments = 1.00
    On shear forces = 1.00
    On prop forces
      Short-term = 1.00/1.00
      Long-term = 1/1
Moments
  Overturning = 122 kNm/m
  Restoring = 122 kNm/m
  Out-of-balance = 0 kNm/m
  Restoring/Overturning = 100 %
  The wall is in equilibrium

Construction Stage 1: Structural Forces

Depth (m)	Bending Moment (kNm/m)	Shear Force (kN/m)	Prop Force (kN/m)	Notes
1.00	-1.6	-28.4	33.3	
2.60	24.8	0.3	See above	Maximum bending moment
3.60	10.4	30.7	See above	Maximum shear force

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Construction Stage 1: BaseStability

H/B	B/L	Beta	Nc	Avg Cu kPa	Fbh
0.22	0.35	1.00	5.59	43.0	3.16

GEOTECH ASSOCIATES LTD.

30TH ANNIVERSARY

CONSULTING CIVIL & GEOTECHNICAL ENGINEERS

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AECOM
REPORT ON GEOTECHNICAL INVESTIGATION
FOR
THE DESIGN OF SEWER TRUNK MAIN
FOR THE
CITY OF SAN FERNANDO

REPORT NO: GA 07 326

10/05/04

10/05/04.

May 4, 2010

Directors: Martin Andrews, B.Sc., M.Sc. (Managing Director), Malcom J. Joab (Director), B.Sc., M.Sc., DIC., Andrew Budhram, B.Sc.

MEMBERS: ASSOCIATION OF PROFESSIONAL ENGINEERS OF TRINIDAD AND TOBAGO

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GENERAL CONDITIONS AND LIMITATIONS OF REPORT

A. USE OF THE REPORT

A.1 This report has been prepared for a specific Client, location, and for a proposed use as outlined herein. The factual data, interpretations are recommendations contained pertain only to the project as described.

They are not applicable to any other project, or site location. If the project is modified in concept, location or elevation, Geotech should be retained to confirm that the recommendations are still valid.

A.2 If the project is not initiated within (2) two years from the date of the report, Geotech should be given an opportunity to review the report and recommendations to take into consideration changes in the land use or other pertinent factors.

A.3 The comments given in the report are intended only for the guidance of the design engineer. The extent of the investigation which would be required to determine all the relevant underground conditions which may affect construction costs, techniques, and equipment choice, scheduling and sequence of operations would normally be greater than has been carried out for design purposes. The Contractor should therefore be aware that subsoil conditions may vary from those encountered in the boreholes.

B. FOLLOW UP

B.1 All details of the design and proposed construction may not be known at the time of the submission of Geotech report. It is recommended that Geotech be retained during the final design stage to review the design drawings and specifications related to foundations, earthworks, retaining systems and drainage, to determine that they are consistent with the intent of report.

B.2 Retention of Geotech during construction is recommended to confirm and document that the subsurface condition throughout the site do not materially differ from those given in Geotech report and to confirm and document that construction activities do not adversely affect the design intent of Geotech's recommendations.

C. SOIL AND ROCK CONDITIONS

C.1 Soil and rock descriptions in this report are based on commonly accepted methods of classification and identification employed in professional geotechnical practice. Classification and identification of soil and rock involves judgement and Geotech does not guarantee descriptions as exact, but infers accuracy only to the extent that is common in current geotechnical practice.

C.2 The soils and rock conditions described in this report are those observed at the time of the study. Unless otherwise noted, those conditions form the basis of the recommendations in the report. The condition of the soil and rock may be significantly altered by construction activities (traffic, excavation, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soil to change due to wetting or drying. Unless otherwise indicated the soil and rock must be protected from these changes or disturbance during construction.

D. LOGS OF TEST HOLES AND SUBSURFACE INTERPRETATIONS

D.1 Soil and rock formations are variable to a greater or lesser extent. The test hole logs indicate the approximate subsurface conditions only at the locations of the test holes. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. The precision with which subsurface conditions are indicated depends on the method of boring, the frequency of sampling, the method of sampling and the uniformity of subsurface conditions. The spacing of test holes, frequency of sampling and type of boring also reflect budget and schedule considerations.

D.2 Subsurface conditions between test holes are holes are inferred and may vary significantly from conditions encountered at the test holes.

D.3 Groundwater conditions described in this report refer only to those observed at the place and time of observation noted in the report. These conditions may vary seasonally or as a consequence of construction activities on the site or adjacent sites.

E. DRAINAGE

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage can have serious consequences. Geotech can take no responsibility for the effects of drainage unless Geotech is specifically involved in the detailed design and follow-up site services during construction of the system.

GENERAL NOTES

I. Unless otherwise stated, all soil tests are carried out in accordance with ASTM Standards.

II. All soil samples are disposed of after three (3) months from the date of issue of the report, unless the Client issues other specific instructions for sample retention.

LIST OF ABBREVIATIONS AND NOTATIONS

The abbreviations, and other notations on the figures and in the text of this report are as follows:

I. ABBREVIATIONS

ASTM	- American Society of Testing and Materials
AASHTO	- American Association of State Highway and Transportation Officials
BSI	- British Standards Institution
UBC	- Uniform Building Code
CBR	- California Bearing Ratio
CP	- Code of Practice
SPT	- Standard Penetration Test
DCPT	- Dynamic Cone Penetration Test
LPA	-Computer Program for Analysis of Liquefaction Potential
APILE^{plus}	-Computer Program for Analysis of the Axial Capacity of Driven Piles
LPILE^{plus}	-Computer Program for Stress and Deformation Analysis of Piles Under Lateral Loading
PC STABL 5M	-Computer program for two-dimensional, limit equilibrium slope stability analysis

II. PENETRATION RESISTANCE

Standard Penetration Resistance or *N Value*: A value obtained from the Standard Penetration Test (*SPT*).

Description
The number of blows required by a 63.5 kilogram hammer dropped over a height of 760 mm to drive the standard 50.8 mm outer diameter split barrel sampler 300 mm into the ground.

III. SOIL DESCRIPTION

(a) *Cohesionless Soils*

Relative Density	N value
Very loose	0 to 4
Loose	5 to 10
Medium dense	11 to 30
Dense	31 to 50
Very dense	over 50

(b) *Cohesive Soils*

Consistency	N value	S, kN per sq.m.
Very soft	Less than 1	less than 12
Soft	2 to 4	12 to 25
Medium stiff	5 to 8	26 to 50
Stiff	9 to 15	51 to 100
Very stiff	16 to 30	101 to 200
Hard	over 30	over 200

LIST OF SYMBOLS

A = porewater-pressure coefficient
A (m^2) = area
a_{max} (g) = maximum ground surface acceleration produced by an earthquake
B = porewater-pressure coefficient = $\Delta u/\Delta p$
B (m) = width
C (kN) = resultant cohesion
C_C = coefficient of curvature = $D^2_{30}/D_{10}/D_{60}$
C_U = uniformity coefficient = D_{60}/D_{10}
C_c = compression index = $\Delta e/\Delta \log \sigma'_v$; creep ratio
C_r = recompression index
C_s = swelling index
c = cohesion intercept
c' = cohesion intercept of Mohr-Coulomb failure envelope in terms of effective stress at failure
c_h (m^2/year) = coefficient of consolidation when flow in the horizontal direction
c_v (m^2/year) = coefficient of consolidation
S_u (kPa) = undrained shear strength
CU = consolidated undrained triaxial compression test
D (m) = depth; diameter
D_{10} = effective grain size
D_{50} = mean grain size
DS = direct shear test
E (kPa) = modulus of elasticity
EI (kPa·m^4) or (kN·m^2) = flexural stiffness of pile
e = void ratio
e_0 = *in situ* void ratio under effective overburden pressure σ_{v0}'
F = factor of safety
FS = factor of safety
G_s = specific gravity of solid constituents $G_s = \gamma_s/\gamma_w$
PI = plasticity index
K_a = coefficient of active earth pressure
K_p = coefficient of passive earth pressure
k (m/s) = coefficient of permeability
K_h (kPa/m) = modulus of horizontal subgrade reaction
N = dimensionless factor (N_c, N_γ, and N_q = bearing capacity factors; N_s = stability factor in theory of stability of slopes); numbers of blows on sampling spoon during performance of *STP* test
OCR = overconsolidation ratio = $\sigma'_p/\sigma'_{v0} = \sigma'_{v\,max}/\sigma'_{v0}$
P (kN or kN/m) = resultant pressure, normal force
P_a (kN/m) = active earth pressure
P_p (kN/m) = passive earth pressure
p (kPa) = pressure of normal stress; subgrade reaction
p' (kPa) = effective stress = $(\sigma'_1 + \sigma'_3)/2$
Q (kN) = concentrated load; strut load
Q_a (kN) = allowable load on pile
Q_f (kN) = skin friction (total)
Q_p (kN) = ultimate bearing capacity resulting from point resistance
Q_u (kN) = ultimate uplift of resistance of drilled shaft
q (kPa) = shear stress $(\sigma'_1 - \sigma'_3)/2$
q (kPa) = uniformly distributed load; surcharge per unit of area; uniformly distributed line load
q (kPa) = allowable soil pressure
q_u (kPa) = unconfined compressive strength
r_u = porewater pressure coefficient = u/σ_v
S_r = degree of saturation
s_u = undrained shear strength (often $s_u = q_u/2$)
T_v = time factor for one-dimensional consolidation in vertical direction
UC = unconfined compression test
UU = unconsolidated undrained triaxial compression test
u (kPa) = porewater pressure
u' (kPa) = excess porewater pressure
Δu (kPa) = porewater pressure change caused by all-around pressure or by shear stress
LL = liquid limit
PL = plastic limit
γ (kN/m^3) = total unit weight
γ' (kN/m^3) = submerged unit weight
γ_d (kN/m^3) = dry unit weight, unit weight of soil if water is entirely replaced by air
γ_w (kN/m^3) = unit weight of water
γ_{sat} (kN/m^3) = unit weight in saturated state
ρ_d (kN/m^3) = density in dry state
ρ_w (kN/m^3) = density of water
σ (kPa) = total normal stress
σ' (kPa) = effective normal stress
σ_1 (kPa) = major principal stress
σ_3 (kPa) = minor principal stress
σ'_1 (kPa) = effective major principal stress
σ'_3 (kPa) = effective minor principal stress
σ'_p (kPa) = preconsolidation pressure
σ_v (kPa) = total vertical stress
σ_v' (kPa) = effective vertical stress
σ'_{max} (kPa) = maximum past pressure
φ' (degree) = effective-stress friction angle; angle of shearing resistance; angle of internal friction

1.0 INTRODUCTION

1.1 Terms of Reference

GEOTECH ASSOCIATES LTD. was commissioned by AECOM, to carry out a geotechnical investigation for the design of the Wastewater collection system the City of San Fernando and environs. This investigation was carried out in accordance with the stipulated conditions in our proposal letter dated June 13, 2007 and revised proposal of September 10, 2009.

1.2 Objectives

This investigation was geared toward identifying the subsoil conditions along the proposed pipeline route and lift stations, and providing parameters for the design of earth retaining structures and foundation design.

1.3 Scope

The following tasks constituted the scope of the works:

- Fieldwork geared toward obtaining representative samples of the subsoil and necessary *in-situ* parameters;
- Performing laboratory tests to determine the characteristics of the subsoils;
- Providing guidelines for appropriate input geotechnical parameters for pipe installation including comments on the stability of pipe trenches and the ease or difficulty of excavation.
- A summary of the ground water level encountered and;
- Providing guidelines regarding the corrosivity of the subsoils.

2.0 DESCRIPTION OF SITE

2.1 Location & Site Description

The proposed expansion of the existing sewage collection system is earmarked for the City of San Fernando and environs, and it includes the following seven catchments *(See Enclosure No. 1)*:

- Marabella
- Tarouba-Cocoyea
- Pleasantville-Corinth
- Green Acres
- San Fernando Central
- San Fernando South
- Vistabella

The expansion works would also include the construction of a junction chamber at the existing San Fernando sewage treatment plant at Gulf View.

Topographically, these areas may be described as gently rolling with the exception of the Marabella catchment which is generally flat.

Each catchment is densely populated and consequently it is understood that the sewer truck main will be installed using a micro-tunnel boring machine in order to avoid as far as practical, disruption to nearby residents.

3.0 FIELD INVESTIGATION

The field investigation originally consisted of test-pits to be advanced with a mechanical backhoe along the pipeline route and; boreholes at the location of lift stations. The design invert level of the pipelines however were generally below the practical limit of the mechanical backhoe. Therefore, the scope of the fieldwork was adjusted to boreholes throughout. These boreholes were generally advanced to a depth 1 m below the design invert level of the pipeline. The investigation therefore consisted of drilling sixty (60) boreholes along the proposed route at the approximate locations shown on *Enclosure No. 1*.

3.1 Boreholes

The boreholes were advanced with an Acker portable drill rig employing wash boring techniques. The boreholes were drilled during the period February 1 - April 9, 2010. The boreholes were drilled to depths summarized in *Table 3.1* below.

Table 3.1 Summary of Borehole Depths

Location/Catchment	Borehole ID	Depth (m)
Wastewater Treatment Plant	B0-1	11.1
	B0-2	9.6
Marabella	B10-1	6.6
	B10-3	6.6
	B10-4	6.6
	B10-8	6.6
	B10-13	6.6
	B10-15	8.1
	B10-17	5.0
	B10-20	8.1
	B10-24	11.1
	B10-27	11.1

Table 3.1 Summary of Borehole Depths (cont'd)

Catchment	Borehole ID	Depth (m)
Marabella	B10-30	9.6
	B10-31	5.0
Tarouba-Cocoyea	B15-2	5.0
	B15-4	8.1
Pleasantville-Corinth	B25-1	5.0
	B25-3	3.5
	B25-4	3.5
	B25-6	6.6
	B25-8	5.0
	B25-10	3.5
	B25-12	3.5
	B25-15	6.6
	B25-17	6.6
	B25-19	5.0
	B25-21	5.0
Green Acres	B40-1	5.0
	B40-2	5.0
San Fernando Central	B55-1	11.1
	B55-3	8.1
	B55-5	9.6
	B55-7	9.6
	B55-9	9.6
	B55-10	11.1

Table 3.1 Summary of Borehole Depths (cont'd)

Catchment	Borehole ID	Depth (m)
San Fernando Central	B55–11	6.6
	B55-12	11.1
	B55-13	11.1
	B55-14	12.7
	B55-15	14.2
	B55-16	12.7
	B55-17	12.7
	B55-18	11.1
	B55-19	12.7
San Fernando South	B70-2	6.6
	B70-4	8.1
	B70-6	5.0
	B70-8	5.0
	B70-10	5.0
	B70-13	3.5
	B70-15	5.0
	B70-17	6.6

Table 3.1 Summary of Borehole Depths (cont'd)

Catchment	Borehole ID	Depth (m)
Vistabella	B80-4	5.0
	B80-11	5.0
	B80-15	6.6
	B80-17	8.1
	B80-19	8.1
	B80-22	11.1
	B80-24	11.1
	B80-25	11.1

3.1.1 *Sampling*

Samples were taken at intervals of 0.75 m for the first 3.0 m and at 1.5 m intervals thereafter. Both disturbed split spoon and undisturbed Shelby tube samples were taken. The split spoon sampling procedure also entails the measurement of the Standard Penetration Resistance, or *N value* of the soil.

3.1.2 *Standard Penetration Test*

The Standard Penetration Test (SPT) was carried out in conjunction with split spoon sampling, in accordance with the method outlined on page *(vi)* of the preface. This test gives the Standard Penetration Resistance or *N value* of the soil. The *N value* is related to soil strength and density and is a useful parameter in estimating the bearing capacity of the subsoil.

3.1.3 *Water Level Observations*

The groundwater levels were measured and recorded in the boreholes immediately after drilling.

4.0 LABORATORY INVESTIGATIONS

4.1 Testing

Laboratory testing consisted of routine classification tests and engineering properties tests to determine the properties of the subsoil.

The routine classification tests consisted of:

- Natural moisture contents on all samples;
- Grain size analyses on selected samples;
- Atterberg's limits tests on selected samples and;

Additionally, the following chemical tests were conducted on selected samples to assess the corrosivity of the subsoils.

- pH
- Chloride content
- Sulphate content

4.2 Results

The test results are included on the enclosures as outlined below and are discussed in subsequent sections of the report.

- Moisture contents are plotted on the Borehole logs *(Enclosure Nos. 2 - 67)*;

- The grain size analyses are shown on the Gradation curves *(Enclosure Nos. 68 - 95)*;

- The results of Atterberg's Limits test is shown on *Enclosure Nos. 96 - 107*;

5.0 GEOLOGICAL & GEOTECHNICAL CONDITIONS

5.1 General Geological Conditions

Prior to presenting the detailed geotechnical conditions, a brief description of the site geology is given. Two (2) geological formations are encountered within the study area. These are:

1. Cipero Formation
2. Nariva Formation

5.1.1 Cipero Formation (Southern Basin)

The Cipero Formation consists primarily of slightly indurates light coloured (cream to white) chalky marls, calcareous silts and dark non-calcareous clays, sands and blocks of pink to cream coloured coralliferous and orbitoidal biotermal reefal limestones, the latter occurring arbitrarily throughout the sequence. The age of the Cipero formation is considered to be Miocene.

This formation is subdivided into the Upper, Middle and Lower Cipero members based primarily on foraminiferal assemblages, since lithological differentiation is difficult to ascertain in the field. In addition, there are numerous slumps or 'exotic blocks' of primarily limestones and arenaceous deposits throughout the sequence, which lead to difficulty in defining the various units.

5.1.2 Nariva Formation (Northern Basin Sediment)

The Nariva Formation is time equivalent to parts of the Middle and Lower Cipero Formation, but was interpreted to be deposits in a separate and distinct part of Trinidad Basin (Northern Basin) and can interdigitate with the Cipero and other sediments of the Southern Basin.

The Nariva Formation can be described as a sequence of blue-grey clays and shales, which weather to a reddish brown soil; the colour being attributed to a significant presence of iron peroxides which results from chemical erosion of banded ferruginous material found in the clays. Within this sequence can be found exotic blocks of limestones, grits, conglomerates, sandstones and older shales called the Nariva Wildflysch.

The Nariva Clays are subject to dessication during the dry season, which are filled during the following wet season. Repetition of these events leads to extensive hill creep at the surface and the Nariva clays are expansive.

5.2 General Geotechnical Conditions

The soil conditions encountered within the respective catchments were very consistent. They generally consisted of stiff to very stiff silty clays and clayey silts underlain (in places where the boreholes extend sufficiently deep) by hard silty clays and clayey silts. In some cases a fill layer of variable thickness was encountered.

At the existing wastewater treatment plant site, the deposits were generally softer consisting of a fill layer, underlain by soft to medium stiff silty clays, further underlain by stiff to very stiff silty clays.

The detailed soil conditions encountered within the boreholes are shown on the Borehole logs *(Enclosure Nos 2 - 67)*. A summarised account of the salient features pertinent to foundation design is presented below.

5.3 Site Specific Geotechnical Conditions

A summary of the soil conditions encountered within the respective catchments and at the wastewater treatment plant is presented overleaf:

5.3.1 *Wastewater Treatment Plant (B0-1 to B0-2)*

Unit	Fill	1	2
Description	Loose clayey sands	Soft to medium stiff silty clay and loose gravelly sand	Stiff to very stiff silty clay
Depth Range (m)	Grd. Surface to 1.5 m	Base of fill layer or grd. Surface to 4.6 m	End of boreholes at depths 9.6 - 11.1
N value	9	4 - 10	9 - 27
Water Content (%)	10.7 - 38.8	26.1 - 77.8	28.1 - 32.5
Wet Density (kN/m³)	-	-	-
USCS Class.	ML	CH	ML, CH, SM
Gravel (%)	-	Fine grained: 0 - 18.5 coarse grained: 18.4 - 40.0	Fine grained: 0 - 24.5 coarse grained: 3.2
Sand (%)	-	Fine grained: 6.3 - 20.2 Coarse grained: 38.8 - 43.3	Fine grained: 1.6 - 42.5 Coarse grained: 54.3
Silt/clay (%)	-	Fine grained: 20.6 - 33.1 Coarse grained: 71.3 - 93.7	Fine grained: 33.1 - 87.9 Coarse grained: 12.5
Remarks	Not encountered in Borehole B0-1	Sub-unit of very stiff sandy silty clay encountered in Borehole B0-1 from grd. - 1.5 m	-

5.3.2 *Marabella Catchment (B10-1 to B10-31)*

Unit	Fill	1	2
Description	Loose to dense sandy gravel and gravelly sand	Stiff to very stiff silty clay and medium dense sandy gravels	Hard silty clays and clayey silts and dense sands
Depth Range (m)	Grd. Surface to 1.5 m	Base of fill or grd. surface to 2.2 - 6.1 m	Base of unit 1 or fill to end of boreholes at 5.0 - 11.1 m
N value	4 - 10	9 - 30	31 - 61
Water Content (%)	6.2 - 39.0	3.9 - 63.0	17.6 - 28.3
Wet Density (kN/m³)	-	16.20 - 20.92	-
USCS Class.	ML	CL, CH, ML, MH, SM, GC	CL, CH
Gravel (%)	-	Fine grained: 0 - 24.6 coarse grained: 32.8 - 53.5	Fine grained: 0 - 2.6 coarse grained: 0 - 21.1
Sand (%)	-	Fine grained: 0.9 - 39.7 Coarse grained: 15.1 - 36.6	Fine grained: 1.8 - 12.4 Coarse grained: 51.3 - 78.5
Silt (%)	-	Fine grained: 17.4 - 42.5 Coarse grained: 4.1 - 24.3	Fine grained: 27.7 - 54.4 Coarse grained: 9.8 - 16.1
Clay (%)	-	Fine grained: 23.3. - 63.2 Coarse grained: 5.7 - 27.7	Fine grained: 36.7 - 66.5 Coarse grained: 11.5 - 11.7
Remarks	Not encountered: B10-15, B10-20, B10-24 & B10-31	Sub-units B10-08: Medium stiff silty clay (1.5 - 4.6 m); N = 5 - 10 B10-17: Soft to medium stiff clayey silt (1.5 - 4.6 m); N = 3 - 10 Not encountered B10-27, B10-30 Extends to end of borehole in B10-01, B10-08, B10-17, B10-31	Sub-units B10-24: Very stiff silty clay (7.6 - 9.1 m) N = 25 B10-30: Very stiff silty clay (6.1 - 7.6 m) N = 28 Not encountered B10-01, B10-08, B10-17, B10-31

5.3.3 Tarouba-Cocoyea Catchment (B15-2 to B15-4)

Unit	1	2
Description	Very stiff silty clay	Hard silty clays and clayey silts
Depth Range (m)	Grd. surface to 1.5 - 2.2 m	Base of unit 1 to end of boreholes at 5.0 - 8.1 m
N value	16 - 21	31 - 63
Water Content (%)	20.5 - 30.4	19.7 - 30.7
Wet Density (kN/m^3)	-	-
USCS Class.	CH	CL
Gravel (%)	No gravel	
Sand (%)	3.1 - 10.3	2.2 - 4.9
Silt (%)	31.9 - 33.3	26.9 - 64.6
Clay (%)	56.4 - 65.1	33.1 - 68.3
Remarks		

5.3.4 Pleasantville-Corinth Catchment (B25-1 to B25-21)

Unit	Fill	1	2
Description	Loose to dense gravelly sand with occasional rubble	Stiff to very stiff silty clay	Hard silty clays
Depth Range (m)	Grd. Surface to 1.0 - 3.0 m	Base of fill or grd. surface to 3.0 - 6.1 m	Base of unit 1 to end of boreholes at 3.5 - 6.6 m
N value	5 - 38	9 - 26	31 - 36
Water Content (%)	9.4 - 35.7	17.2 - 37.3	29.5 - 34.8
Wet Density (kN/m^3)	-	16.77 - 19.18	-
USCS Class.	SM	SC, CL, CH	-
Gravel (%)	23.9 - 37.0	0 - 19.7	-
Sand (%)	42.9 - 57.4	1.2 - 59.1	-
Silt (%)	8.7 - 10.3	10.3 - 36.2	-
Clay (%)	8.3 - 10.8	35.1 - 79.6	-
Remarks	Not encountered: B25-04, B25-08, B25-10, B25-12	Sub-units B25-06: Medium stiff silty clay (1.5 - 4.6 m); N = 6 - 8 B25-08: Medium stiff silty clay (grd. surface - 2.2 m); N = 6 - 8 Extends to end of borehole in B25-03, B25-06, B25-08, B25-10, B25-12	Not encountered B25-03, B25-06, B25-08, B25-10, B25-12

5.3.5 *Green Acres Catchment* *(B40-1 to B40-2)*

Unit	Fill	1
Description	Dense silty gravel	Stiff to very stiff silty clays and sandy silty clay
Depth Range (m)	Grd. surface to 1.5 m	Base of fill or grd. surface to end of boreholes at 5.0 m
N value	38	10 -26
Water Content (%)	17.1 - 40.7	26.6 - 37.3
Wet Density (kN/m³)	-	-
USCS Class.	-	CL, CH
Gravel (%)	-	0 - 5.7
Sand (%)	-	5.7 - 25.3
Silt (%)	-	33.0 - 35.9
Clay (%)	-	36.0 - 58.4
Remarks	Not encountered in Borehole B40-02	

5.3.6 *San Fernando Central Catchment* *(B55-1 to B55-19)*

Unit	Fill	1	2
Description	Medium dense to very dense gravelly sand, clayey silty sand, gravelly silty sand, silty sandy gravel, hard gravelly clay	Stiff to very stiff silty clay	Hard silty clays and dense to very dense sandy silt
Depth Range (m)	Grd. Surface to 1.5 - 3.0 m	Base of fill or grd. surface to 2.6 - 10.6 m	Base of unit 1 or fill to end of boreholes at 6.6 - 14.2 m
N value	12 - 62	9 - 28	31 - in excess of 100
Water Content (%)	5.6 - 47.9	9.6 - 42.9	19.0 - 31.8
Wet Density (kN/m³)	20.57 - 21.51	15.65 - 21.92	-
USCS Class.	CH (in Hard clays)	CL, CH, ML, SM	CL, CH
Gravel (%)	Fine grained: 6.8 coarse grained: 11.9 - 39.7	Fine grained: 0 - 21.1 coarse grained: 0 - 3.5	Fine grained: 0 - 10.6 Coarse grained: 2.0
Sand (%)	Fine grained: 24.1 Coarse grained: 19.3 - 47.4	Fine grained: 0.9 - 28.1 Coarse grained: 6.2 - 52.0	Fine grained: 0.6 - 12.9 Coarse grained: 21.0
Silt (%)	Fine grained: 39.4 Coarse grained: 13.1 - 32.0	Fine grained: 13.8 - 49.5 Coarse grained: 11.4 - 68.0	Fine grained: 18.0 - 68.6 Coarse grained: 62.5
Clay (%)	Fine grained: 29.8 Coarse grained: 7.0 - 35.7	Fine grained: 24.9 - 84.2 Coarse grained: 25.8 - 35.1	Fine grained: 18.3 - 80.4 Coarse grained: 14.5

Remarks	Not encountered: B55-11, B55-12, B55-14 - B55-19 Loose silty sandy gravel encountered in Borehole B55-07	Sub-units B55-07: Medium stiff silty clay (2.2 - 4.6 m); N = 8 B55-09: Soft silty clay (3.0 - 4.62 m); N = 4 B55-10: Medium stiff sandy clayey silt (3.0 - 6.1 m); N = 6 B55-12: Hard silty clay (grd surface to 3.1 m) N = 32 - 43 Hard silty clay (1.5 - 2.2 m); N = 34 B55-14: Medium stiff silty clay (4.6 - 6.1 m) N = 8 B55-15: Medium stiff silty clay (2.2 - 4.6 m) N = 6 B55-16: Medium stiff (grd surface to 1.5 m) N = 8 B55-18: Medium stiff clay (grd surface to 1.5 m, 2.2 - 6.1 m) N = 6- 8 B55-19: Loose to very loose clayey sand (2.2 - 4.6 m) N = 4 - 6 Soft to medium stiff silty clay (4.6 - 7.6 m) N = 4 - 5 Not encountered B55-01, B55-03, B55-05	

5.3.7 *San Fernando South Catchment (B70-2 to B70-17)*

Unit	Fill	1
Description	Medium dense to very dense sandy gravel with rubble	Stiff to very stiff silty clays, sandy clays and silty sandy clays and; medium dense clayey sandy silts
Depth Range (m)	Grd. surface to 2.0 - 3.5 m	Base of fill or grd. surface to end of boreholes at 5.0 - 6.6 m
N value	14 to in excess of 100	9 - 27
Water Content (%)	8.6 - 49.8	16.1 - 30.2
Wet Density (kN/m^3)	-	-
USCS Class.	-	CL, CH, ML
Gravel (%)	54.5	Fine grained: 0 - 20.6 Coarse grained: 21.9
Sand (%)	28.2	Fine grained: 1.7 - 32.7 Coarse grained: 48.1
Silt (%)	7.8	Fine grained: 14.9 - 38.5 Coarse grained: 11.9
Clay (%)	9.6	Fine grained: 25.2 - 62.8 Coarse grained: 19.0
Remarks	Not encountered B70-02, B70-04, B70-08, B70-10, B70-17 Extends to the end of Borehole B70-13	Sub-units: B70-02: Medium stiff silty clay (3.0 - 4.6 m) N = 7 B70-06: Hard gravelly sandy clay (3.0 - end of borehole) N = 35 - 38 B70-08: Medium stiff clayey sandy silt (2.2 - 4.6 m) N = 5 - 7 Loose gravelly sand (4.6 - end of borehole) N = 10 B70-10: Medium stiff silty sandy clay (3.1 - 4.6 m) N = 6 B70-17: Hard silty clay (grd surface to 1.5 m & 6.1 - end of borehole) N = 32 - 33 Not encountered in Borehole B70-13

5.3.8 *Vistabella Catchment (B80-4 to B80-25)*

Unit	Fill	1	2
Description	Medium dense sand, sandy gravel, silty gravel,	Stiff to very stiff silty clay	Hard silty clays, clayey silts and clayey sandy silts
Depth Range (m)	Grd. Surface to 1.5 - 2.2 m	Base of fill or grd. surface to 1.5 - 6.1 m	Base of unit 2 to end of boreholes at 5.0 - 11.1 m
N value	13 - 19	9 - 27	37 - in excess of 100
Water Content (%)	11.0 - 31.9	17.8 - 43.9	27.5 - 33.3
Wet Density (kN/m^3)	-	17.26 - 21.36	-
USCS Class.	-	CL, CH, ML, SC	CH
Gravel (%)	-	0 - 15.8	No gravel
Sand (%)	-	1.4 - 21.9	0.4 - 32.5
Silt (%)	-	16.6 - 42.8	29.3 - 59.2
Clay (%)	-	33.3 - 74.6	29.8 - 70.3
Remarks	Not encountered: B80-22, B80-24, B80-25	Sub-units B80-19: Medium stiff sandy clay (4.6 - 7.6 m); N = 7 - 8 B80-25: Medium stiff silty clay (grd surface - 1.5 m); N = 7 Extends to the end of B80-04, B80-11, B80-17, B80-19	Not encountered: B80-04, B80-11, B80-17, B80-19

5.4 Water Level Observations

The ground water levels as measured in the boreholes upon completion of drilling are shown on the respective borehole logs *(Enclosure Nos. 2 - 67)*, and are summarized overleaf:

Location/Catchment	Borehole ID	Waterlevel (m)
Wastewater Treatment Plant	B0-1	1.2
	B0-2	0.9
Marabella	B10-1	0.9
	B10-3	NE
	B10-4	0.6
	B10-8	0.6
	B10-13	0.9
	B10-15	0.9
	B10-17	0.6
	B10-20	0.9
	B10-24	0.8
	B10-27	1.2
	B10-30	0.9
	B10-31	0.6
Tarouba-Cocoyea	B15-2	0.9
	B15-4	0.9

* NE = Not encountered

Catchment	Borehole ID	Waterlevel (m)
Pleasantville-Corinth	B25-1	NE
	B25-3	NE
	B25-4	NE
	B25-6	1.7
	B25-8	2.6
	B25-10	1.8
	B25-12	2.6
	B25-15	1.8
	B25-17	1.8
	B25-19	1.2
	B25-21	1.7
Green Acres	B40-1	NE
	B40-2	3.6
San Fernando Central	B55-1	2.1
	B55-3	0.9
	B55-5	1.2
	B55-7	0.4
	B55-9	0.9
	B55-10	0.9

* NE = Not enocuntered

Catchment	Borehole ID	Waterlevel (m)
San Fernando Central	B55–11	1.8
	B55-12	0.4
	B55-13	0.4
	B55-14	2.4
	B55-15	2.1
	B55-16	0.4
	B55-17	1.2
	B55-18	1.8
	B55-19	1.8
San Fernando South	B70-2	2.9
	B70-4	NE
	B70-6	NE
	B70-8	3.0
	B70-10	3.0
	B70-13	NE
	B70-15	3.8
	B70-17	3.3

* NE = Not encountered

Catchment	Borehole ID	Waterlevel (m)
Vistabella	B80-4	1.8
	B80-11	0.8
	B80-15	1.0
	B80-17	0.8
	B80-19	0.9
	B80-22	1.2
	B80-24	0.6
	B80-25	1.2

It should be noted that the waterlevels measured were very likely strongly influenced by washwater during the drilling process. It is expected that the ambient ground waterlevel is deeper than that indicated above.

5.5 Engineering Properties of Soil

5.5.1 Shear Strength

The shear strength of the deposits encountered in the boreholes was estimated using correlations between *N value* and effective angle of internal shearing resistance, ϕ' for coarse grained soils (sands and gravels) or undrained shear strength, S_u for fine grained soils (silts and clays). The results of the correlations are tabulated overleaf.

Location/Catchment	Unit	Average N value	ϕ' (deg.)	S_u (kPa)
Wastewater Treatment Plant	1 2	7 19	28 31	45 115
Marabella	1 2	19 40	31 39	115 200
Tarouba-Cocoyea	1 2	19 48	-	115 200
Pleasantville-Corinth	1 2	18 34	-	105 200
Green Acres	1	17	-	100
San Fernando Central	1 2	19 -	- 43	115 200
San Fernando South	1 2	16 37	-	95 200
Vistabella	1 2	18 -	-	105 200

6.0 FOUNDATION ANALYSIS AND DESIGN

6.1 General

The foundation types that were evaluated can be broadly classified into two (2) types:

- Shallow Foundations and;
- Deep Foundations.

Shallow foundations, as the name suggests, are defined as having a depth of foundation less than the width of the footing. Examples of these are spread footings and raft or mat foundations.

Deep foundations are used particularly at locations where the surficial deposits are unable to sustain the foundation loads, and these loads are hence transferred to deeper, more competent deposits. These foundation types employ two (2) means by which the loads are transferred. These are via a combination of:

- end bearing on the more competent deposits which have the greater bearing capacity and;
- the skin friction developed between the soil and the foundation over its length.

The evaluation of a particular foundation type is based on two (2) main criteria. These are:

- the allowable bearing capacity of the soil upon which the foundation is seated;
- the maximum and differential settlement at the expected load level.

6.2 Shallow Foundations

6.2.1 <u>*Maximum Safe Bearing Capacity*</u>

(a) Wastewater Treatment Plant - Junction Chamber

The estimated maximum safe bearing capacity at the junction chamber at the wastewater treatment plant is given in *Table 6.1* overleaf.

Table 6.1 Summary of Maximum Safe Bearing Capacity

Junction Chamber	Estimated Sump Depth (m)	Max. Safe Bearing Capacity (kPa)
Wastewater Treatment Plant	10	190

6.2.2 <u>*Settlement*</u>

Due to the significant proposed depths of the sump foundations, settlements are expected to be negligible.

6.2.3 <u>*Upthrust*</u>

Upthrust occurs when there is an imbalance in the water level particularly at the base of excavations. In the case of the lift stations, upthrust force would be exerted on the base of the ground slab of the sump. The upthrust is estimated based on the ground water level and the proposed sump depth and its effect would be greatest when the sump is empty. The estimated upthrust is 90 kPa.

6.3 Deep Foundations

Deep foundations were not considered since shallow foundations provide a feasible foundation solution.

7.0 TEMPORARY SHORING - DEEP SHAFTS

7.1 General

As mentioned previously, it is anticipated that the sewer trunk main would be advanced using a micro-tunneling boring machine. This machine would gain access to the proposed pipeline invert via pre-excavated shafts, and the tunnel would be advanced from shaft to shaft. The lateral stability of the walls of the shaft is a very important aspect of geotechnical design.

Based on a review of the design depths, it is recommended that shoring be installed generally for shafts deeper than 5 m. The locations/catchments for which site specific shoring design is required is given below:

- Wastewater Treatment Plant
- Marabella Catchment
- Tarouba-Cocoyea Catchment
- San Fernando Central Catchment
- Vistabella Catchment

7.2 Temporary Shoring Design Guidelines

7.2.1 Deep Shafts

In the design of the temporary shoring, two (2) primary criteria that must be addressed, viz.:

- The design must ensure that an adequate factor of safety against overturning and embedment is achieved. In this case, since these are temporary works, the factor of safety used in the analyses was reduced to 1.25.
- The head deflection of the wall must be kept to a minimum. This is of particular importance in this case since the proposed excavation will be in close proximity to roads and other structures which cannot sustain large lateral ground strains.

Analyses were carried out using the computer programme **CT Shoring** to determine the guidelines for design of temporary shoring for the worst case soil conditions encountered in the treatment/catchment. Computer printouts of the design are given in *Appendix I*. The results of the analyses are shown on *Tables 7.1 - 7.5*.

Table 7.1 Temporary Shoring Guidelines - Wastewater Treatment Plant - Borehole B0-1

Design Parameter	Depth of Excavation - 9.5 m
Min. Pile Length/m	16
No. of Props	4
Location of Prop(s)	2m, 4m, 6m & 8 m from top
Max. Bending Moment/kNm	334
Prop Force(s)/kN	50 @ 2m 85 @ 4m 140 @ 6m 345 @ 8m
Min. Required Section Modulus/cm^3/pile	2037.5

Table 7.2 Temporary Shoring Guidelines - Marabella Catchment - Borehole B10-24

Design Parameter	Depth of Excavation - 9.5 m
Min. Pile Length/m	15
No. of Props	4
Location of Prop(s)	2m, 4m, 6m & 8m from top
Max. Bending Moment/kNm	160
Prop Force(s)/kN	55 @ 2m 90 @ 4m 140 @ 6m 220 @ 8m
Min. Required Section Modulus/cm^3/pile	970.2

Table 7.3 Temporary Shoring Guidelines - Tarouba-Cocoyea Catchment - Borehole B15-04

Design Parameter	Depth of Excavation - 6.5 m
Min. Pile Length/m	12
No. of Props	2
Location of Prop(s)	2m & 4m from top
Max. Bending Moment/kNm	280
Prop Force(s)/kN	55 @ 2m 210 @ 4m
Min. Required Section Modulus/cm^3/pile	1701.5

Table 7.4 Temporary Shoring Guidelines - San Fernando Central Catchment - Borehole B55-16

Design Parameter	Depth of Excavation - 12.5 m
Min. Pile Length/m	25
No. of Props	5
Location of Prop(s)	2m, 4m, 6m, 8m & 10m from top
Max. Bending Moment/kNm	1614
Prop Force(s)/kN	60 @ 2m 90 @ 4m 145 @ 6m 200 @ 8m 790 @ 10m
Min. Required Section Modulus/cm^3/pile	9846.9

Table 7.5 Temporary Shoring Guidelines - Vistabella Catchment - Borehole B80-25

Design Parameter	Depth of Excavation - 9.5 m
Min. Pile Length/m	15
No. of Props	4
Location of Prop(s)	2m, 4m, 6m & 8m from top
Max. Bending Moment/kNm	332
Prop Force(s)/kN	60 @ 2m 85 @ 4m 140 @ 6m 350 @ 8m
Min. Required Section Modulus/cm^3/pile	2022.5

8.0 STABILITY OF PIPE TRENCHES - SHALLOW SHAFTS

8.1 General

This discussion is applicable for shafts which are less than 5 m deep. There are three (3) main considerations which govern the determination of stable slopes for open excavations. The first of these is the type of soil. The second is the length of time over which the excavations will be required to remain open, and the third is the permissible degree of risk of slipping. This latter factor is important in narrow excavations as is the case with pipe trenches.

8.2 Slope Stability

The surficial deposits consists of generally of stiff to very stiff silts/clays would not be prone to sloughing. However, these deposits are typically fissures and there are isolated sub-units of softer, less competent materials; both these materials may slough *en masse* after excavation.

The time over which the excavations is required to remain open is unknown as this would depend primarily on the construction methodology employed. However, it is likely to at least one day.

In respect of the permissible risk of failure or slipping, this risk must be very low since the trenches are expected to be up to 5 m deep, and there may be the requirement that workers would be required to conduct construction activities within the trenches.

The soft/loose nature of some of the deposits, the presence of water near to the ground surface and the sandy nature of some soils make the risk of sloughing or slope failure of unsupported excavations high. Consequently, the excavated face should be cut back where there space is available and where the entire excavation is *above* the water level. In cases where the water level is encountered or where space does not allow cut backs, shoring is required. Using the US Dept. of Labour OSHA 1926 Subpart P App A publication, the soils encountered are Type B soils (i.e. cohesive soils with *unconfined compressive strength* greater than 48 kPa but less than 144 kPa; and cohesionless soils above the water table) and Type C soils (cohesionless soils below the water table). Based on OSHA 1926 Subpart P App B, Table B-1, the maximum allowable slopes for excavations less than 6 m is 1:1 (above the water table). If ground water is encountered, for excavations less than 6 m, OSHA 1926 recommends that the slope angle be increased to 1.5:1 (H:V). In built-up areas shoring will be required.

9.0 CORROSIVITY OF SUBSOILS

As mentioned above, the chemical analyses consisted of: pH, sulphate and chloride content which were conducted on selected samples from the boreholes. The ranges of each parameter obtained are summarized as follows:

Catchment	pH	Sulphate (%)	Chloride (%)
Marabella	6.42 - 7.53	0.004 - 0.044	0.009 - 0.103
Pleasantville/Corinth	7.89 - 8.02	0.004 - 0.007	0.006 - 0.011
San Fernando Central	7.64 - 7.79	0.004 - 0.295	0.003 - 0.028
San Fernando South	7.22	0.038	0.013
Vistabella	7.22 - 8.64	0.010 - 0.061	0.020 - 0.029

Based upon ACI (American Concrete Institute) Manual of Concrete Practice, concrete in contact with soil containing <0.1% sulphate can be classified as having mild sulphate exposure.

For the measured concentrations of sulphate, normal Portland cement can be used in the manufacture of substructures. The mix for these elements and other structures in contact with the ground should however have a minimum cement content of 310 kg/m^3, and a maximum water-cement ratio of 0.55. This would be applicable for all the catchments except San Fernando Central.

Concrete in contact with soil containing 0.20 - 2.00% sulphate can be classified as having severe sulphate exposure as obtained in the San Fernando Central catchment. Therefore, concrete in this catchment, Type V cement must be used in the manufacture of substructures. The mix for these elements and other structures in contact with the ground should however have a maximum water-cement ratio of 0.45.

The results of the chemical analyses are given in *Appendix II*.

10.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the foregoing discussion, the following conclusions can be drawn and recommendations made:

1. The subsoils encountered in the boreholes are given in *Section 5.3*.

2. A summary of the ground water levels encountered in the boreholes are given in *Section 5.4*.

3. The recommended allowable safe bearing capacity at the junction chamber at the wastewater treatment plant is 190 kPa. Settlements are anticipated to be negligible.

4. Based on the recorded water levels at the junction chamber, the elevation of the base of the sump is expected to be below the ground water level. Therefore, an upthrust force would be exerted on the base slab which is expected to be greatest when the sump is empty. It is recommended that the slab be designed to resist an upthrust of 90 kPa. Additionally, provisions must be made for dewatering of excavations where necessary.

5. Deep foundations were not considered since shallow foundations provide a feasible foundation solution.

6. As mentioned previously, it is anticipated that the sewer trunk main would be advanced using a micro-tunneling boring machine. This machine would gain access to the proposed pipeline invert via pre-excavated shafts, and the tunnel would be advanced from shaft to shaft. The lateral stability of the walls of the shaft is a very important aspect of geotechnical design.

   Based on a review of the design depths, it is recommended that shoring be installed generally for shafts deeper than 5 m. The locations/catchments for which site specific shoring design is required is given below:

   - Wastewater Treatment Plant
   - Marabella Catchment
   - Tarouba-Cocoyea Catchment
   - San Fernando Central Catchment
   - Vistabella Catchment

   Guidelines for the design of the temporary shoring are given in *Tables 7.1 - 7.5*.

7. The soft/loose nature of some of the deposits, the presence of water near to the ground surface and the sandy nature of some soils make the risk of sloughing or slope failure of unsupported excavations high. Consequently, the excavated face should be cut back where there space is available and where the entire excavation is *above* the water level. In cases where the water level is encountered or where space does not allow cut backs, shoring is required. The maximum allowable slopes for excavations less than 6 m is 1:1 (above the water table). If ground water is encountered, for excavations less than 6 m, OSHA 1926 recommends that the slope angle be increased to 1.5:1 (H:V). In built-up areas shoring will be required.

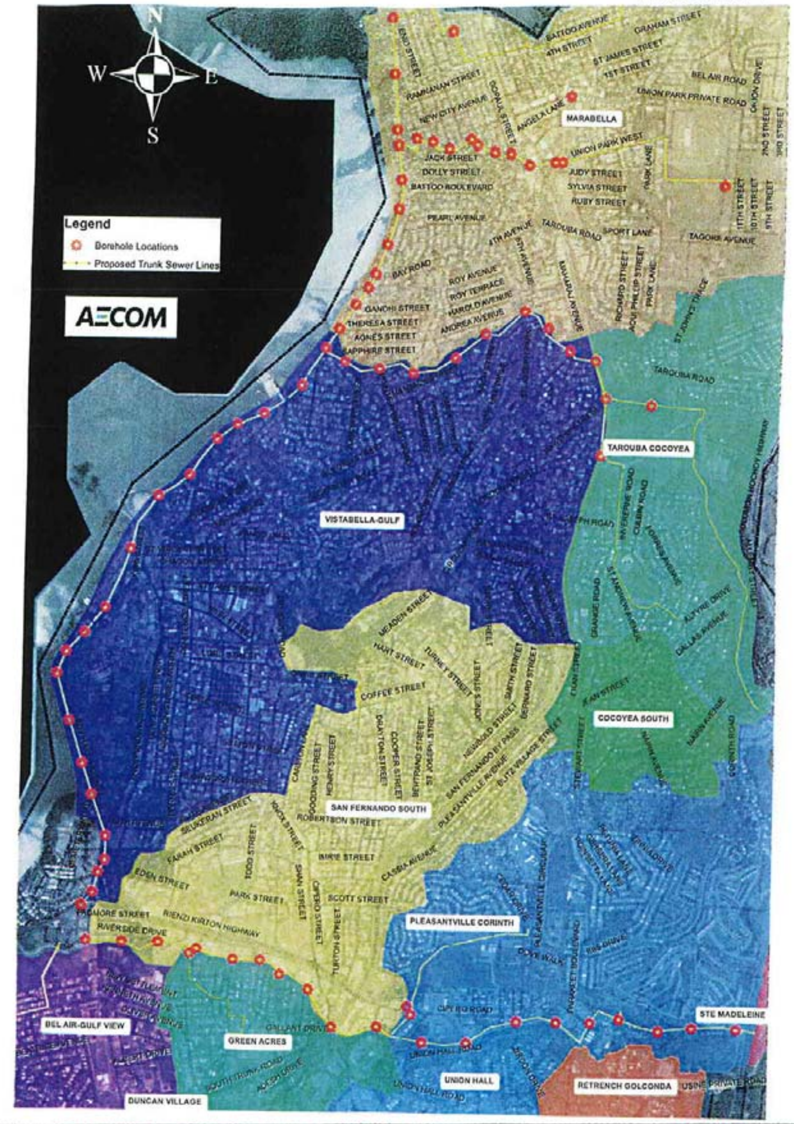
8. Based on the results of the borehole and test-pit investigation, it is possible that the ground water table would be encountered during pipeline installation. Therefore, adequate pumping must be provided to ensure that the excavations are kept dry. This would provide an added safeguard against loss of shear strength and sloughing/slope failure of the walls of the excavation.

9. Based upon ACI Manual of Concrete Practice, concrete in contact with soil containing <0.1% sulphate can be classified as having mild sulphate exposure. For the measured concentrations of sulphate, normal Portland cement can be used in the manufacture of substructures. The mix for these elements and other structures in contact with the ground should however have a minimum cement content of 310 kg/m^3, and a maximum water-cement ratio of 0.55, except for the San Fernando Central Catchment.

   For this catchment, a value of sulphate content greater than 0.20% was recorded. Therefore, these soils are classified as having severe sulphate exposure. Therefore, Type V cement must be used in the manufacture of concrete substructures. These mixes must have a maximum water-cement ratio of 0.45.

ENCLOSURES

ENCLOSURE No. 1



PROJECT Geo. Services for Wastewater Treatment Pipeline

JOB NO. GA 07 326
DATE May 2010

PLAN SHOWING LOCATION OF BOREHOLES

Geotech Associates Limited

ENCLOS 07326.GPJ 4/5/10

GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 2

BOREHOLE LOG

BOREHOLE No: B 0-1
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: WWTP
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 29/3/10 Completed on: 29/3/10

- Drive, No Sample Collected
- Disturbed Sample
- Split Spoon Sample
- Shelby Tube Sample
- Core Sample
- Water Level at End of Drilling
- Water Level 24 hrs. or more

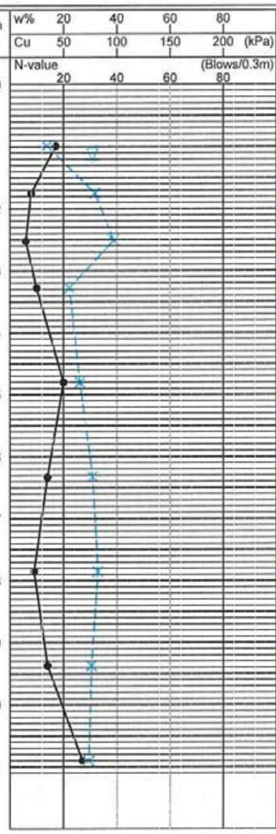
Water Content (W%)
- Plastic and Liquid Limit
- Natural Moisture Content

Shear Strength (Cu)
- Unconsolidated Undrained Triaxial, UU
- Unconfined Compression, UC
- Pilcon Vane Shear, PV
- Field Vane Shear, FV

Penetration Resistance (N)
- Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Additional Tests and Remarks
Ground Surface	0		
Medium dense, grey, CLAYEY SAND, trace gravel. (FILL)	1	1	USCS:ML
Medium stiff, grey and brown, SILTY CLAY, some gravel, trace sand.	2	2	USCS:ML
		3	
Loose, brown, GRAVELLY SAND.	3	4	
	4		
Medium dense, brown, GRAVELLY SAND.	5	5	
Stiff to very stiff, brown and grey, SILTY CLAY, some sand and gravel.	6	6	USCS:ML
	7		
	8	7	
	9		
		8	
	10		
	11	9	USCS:SM
End of Borehole at 11.13m.			

Wet Density kN/m3



BH P12RX 07326.GPJ 4/6/10

GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 3

BOREHOLE LOG

BOREHOLE No: B 0-2
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: WWTP
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 29/3/10 Completed on: 29/3/10

- Drive, No Sample Collected
- Disturbed Sample
- Split Spoon Sample
- Shelby Tube Sample
- Core Sample
- Water Level at End of Drilling
- Water Level 24 hrs. or more

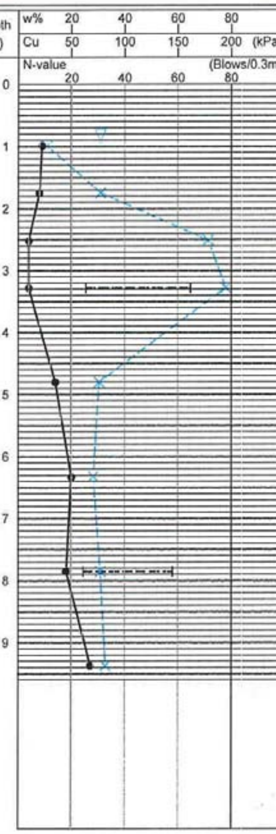
Water Content (W%)
- Plastic and Liquid Limit
- Natural Moisture Content

Shear Strength (Cu)
- Unconsolidated Undrained Triaxial, UU
- Unconfined Compression, UC
- Pilcon Vane Shear, PV
- Field Vane Shear, FV

Penetration Resistance (N)
- Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Additional Tests and Remarks
Ground Surface	0		
Loose, dark grey and brown, CLAYEY SAND, some gravel and silt. (FILL)	1	1	
Soft to medium stiff, grey and brown, SILTY CLAY, trace sand.	2	2	
		3	
	3	4	USCS:CH
	4		
Stiff to very stiff, grey and brown, SILTY CLAY, trace sand.	5	5	
	6	6	
	7		
	8	7	USCS:CH
	9	8	
End of Borehole at 9.6m.			

Wet Density kN/m3



BH P12RX 07326.GPJ 4/6/10

GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. 4

BOREHOLE LOG

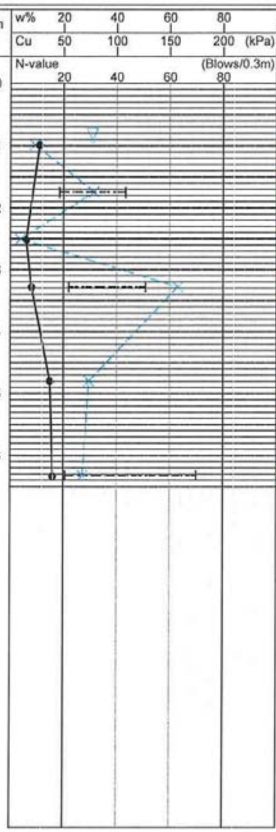
BOREHOLE No: B10-01
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Marabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 11/3/10 Completed on: 11/3/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Loose, brown, SANDY GRAVEL. (FILL)	1		1		
	Medium stiff, greenish grey and grey, SANDY, SILTY CLAY, some gravel.	2		2	19.99	USCS:CL
		3		3		
		4		4		USCS:CH
	Stiff to very stiff, yellowish brown, SILTY CLAY, trace sand.	5		5		
		6		6		USCS:CH
	End of Borehole at 6.56m.					



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. 5

BOREHOLE LOG

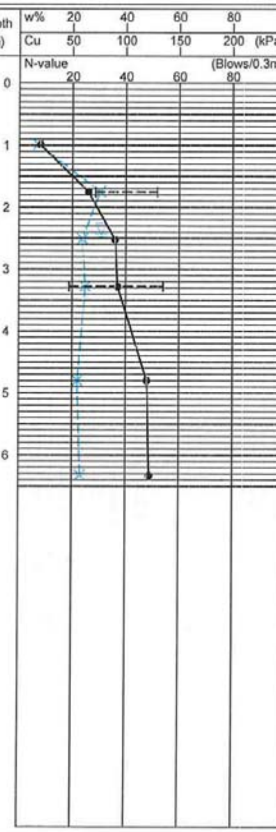
BOREHOLE No: B10-03
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Marabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 11/3/10 Completed on: 11/3/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Loose, brown, SANDY GRAVEL. (FILL)	1		1		
	Very stiff, greenish brown, SILTY, SANDY CLAY.	2		2		USCS:MH
	Hard, brown, SILTY CLAY, trace sand.	3		3		
		4		4		
		5		5		
		6		6		
	End of Borehole at 6.56m.					



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 — ENCLOSURE No. 6

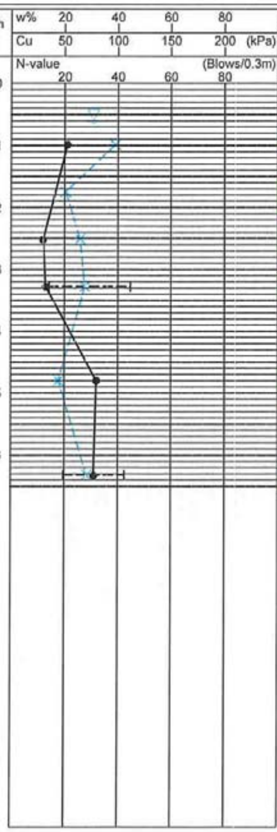
BOREHOLE LOG

BOREHOLE No: B10-04
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Marabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 11/3/10 Completed on: 11/3/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test



Soil Description	Depth (m)	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
Ground Surface	0			
Medium dense, brown, SANDY GRAVEL. (FILL)	1	1		
Medium dense, brown, SANDY GRAVEL, some silt and clay.	2	2 (Shelby Tube)	18.93	
		3		
Stiff, greenish brown, GRAVELLY, SANDY CLAY, some silt.	3	4		USCS:CH
	4			
Dense, dark brown, SAND, some clay, trace silt.	5	5		
Hard, greenish brown, CLAYEY SILT, some sand.	6	6		USCS:CL
End of Borehole at 6.56m.				

GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 — ENCLOSURE No. 7

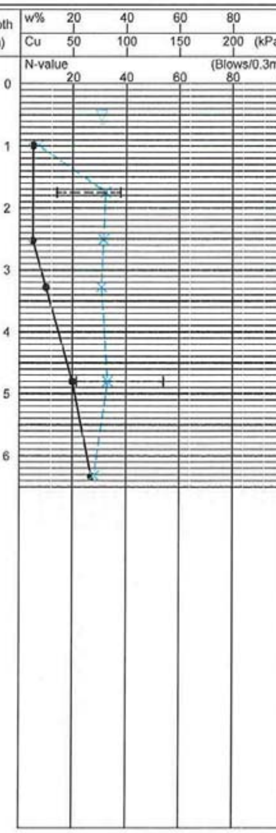
BOREHOLE LOG

BOREHOLE No: B10-08
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Marabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 10/3/10 Completed on: 10/3/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test



Soil Description	Depth (m)	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
Ground Surface	0			
Loose, yellowish brown, SANDY GRAVEL. (FILL)	1	1		
Medium stiff, greenish grey, SILTY CLAY, some sand.	2	2 (Shelby Tube)	18.99	USCS:CL
		3		
	3	4		
	4			
Very stiff, greenish grey, SILTY CLAY, trace sand.	5	5		USCS:CH
	6	6		
End of Borehole at 6.56m.				

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TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. 8

BOREHOLE LOG

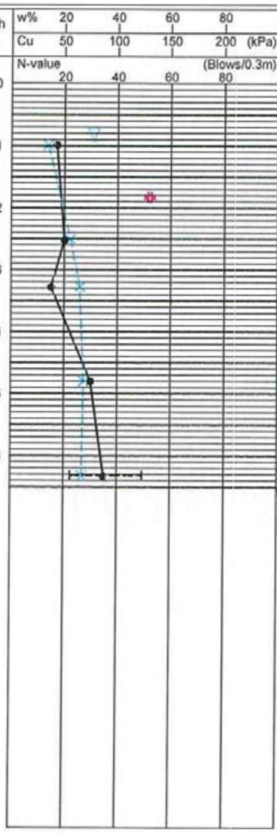
BOREHOLE No: B10-13
Sheet 1 of 1

Client: AECOM
Project: Geo Services for Wastewater Treatment Pipeline
Location: Marabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 8/3/10 Completed on: 8/3/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
Ground Surface	0			
Medium dense, brown, SANDY GRAVEL. (FILL)	1	1		
Stiff to very stiff, brown and reddish brown, SILTY CLAY, trace sand and gravel.	2	2		
	3	3, 4		
	4			
	5	5		
Hard, greenish grey and brown, SILTY CLAY, trace sand and gravel.	6	6		USCS:CH
End of Borehole at 6.56m.				



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. 9

BOREHOLE LOG

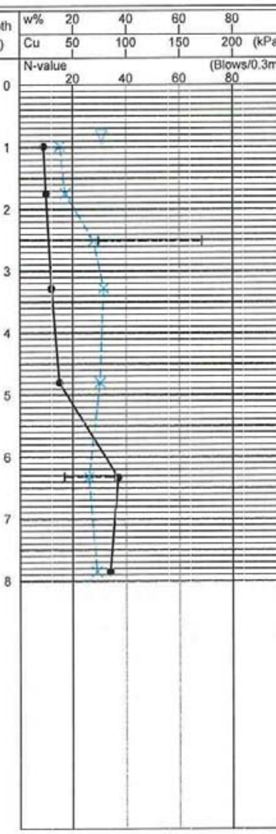
BOREHOLE No: B10-15
Sheet 1 of 1

Client: AECOM
Project: Geo Services for Wastewater Treatment Pipeline
Location: Marabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 8/3/10 Completed on: 8/3/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
Ground Surface	0			
Stiff, brown, CLAYEY, SANDY SILT, some gravel.	1	1		USCS:ML
Stiff, brown and grey, SILTY CLAY, trace sand.	2	2		
	3	3	18.71	USCS:CH
		4		
	4			
	5	5		
Hard, brown and grey, CLAYEY SILT, trace sand and gravel.	6	6		USCS:CL
	7	7		
End of Borehole at 8.08m.	8			



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. 10

BOREHOLE LOG

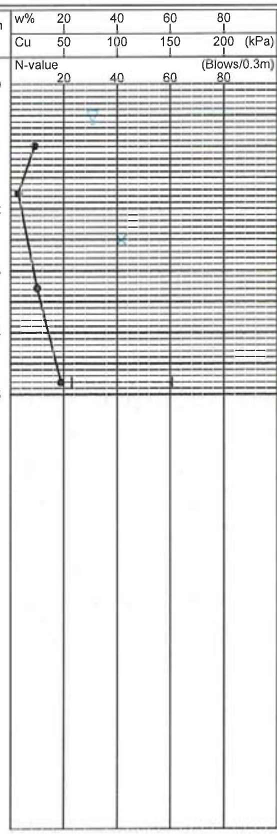
BOREHOLE No: B10-17
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Marabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 9/3/10 Completed on: 9/3/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Loose, brown, SANDY GRAVEL. (FILL)	1		1		USCS:SM
	Soft to medium stiff, grey and greenish grey, CLAYEY SILT, with occasional organics.	2		2		
		3		3	16.20	
		4		4		
	Very stiff, brown and grey, SILTY CLAY, trace sand.	5		5		USCS:CH
	End of Borehole at 5.03m.					



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. 11

BOREHOLE LOG

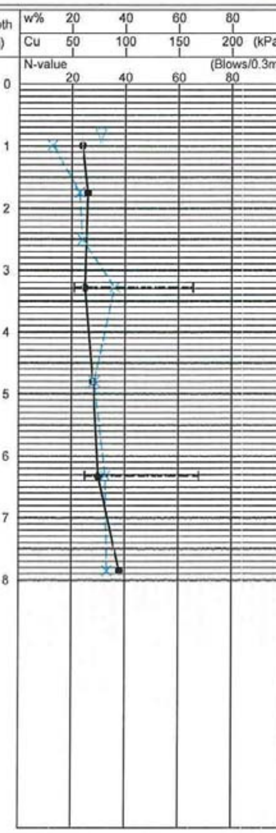
BOREHOLE No: B10-20
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Marabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 26/2/10 Completed on: 26/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Medium dense, brown, CLAYEY, SILTY GRAVEL.	1		1		
	Very stiff, brown and grey, SILTY CLAY, trace sand.	2		2		
		3		3	18.63	
				4		USCS:CH
		4				
		5		5		
	Hard, brown and grey, SILTY CLAY, trace sand.	6		6		USCS:CH
		7				
	End of Borehole at 8.08m.	8		7		



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **12**

BOREHOLE LOG

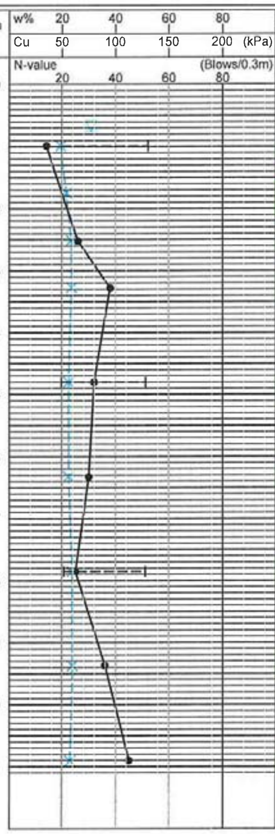
BOREHOLE No: B10-24
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Marabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 26/2/10 Completed on: 26/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
Ground Surface	0			
Stiff to very stiff, grey and yellowish brown, SILTY CLAY, with occasional gravel.	1	1		USCS:GC
	2	2	20.13	
		3		
Hard, grey and yellowish brown, SILTY CLAY, trace sand.	3	4		
	4–5	5		USCS:CH
Very stiff, grey and yellowish brown, SILTY CLAY, trace sand.	6	6		
	7–8	7		USCS:CH
Hard, grey and brown, SILTY CLAY.	9	8		
	10–11	9		
End of Borehole at 11.13m.				



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GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **13**

BOREHOLE LOG

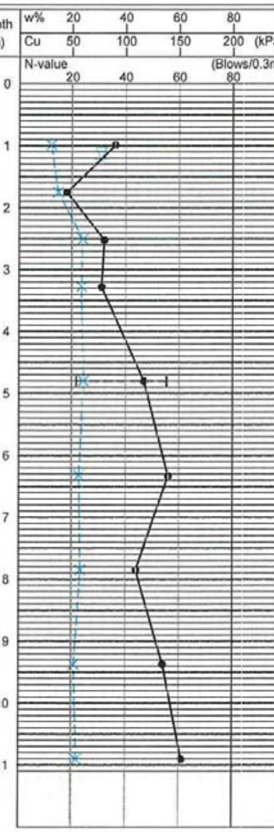
BOREHOLE No: B10-27
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Marabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 24/2/10 Completed on: 24/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
Ground Surface	0			
Dense to medium dense, brown, GRAVELLY SAND, some silt, trace clay. (FILL)	1	1		
	2	2		
Hard, olive green and brown, SILTY CLAY, trace sand and gravel.	3	3		
	4	4		
	5	5		USCS:CH
	6	6		
	7–8	7		
	9	8		
	10–11	9		
End of Borehole at 11.13m.				



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GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. 14

BOREHOLE LOG

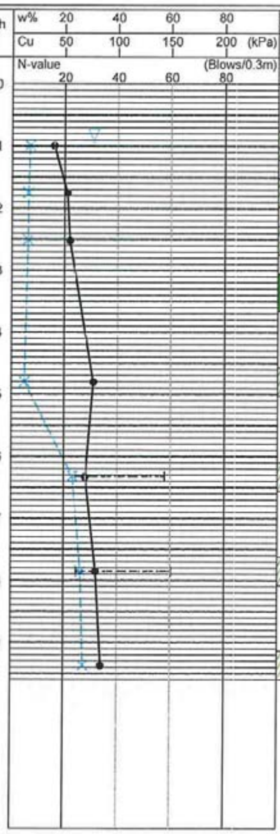
BOREHOLE No: B10-30
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Marabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 24/2/10 Completed on: 24/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
I"Pilcon Vane Shear, PV
I"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Medium dense, brown, SANDY GRAVEL, trace clay and silt.	1		1		
		2		2		
				3		
		3		4		
		4				
	Dense, brown, GRAVELLY SAND, some silt and clay.	5		5		
	Very stiff, brown, SILTY CLAY, some sand, trace gravel.	6		6		USCS:CH
	Hard, olive green and brown, SILTY CLAY, trace sand and gravel.	7				
		8		7		USCS:CH
		9		8		
	End of Borehole at 9.6m.					



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. 15

BOREHOLE LOG

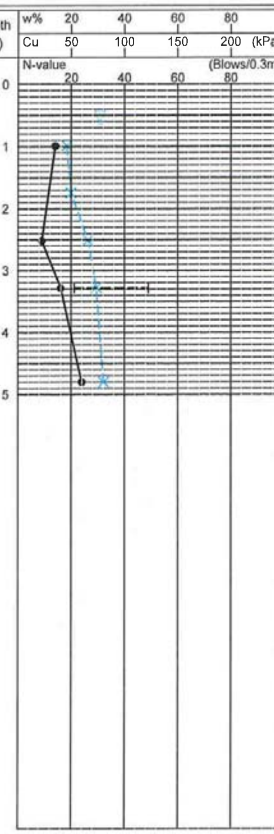
BOREHOLE No: B10-31
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Marabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 29/3/10 Completed on: 29/3/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
I"Pilcon Vane Shear, PV
I"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Stiff to very stiff, grey and brown, SILTY CLAY, some to trace sand.	1		1		USCS:ML
		2		2	20.92	
				3		
		3		4		USCS:CH
		4				
		5		5		
	End of Borehole at 5.03m.					



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **16**

BOREHOLE LOG

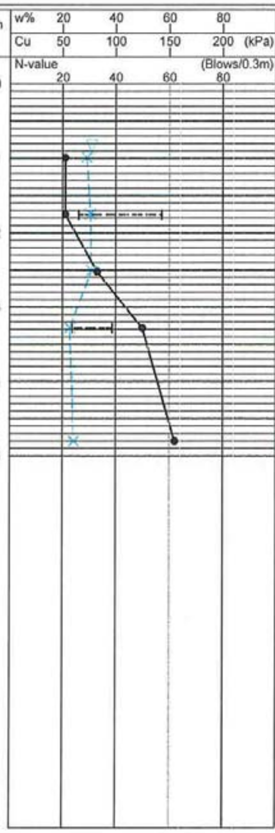
BOREHOLE No: B15-02
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Tarouba-Cocoyea Catchment
Ground Elevation: m
Boring Method: M. Joab
Prep by: M. Joab
Boring Started on: 8/2/10 Completed on: 8/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
	Ground Surface	0				
	Very stiff, dark brown, SILTY CLAY, trace sand.	1		1		
		2		2		USCS:CH
	Hard, dark brown, CLAYEY SILT, trace sand.			3		
		3		4		USCS:CL
		4		5		
	End of Borehole at 5.03m.	5				



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TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **17**

BOREHOLE LOG

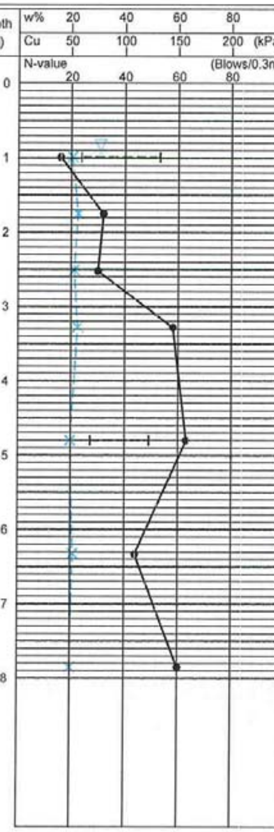
BOREHOLE No: B15-04
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Tarouba-Cocoyea Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 8/2/10 Completed on: 8/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
	Ground Surface	0				
	Very stiff, brown, SILTY CLAY, some sand.	1		1		USCS:CH
	Hard, dark brown and dark grey, SILTY CLAY, trace sand.	2		2		
				3		
		3		4		
		4				
		5		5		USCS:CL
		6		6		
		7				
		8		7		
	End of Borehole at 8.08m.					



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REPORT No. GA 07 326 ENCLOSURE No. 18

BOREHOLE LOG

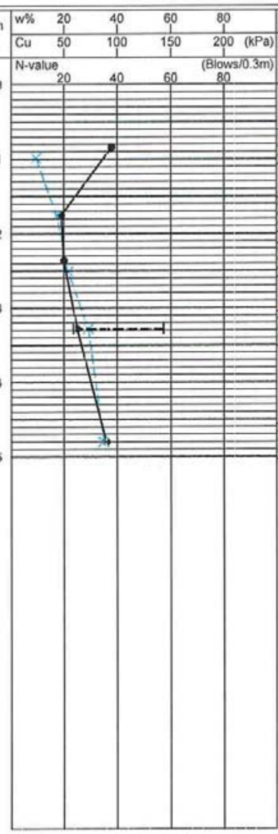
BOREHOLE No: B25-01
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Pleasant-Corinth Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 26/2/10 Completed on: 26/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Dense to medium dense, dark grey, GRAVELLY SAND. (FILL)			1		
				2		USCS:SM
				3		
	Very stiff, dark grey, SILTY CLAY.			4		USCS:SC
	Hard, dark grey and brown, SILTY CLAY.			5		
	End of Borehole at 5.03m.					



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REPORT No. GA 07 326 ENCLOSURE No. 19

BOREHOLE LOG

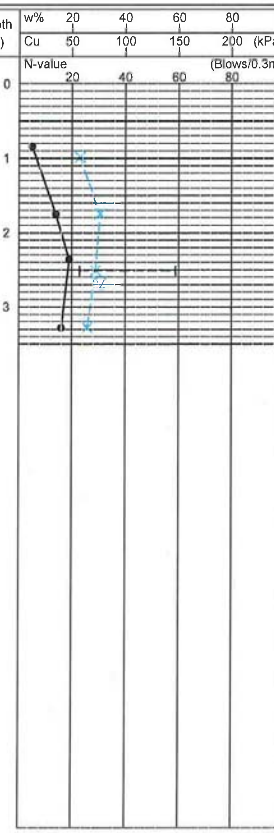
BOREHOLE No: B25-03
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Pleasant-Corinth Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 1/3/10 Completed on: 1/3/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Loose, dark grey, GRAVELLY SAND, with occasional pieces of rubble. (FILL)			1		
	Stiff to very stiff, brown and grey, SILTY CLAY, trace sand.			2		USCS:CH
				3		
				4		
	End of Borehole at 3.5m.					



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TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 20

BOREHOLE LOG

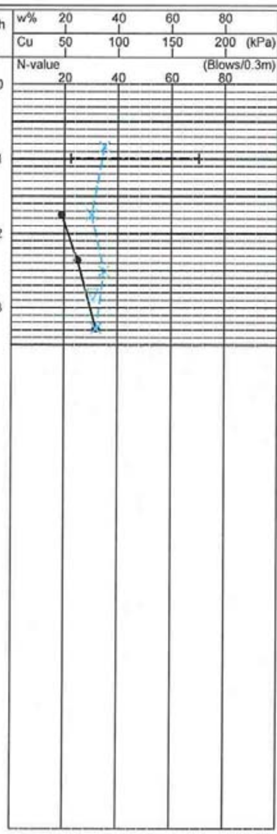
BOREHOLE No: B25-04
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Pleasant-Corinth Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 26/2/10 Completed on: 26/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
Ground Surface	0				
Very stiff, brown and grey, CLAY, some silt, trace sand.	1	Shelby Tube	1	18.58	USCS:CH
	2	Split Spoon	2		
		Split Spoon	3		
Hard, brown and grey, SILTY CLAY.	3	Split Spoon	4		
End of Borehole at 3.5m.					



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TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 21

BOREHOLE LOG

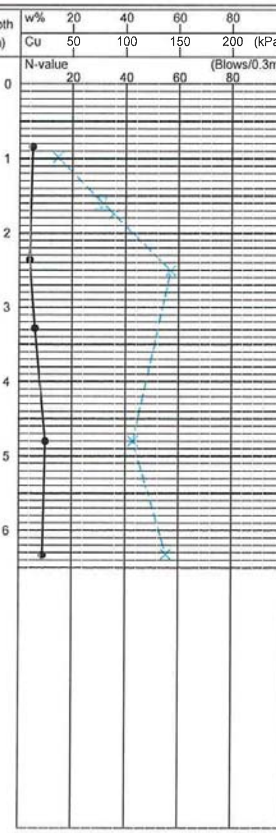
BOREHOLE No: B25-06
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Pleasant-Corinth Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 25/2/10 Completed on: 25/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
Ground Surface	0				
Loose, brown, GRAVELLY SAND, with occasional pieces of rubble. (FILL)	1	Split Spoon	1		
Medium stiff, grey and brown, SILTY CLAY, trace sand.	2	Shelby Tube	2	16.77	
		Split Spoon	3		
	3	Split Spoon	4		
	4				
Stiff, dark grey and dark brown, SILTY CLAY.	5	Split Spoon	5		
	6	Split Spoon	6		
End of Borehole at 6.56m.					



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REPORT No. GA 07 326

ENCLOSURE No. 22

BOREHOLE LOG

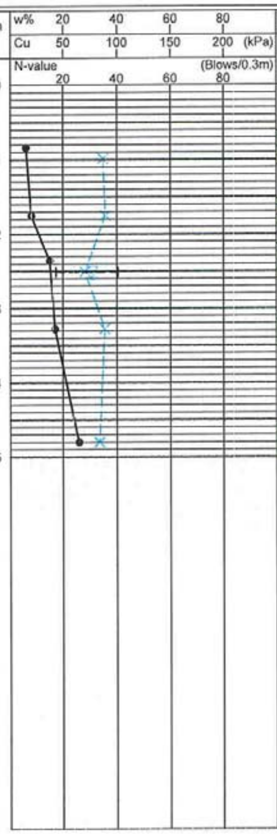
BOREHOLE No: B25-08
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Pleasant-Corinth Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 6/4/10 Completed on: 6/4/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
Ground Surface	0			
Medium stiff, brown and grey, SILTY CLAY.	1	1		
	2	2		
Stiff to very stiff, brown and grey, SILTY, SANDY CLAY, some gravel.		3		USCS:SC
	3	4		
	4			
	5	5		
End of Borehole at 5.03m.				



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REPORT No. GA 07 326

ENCLOSURE No. 23

BOREHOLE LOG

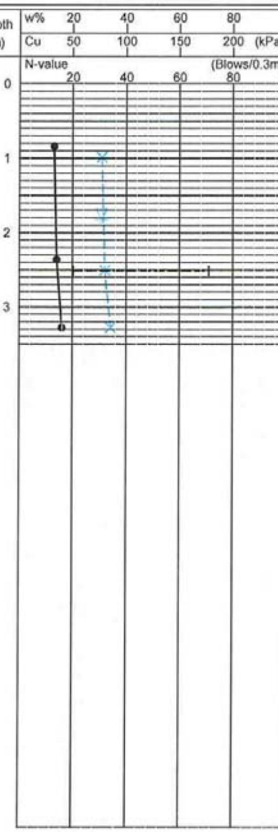
BOREHOLE No: B25-10
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Pleasant-Corinth Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 24/2/10 Completed on: 24/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
Ground Surface	0			
Stiff to very stiff, brown and grey, SILTY CLAY, trace sand.	1	1		
	2	2		
		3		USCS:CH
	3	4		
End of Borehole at 3.5m.				



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REPORT No. GA 07 326 ENCLOSURE No. 24

BOREHOLE LOG

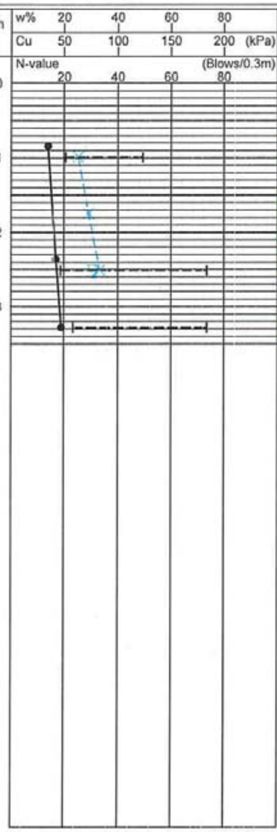
BOREHOLE No: B25-12
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Pleasant-Corinth Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 1/2/10 Completed on: 1/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
Pilcon Vane Shear, PV
Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Stiff to very stiff, brown and grey, SILTY CLAY, trace sand, with occasional organic material.	1		1		USCS:CL
		2		2	19.18	
				3		USCS:CH
		3		4		USCS:CH
	End of Borehole at 3.5m.					



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REPORT No. GA 07 326 ENCLOSURE No. 25

BOREHOLE LOG

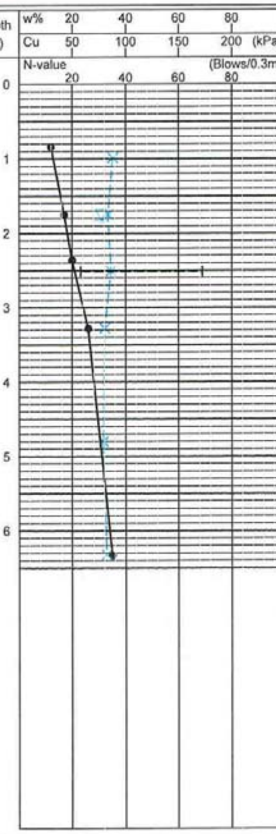
BOREHOLE No: B25-15
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Pleasant-Corinth Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 24/2/10 Completed on: 24/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
Pilcon Vane Shear, PV
Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Loose, brown, GRAVELLY SAND, with pieces of rubble. (FILL)					
	Stiff to very stiff, brown and grey, fissured, SILTY CLAY, trace sand and gravel.	1		1		
		2		2		
				3		USCS:CH
		3		4		
		4				
		5		5	18.41	
		6				
	Hard, brown and grey, SILTY CLAY.			6		
	End of Borehole at 6.56m.					



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REPORT No. GA 07 326 — ENCLOSURE No. 26

BOREHOLE LOG

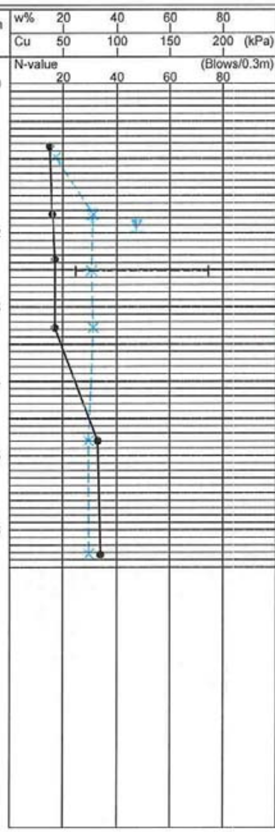
BOREHOLE No: B25-17
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Pleasant-Corinth Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 23/2/10 Completed on: 23/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
	Ground Surface	0				
	Loose, brown, GRAVELLY SAND, with pieces of rubble. (FILL)					
	Very stiff, brown and grey, SILTY CLAY, some sand.	1		1		
		2		2		
				3		USCS:CH
		3		4		
		4				
	Hard, brown and grey, fissured, SILTY CLAY.	5		5		
		6		6		
	End of Borehole at 6.56m.					



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REPORT No. GA 07 326 — ENCLOSURE No. 27

BOREHOLE LOG

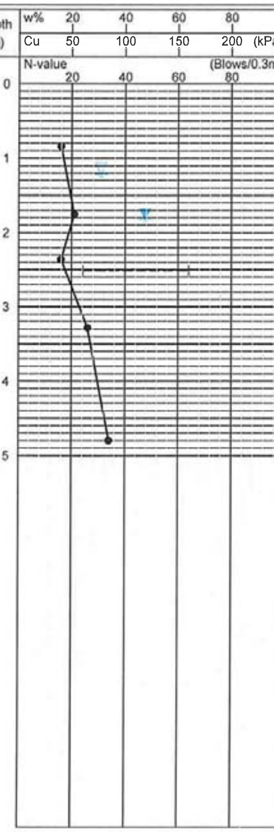
BOREHOLE No: B25-19
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Pleasant-Corinth Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 22/2/10 Completed on: 22/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
	Ground Surface	0				
	Medium dense, grey, GRAVELLY SAND, some silt, trace clay. (FILL)	1		1		
	Very stiff, brown and reddish grey, CLAY, some silt, trace sand.	2		2		
				3		USCS:CH
		3		4		
		4				
	Hard, grey and brown, fissured, SILTY CLAY.	5		5		
	End of Borehole at 5.03m.					



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REPORT No. GA 07 326 ENCLOSURE No. **28**

BOREHOLE LOG

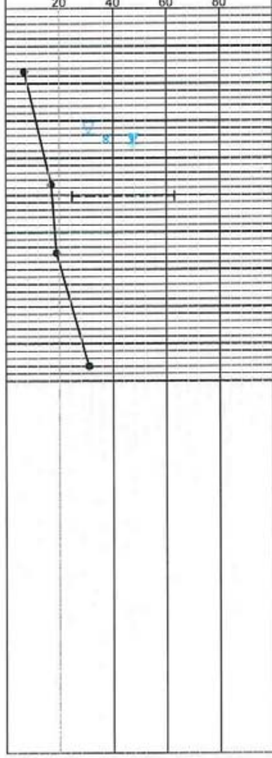
BOREHOLE No: B25-21
Sheet 1 of 1

Client:
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Pleasant-Corinth Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 22/2/10 Completed on: 22/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	w% 20 40 60 80 / (kPa) 50 100 150 200 / (Blows/0.3m) 20 40 60 80	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0					
	Loose, brown, GRAVELLY SAND, some silt, trace clay. (FILL)	1			1		
	Stiff to very stiff, brown, SILTY CLAY, some sand, trace gravel.	2			2	17.01	
					3		USCS:CH
		3					
					4		
		4					
	Hard, brown, fissured, SILTY CLAY.				5		
	End of Borehole at 5.03m.	5					



BH P12BX 07326.GPJ 4/5/10

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TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **29**

BOREHOLE LOG

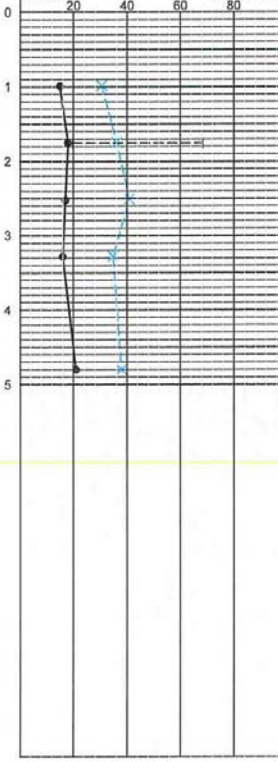
BOREHOLE No: B40-01
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Green Acres Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 8/4/10 Completed on: 8/4/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	w% 20 40 60 80 / Cu 50 100 150 200 (kPa) / N-value (Blows/0.3m) 20 40 60 80	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0					
	Stiff to very stiff, brown, SILTY CLAY, trace sand.	1			1		
		2			2		USCS:CH
					3		
		3			4		
		4					
					5		
	End of Borehole at 5.03m.	5					



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GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. 30

BOREHOLE LOG

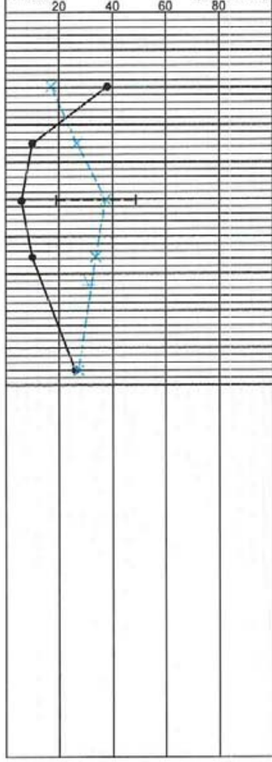
BOREHOLE No: B40-02
Sheet 1 of 1

Client: AECOM
Project: Geo Services for Wastewater Treatment Pipeline
Location: Green Acres Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 7/4/10 Completed on: 7/4/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	w% 20 40 60 80 / Cu 50 100 150 200 (kPa) / N-value 20 40 60 80 (Blows/0.3m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0					
	Dense, brown and grey, SILTY GRAVEL. (FILL)	1			1		
	Stiff, brown and grey, SANDY, SILTY CLAY, trace gravel.	2			2		
	Soft, brown and grey, SILTY CLAY.				3		USCS:CL
	Very stiff, brown and grey, SANDY, SILTY CLAY.	3			4		
		4					
	End of Borehole at 5.03m.	5			5		



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. 31

BOREHOLE LOG

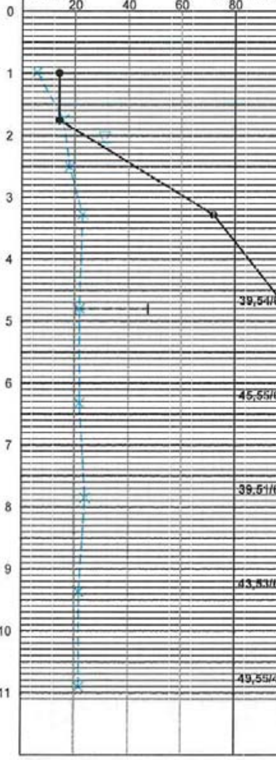
BOREHOLE No: B55-01
Sheet 1 of 1

Client: AECOM
Project: Geo Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 19/2/10 Completed on: 19/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	w% 20 40 60 80 / Cu 50 100 150 200 (kPa) / N-value 20 40 60 80 (Blows/0.3m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0					
	Medium dense, dark brown, CLAYEY, SILTY SAND, some gravel. (FILL)	1			1		
		2			2		
					3	20.57	
	Hard, dark brown, SILT, some clay and sand, trace gravel.	3			4		
		4					
		5	39,54/0"		5		USCS:CL
		6	45,55/6"		6		
		7					
		8	39,51/6"		7		
		9	43,53/6"		8		
		10					
	End of Borehole at 11.13m.	11	49,55/4"		9		



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. 32

BOREHOLE LOG

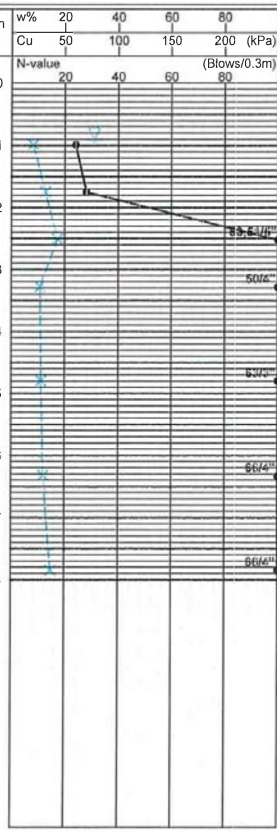
BOREHOLE No: B55-03
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 19/2/10 Completed on: 19/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0			
	Medium dense, brown, GRAVELLY, SILTY SAND, some clay. (FILL)	1	1		
		2	2		
	Dense to very dense, dark brown, SANDY SILT, some clay, trace gravel.	3	3		
		4	4		
		5	5		
		6	6		
		7	7		
	End of Borehole at 8.08m.	8			



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. 33

BOREHOLE LOG

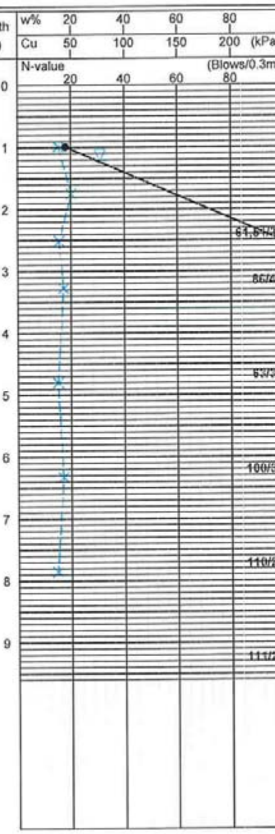
BOREHOLE No: B55-05
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 18/2/10 Completed on: 18/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0			
	Medium dense, brown, GRAVELLY SAND, some silt and clay. (FILL)	1	1		
		2	2	21.51	
	Hard, dark brown, CLAYEY SILT, trace sand.	3	3		
		4	4		
		5	5		
		6	6		
		7	7		
		8			
		9	8		
	End of Borehole at 9.6m.				



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **34**

BOREHOLE LOG

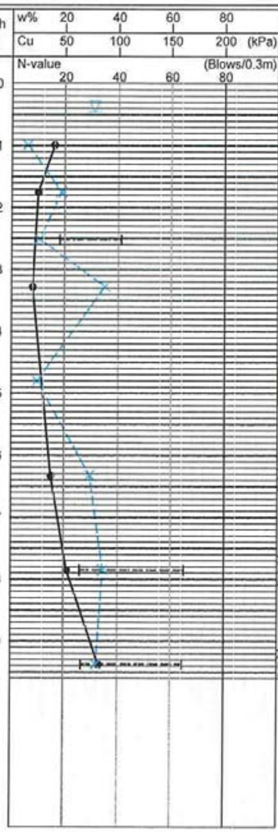
BOREHOLE No: B55-07
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 18/2/10 Completed on: 18/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
I"Pilcon Vane Shear, PV
I"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)
Ground Surface	0
Medium dense to loose, dark brown, SILTY, SANDY GRAVEL, trace clay. (FILL)	0 – 2.3
Medium stiff, brown, SILTY CLAY, trace sand and gravel.	2.3 – 4.6
Stiff to very stiff, olive green and brown, SILTY CLAY, trace sand and silt.	4.6 – 9.2
Hard, brown, SILTY CLAY, trace sand and silt.	9.2 – 9.6
End of Borehole at 9.6m.	



Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
1		
2		
3	18.29	USCS:CL
4		
5	18.48	
6		
7		USCS:CH
8		USCS:CH

GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **35**

BOREHOLE LOG

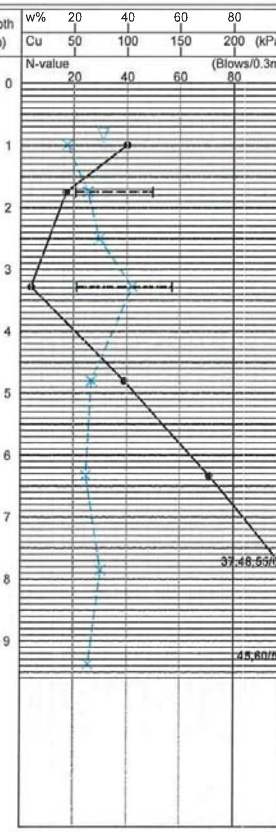
BOREHOLE No: B55-09
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 26/2/10 Completed on: 26/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
I"Pilcon Vane Shear, PV
I"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)
Ground Surface	0
Dense, brown, SILTY, SANDY GRAVEL. (FILL)	0 – 1.5
Stiff, greyish brown, CLAY, some silt, sand and gravel.	1.5 – 3.0
Soft, greyish brown, SILTY CLAY, trace sand and gravel.	3.0 – 4.6
Hard grey, SILTY CLAY.	4.6 – 9.6
End of Borehole at 9.6m.	



Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
1		
2		USCS:CH
3	18.69	
4		USCS:CH
5		
6		
7		
8		

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REPORT No. GA 07 326 — ENCLOSURE No. 36

BOREHOLE LOG

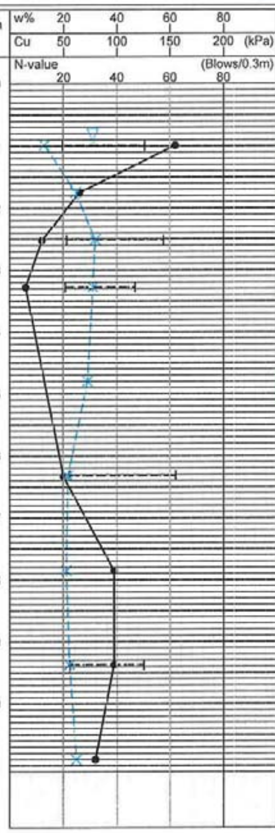
BOREHOLE No: B55-10
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 24/2/10 Completed on: 24/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0			
	Hard, grey and brown, GRAVELLY CLAY, some sand and silt. (FILL)	1	1		USCS:CH
	Very stiff to stiff, brown and grey, CLAYEY SILT, some sand, trace gravel.	2	2		
			3		USCS:CH
	Medium stiff, grey, SANDY, CLAYEY SILT, some gravel.	3–4	4		USCS:CL
		5	5		
	Very stiff, grey, SILTY CLAY, trace gravel and sand.	6–7	6		USCS:CH
	Hard, grey, CLAYEY SILT, trace sand and gravel.	8	7		
		9–10	8		USCS:CH
		11	9		
	End of Borehole at 11.13m.				



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GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 — ENCLOSURE No. 37

BOREHOLE LOG

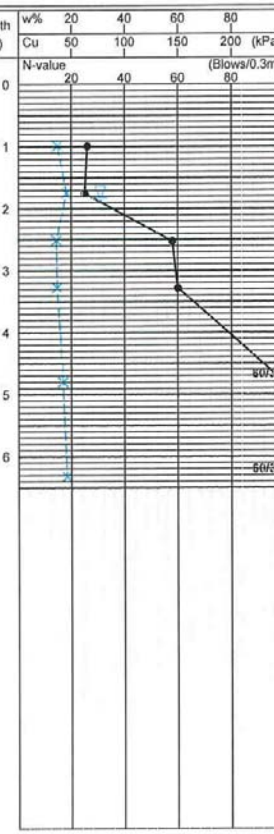
BOREHOLE No: B55-11
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 26/2/10 Completed on: 26/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0			
	Very stiff, greyish brown, SANDY, CLAYEY SILT, some gravel.	1	1		
		2	2		
			3		USCS:ML
	Hard, greyish brown, CLAYEY SILT, some to trace sand, trace to some gravel.	3–4	4		
		5	5		
		6	6		
	End of Borehole at 6.56m.				



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GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 — ENCLOSURE No. 38

BOREHOLE LOG

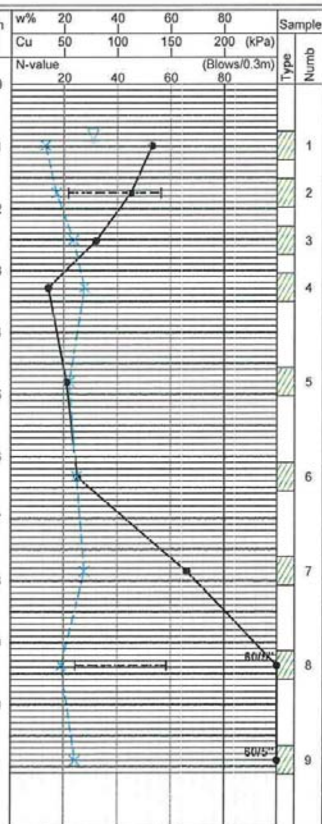
BOREHOLE No: B55-12
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 25/2/10 Completed on: 25/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
Ground Surface	0			
Hard, brown and grey, SILTY CLAY, trace sand and gravel.	1	1		
	2	2		USCS:CH
		3		
Stiff to very stiff, grey, SILTY CLAY, trace gravel and sand.	3	4		
	4			
	5	5		USCS:ML
	6	6		
	7			
Hard, grey, SILTY CLAY, trace sand.	8	7		
	9	8		USCS:CH
	10			
	11	9		
End of Borehole at 11.13m.				



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TRINIDAD, WI

REPORT No. GA 07 326 — ENCLOSURE No. 39

BOREHOLE LOG

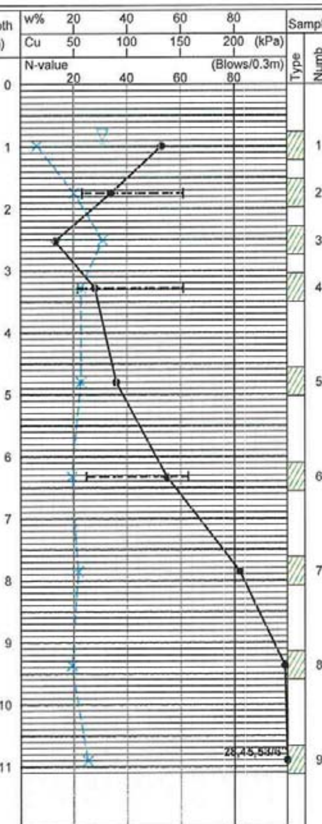
BOREHOLE No: B55-13
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 23/2/10 Completed on: 23/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
Ground Surface	0			
Very dense, grey and brown, GRAVELLY SAND, some silt, trace clay. (FILL)	1	1		
Hard, brown and grey, SILTY CLAY, some sand, trace clay.	2	2		USCS:CH
Stiff to very stiff, grey, CLAYEY SILT, trace sand.		3		
	3	4		USCS:CH
	4			
Hard, grey, SILTY CLAY, trace sand and gravel.	5	5		
	6	6		USCS:CH
	7			
	8	7		
	9	8		
	10			
	11	9		
En dof Borehole at 11.13m.				



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **40**

BOREHOLE LOG

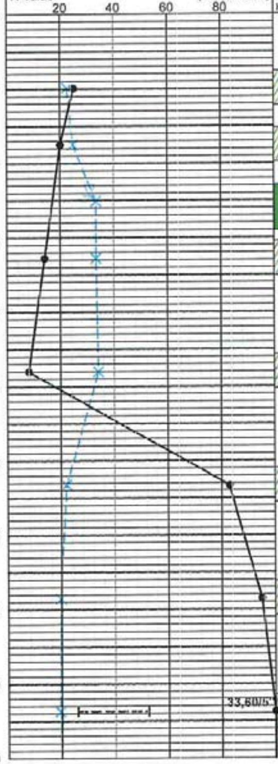
BOREHOLE No: B55-14
Sheet 1 of 2

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 23/2/10 Completed on: 23/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
Ground Surface	0			
Very stiff to stiff, grey and brown, SILTY CLAY, trace sand and gravel.	1	1		
	2	2		USCS:ML
	3	3	18.09	
		4		
Medium stiff, brown and grey, SILTY CLAY, some sand.	5	5		USCS:ML
Hard, grey, CLAYEY SILT, some sand.	6	6		
	7–8	7		
	9	8		USCS:CH
Continued Next Page	10			



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **41**

BOREHOLE LOG

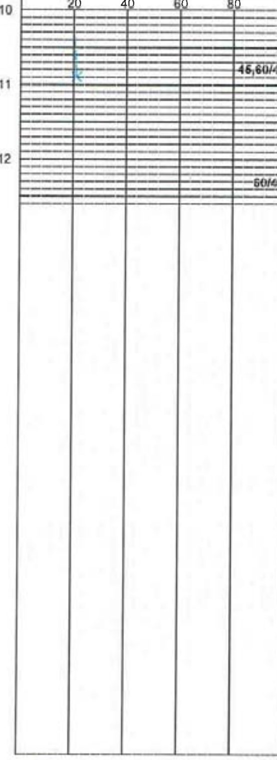
BOREHOLE No: B55-14
Sheet 2 of 2

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 23/2/10 Completed on: 23/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
(continued)	10			
	11	9		
	12	10		
End of Borehole at 12.65m.				



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 42

BOREHOLE LOG

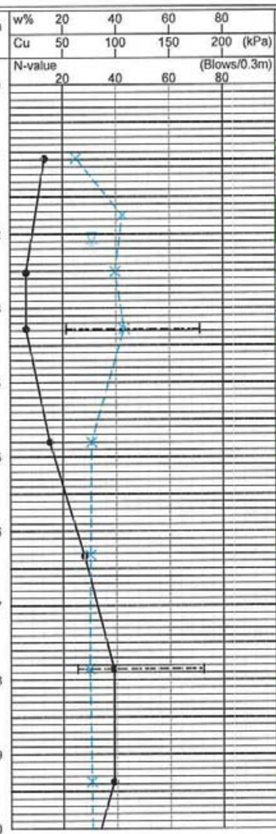
BOREHOLE No: B55-15
Sheet 1 of 2

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 22/2/10 Completed on: 22/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
l"Pilcon Vane Shear, PV
l"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
Ground Surface	0			
Stiff, brown, SILTY CLAY.	1	1		
	2	2	15.65	
Medium stiff, brown, SILTY CLAY, trace sand.	3	3, 4		USCS:CH
Stiff to very stiff, brown and grey, SILTY CLAY.	4–7	5, 6		USCS:CH
Hard, grey, SILTY CLAY, trace sand.	8–10	7, 8		
Continued Next Page				



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TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 43

BOREHOLE LOG

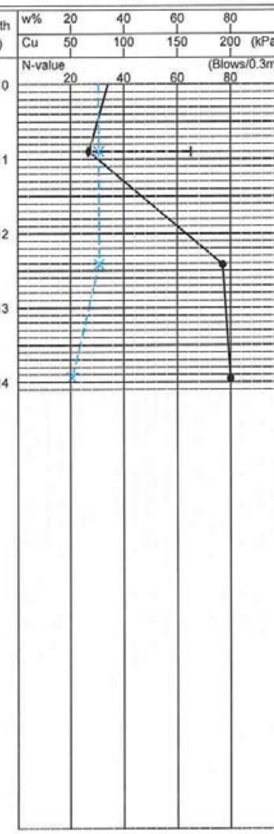
BOREHOLE No: B55-15
Sheet 2 of 2

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 22/2/10 Completed on: 22/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
l"Pilcon Vane Shear, PV
l"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
(continued)	10			USCS:CH
Very stiff, grey, SILTY CLAY, trace sand.	11	9		
Hard, grey, SILTY CLAY.	12–14	10, 11		
End of Borehole at 14.17m.				



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **44**

BOREHOLE LOG

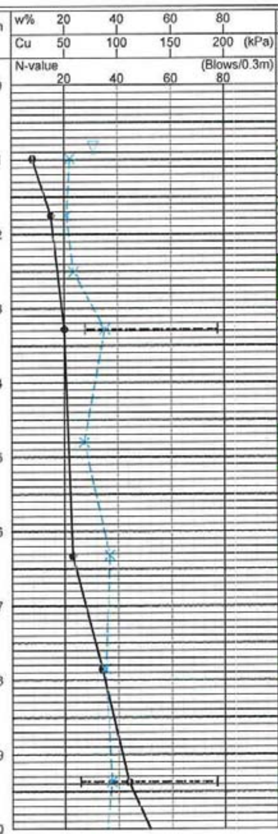
BOREHOLE No: B55-16
Sheet 1 of 2

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 18/2/10 Completed on: 18/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
Ground Surface	0			
Medium stiff, dark brown, GRAVELLY, SANDY, CLAYEY SILT.	1	1		
Stiff to very stiff, brown, SILTY CLAY, trace sand.	2	2		
		3	20.68	
	3	4		USCS:CH
	4			
	5	5	21.34	
	6	6		
	7			
Hard, grey, SILTY CLAY, trace sand.	8	7		
	9	8		USCS:CH
Continued Next Page	10			



BH P12BX 07326.GPJ 4/5/10

GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **45**

BOREHOLE LOG

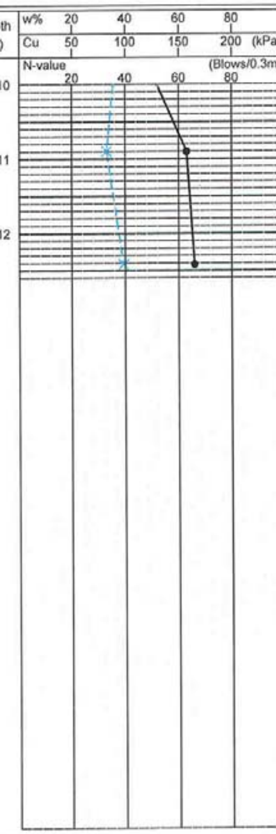
BOREHOLE No: B55-16
Sheet 2 of 2

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 18/2/10 Completed on: 18/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
(continued)	10			
	11	9		
	12	10		
End of Borehole at 12.65m.				



BH P12BX 07326.GPJ 4/5/10

GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **46**

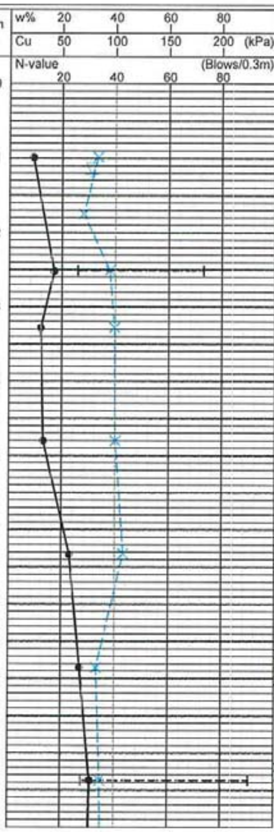
BOREHOLE LOG

BOREHOLE No: B55-17
Sheet 1 of 2

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 18/2/10 Completed on: 18/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
I"Pilcon Vane Shear, PV
I"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test



Depth (m)	Soil Description	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
0	Ground Surface				
	Stiff to very stiff, brown and grey, SILTY CLAY, trace sand and gravel.				
1			1		
2			2	21.92	
			3		USCS:CH
3			4		
4					
5			5		
6			6		
7					
8			7		
9	Hard, grey, SILTY CLAY, trace sand.		8		
10					

Continued Next Page

GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **47**

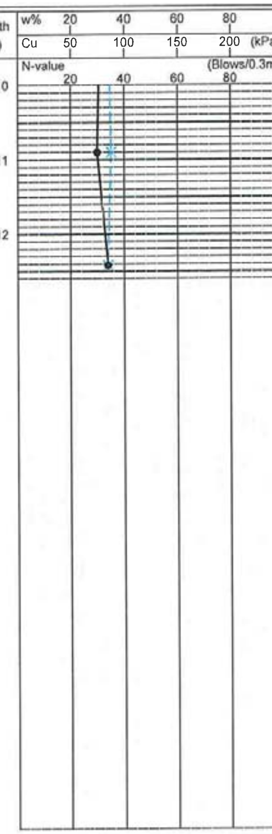
BOREHOLE LOG

BOREHOLE No: B55-17
Sheet 2 of 2

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 18/2/10 Completed on: 18/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
I"Pilcon Vane Shear, PV
I"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test



Depth (m)	Soil Description	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
10	(continued)				
	Very stiff, grey, SILTY CLAY.		9		
11					
12	Hard, grey, SILTY CLAY.		10		
	End of Borehole at 12.65m.				

GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. 48

BOREHOLE LOG

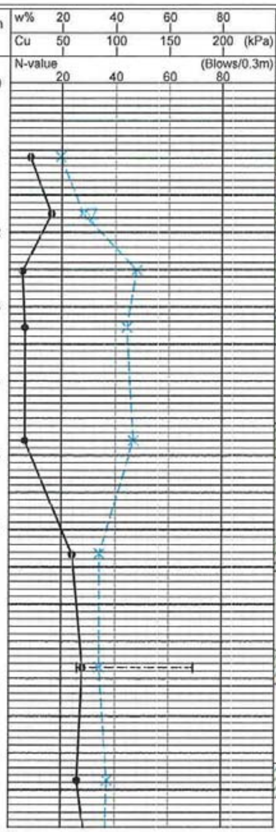
BOREHOLE No: B55-18
Sheet 1 of 2

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 1/4/10 Completed on: 1/4/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
I"Pilcon Vane Shear, PV
I"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
Ground Surface	0				
Medium stiff, grey CLAY.	1		1		
Very stiff, brown, SANDY CLAY, some silt and gravel.	2		2		USCS:ML
Medium stiff, grey CLAY, some silt, trace sand.	3		3		USCS:ML
	3–4		4		
	5		5		
Very stiff, brown, SILTY CLAY, trace sand and gravel.	6–7		6		USCS:CH
	8		7		
	9		8		
Continued Next Page	10				



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. 49

BOREHOLE LOG

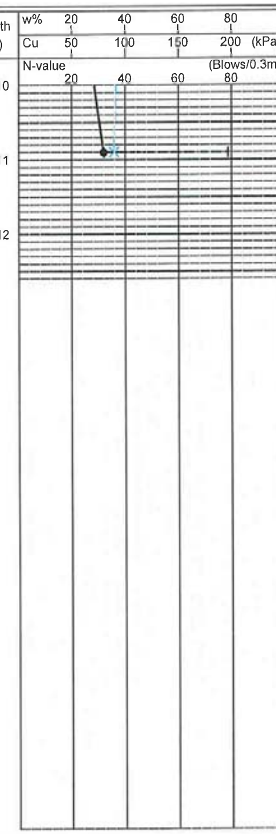
BOREHOLE No: B55-18
Sheet 2 of 2

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 1/4/10 Completed on: 1/4/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
I"Pilcon Vane Shear, PV
I"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
(continued)	10				
Hard, brown, SILTY CLAY, trace sand.	11		9		USCS:CH
End of Borehole at 11.13m.	12				



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **50**

BOREHOLE LOG

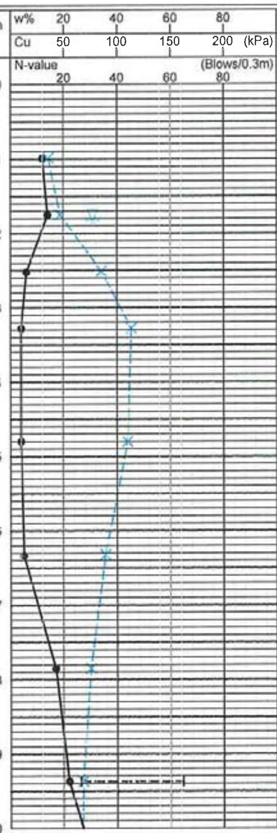
BOREHOLE No: B55-19
Sheet 1 of 2

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 1/4/10 Completed on: 1/4/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
Ground Surface	0			
Stiff, brown, GRAVELLY, SANDY CLAY, some silt.	1	1		
	2	2		
Loose to very loose, brown and grey, CLAYEY SAND, some silt, trace gravel.	3	3		
	4	4		USCS:SM
Soft to medium stiff, grey, SILTY CLAY.	5	5		
	6	6		
	7			
Very stiff, grey CLAY, some silt, trace sand and gravel.	8	7		
	9	8		USCS:CH
Continued Next Page	10			



RHI P12BX 07326.GPJ 4/5/10

GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. **51**

BOREHOLE LOG

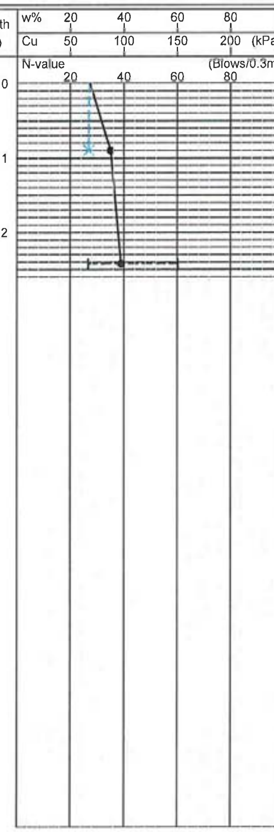
BOREHOLE No: B55-19
Sheet 2 of 2

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando Central Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 1/4/10 Completed on: 1/4/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
(continued)	10			
Hard, grey CLAY, some silt, trace sand.	11	9		
	12	10		USCS:CH
End of Borehole at 12.65m.				



RHI P12BX 07326.GPJ 4/5/10

GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. 52

BOREHOLE LOG

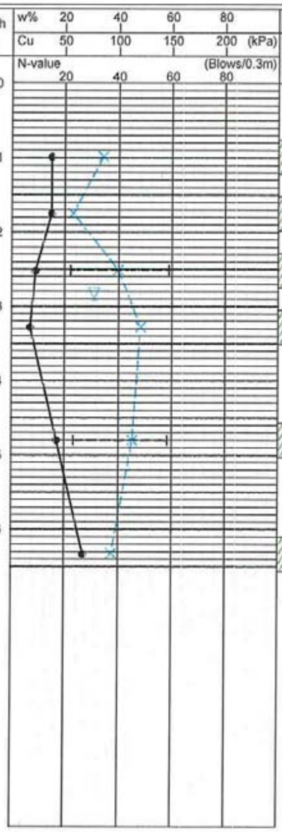
BOREHOLE No: B70-02
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando South Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 9/4/10 Completed on: 9/4/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
I"Pilcon Vane Shear, PV
I"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Stiff, dark grey and brown, SILTY CLAY, some sand.	1		1		
		2		2		
				3		USCS:CH
	Medium stiff, brown, SILTY CLAY, trace gravel.	3		4		
		4				
	Very stiff, grey, SILTY CLAY, some sand, trace gravel.	5		5		USCS:CH
		6		6		
	End of Borehole at 6.56m.					



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REPORT No. GA 07 326 ENCLOSURE No. 53

BOREHOLE LOG

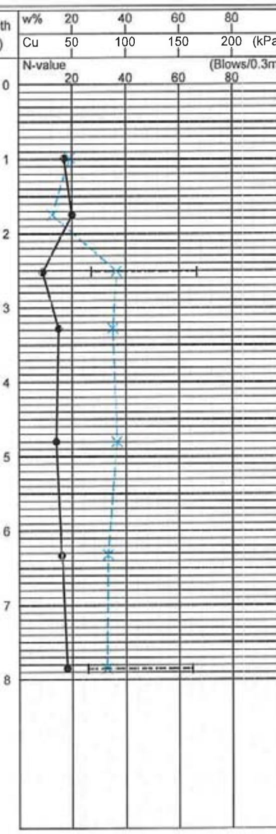
BOREHOLE No: B70-04
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando South Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 24/3/10 Completed on: 24/3/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
I"Pilcon Vane Shear, PV
I"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Stiff to very stiff, reddish brown, yellowish brown and grey, SILTY CLAY, race gravel.	1		1		
		2		2		
				3		USCS:CH
		3		4		
		4				
		5		5		
		6		6		
		7				
		8		7		USCS:CH
	End of Borehole at 8.08m.					



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 — ENCLOSURE No. 54

BOREHOLE LOG

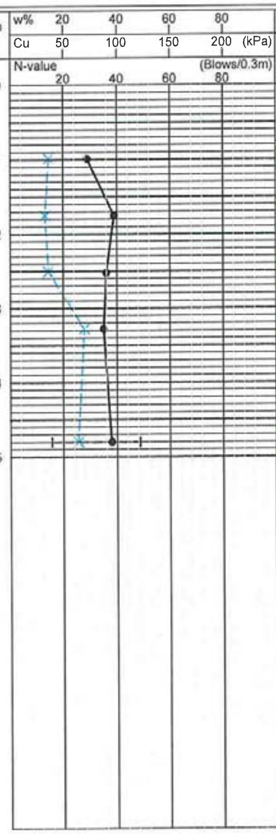
BOREHOLE No: B70-06
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando South Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 8/4/10 Completed on: 8/4/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
	Ground Surface	0				
	Medium dense to dense, brown and grey, SANDY GRAVEL, with rubble. (FILL)			1		
				2		
				3		
	Hard, brown, GRAVELLY, SANDY CLAY, some silt.			4		
				5		USCS:CL
	End of Borehole at 5.03m.	5				



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 — ENCLOSURE No. 55

BOREHOLE LOG

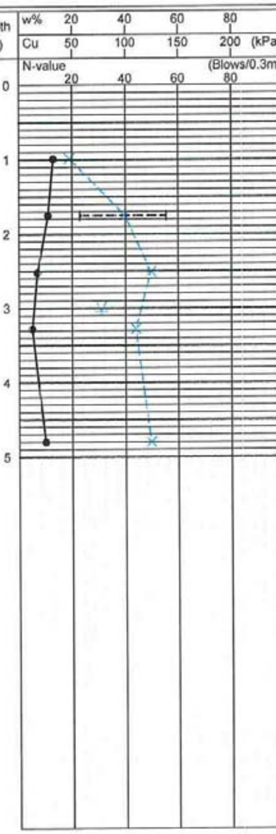
BOREHOLE No: B70-08
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando South Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 9/4/10 Completed on: 9/4/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
	Ground Surface	0				
	Stiff, brown and grey, SILTY CLAY, some sand.			1		
				2		USCS:CH
	Medium stiff, brown and grey, CLAYEY, SANDY SILT, with organic material.			3		
				4		USCS:ML
	Loose, dark grey, GRAVELLY SAND, some clay and silt.			5		
	End of Borehole at 5.03m.	5				



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 56

BOREHOLE LOG

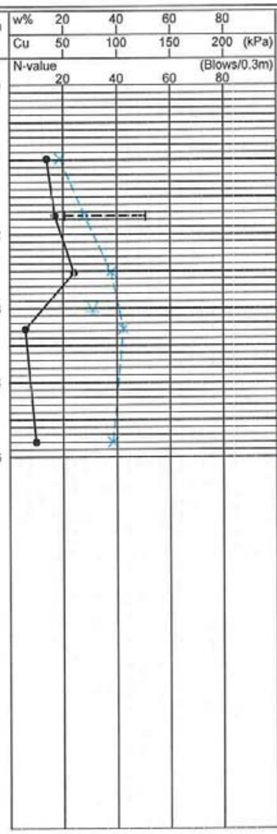
BOREHOLE No: B70-10
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando South Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 7/4/10 Completed on: 7/4/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
	Ground Surface	0				
	Stiff to very stiff, brown, SILTY, SANDY CLAY, trace gravel.	1		1		
		2		2		USCS:CH
				3		
	Medium stiff, brown and grey, SILTY, SANDY CLAY.	3		4		
		4				
	Stiff, brown and grey, SILTY CLAY, with organic matter.	5		5		
	End of Borehole at 5.03m.					



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TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 57

BOREHOLE LOG

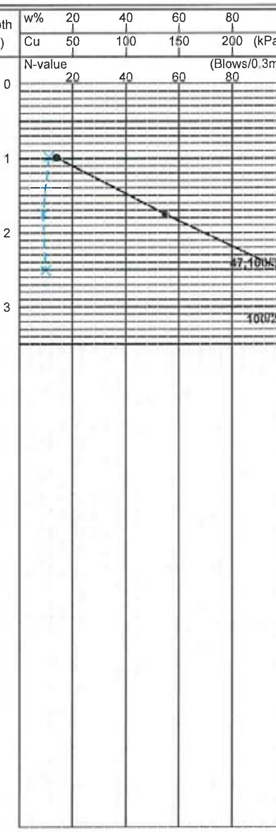
BOREHOLE No: B70-13
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando South Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 6/4/10 Completed on: 6/4/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
	Ground Surface	0				
	Medium dense to dense, brown, SANDY GRAVEL. (FILL)	1		1		
		2		2		
				3		
		3		4		
	End of Borehole at 3.5m.					



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TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 58

BOREHOLE LOG

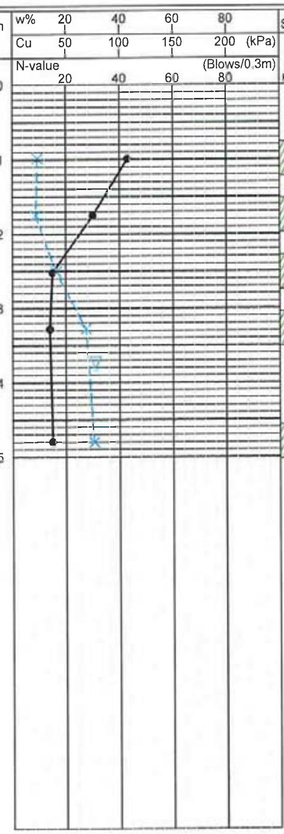
BOREHOLE No: B70-15
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando South Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 6/4/10 Completed on: 6/4/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Dense, brown and grey, SANDY GRAVEL. (FILL)	1		1		
		2		2		
	Stiff, brown and dark brown, SANDY CLAY, with organic material.	3		3		
		4		4		
		5		5		
	End of Borehole at 5.03m.					



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 59

BOREHOLE LOG

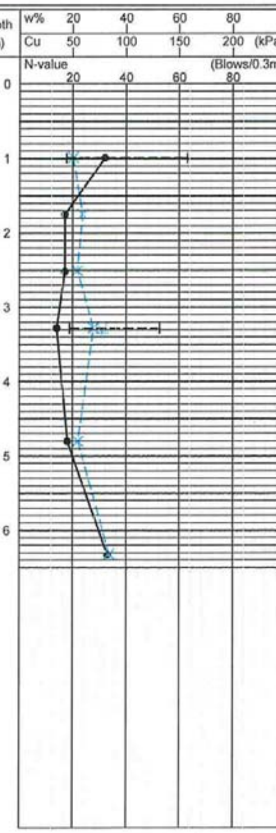
BOREHOLE No: B70-17
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: San Fernando South Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 29/3/10 Completed on: 29/3/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Hard, brown and grey, SILTY CLAY, trace sand and gravel.	1		1		USCS:CH
	Stiff to very stiff, brown and grey, SILTY CLAY, trace sand.	2		2		
				3		
		3		4		USCS:CH
		4				
		5		5		
		6				
	Hard, brown and grey, SILTY CLAY.			6		
	End of Borehole at 6.56m.					



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TRINIDAD, WI

REPORT No. GA 07 326 | ENCLOSURE No. **60**

BOREHOLE LOG

BOREHOLE No: B80-04
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Vistabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 1/4/10 Completed on: 1/4/10

- Drive, No Sample Collected
- Disturbed Sample
- Split Spoon Sample
- Shelby Tube Sample
- Core Sample
- Water Level at End of Drilling
- Water Level 24 hrs. or more

Water Content (W%)
- Plastic and Liquid Limit
- Natural Moisture Content

Shear Strength (Cu)
- Unconsolidated Undrained Triaxial, UU
- Unconfined Compression, UC
- I"Pilcon Vane Shear, PV
- I"Field Vane Shear, FV

Penetration Resistance (N)
- Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Medium dense, light grey, SANDY GRAVEL. (FILL)	1		1		
	Stiff to very stiff, light grey, CLAYEY SILT, trace sand.	2		2		USCS:CL
				3		
		3		4		USCS:CL
		4				
		5		5		
	End of Borehole at 5.03m.					

GEOTECH ASSOCIATES LTD.
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REPORT No. GA 07 326 | ENCLOSURE No. **61**

BOREHOLE LOG

BOREHOLE No: B80-11
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Vistabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 29/3/10 Completed on: 29/3/10

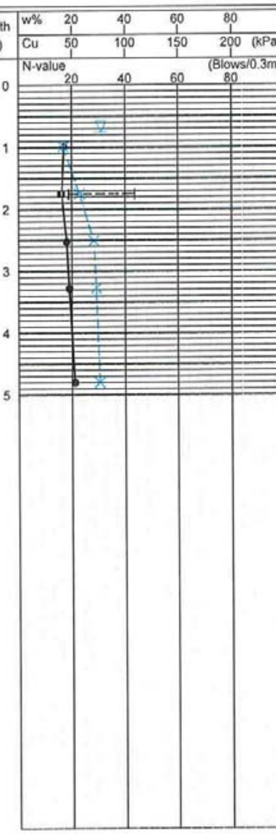
- Drive, No Sample Collected
- Disturbed Sample
- Split Spoon Sample
- Shelby Tube Sample
- Core Sample
- Water Level at End of Drilling
- Water Level 24 hrs. or more

Water Content (W%)
- Plastic and Liquid Limit
- Natural Moisture Content

Shear Strength (Cu)
- Unconsolidated Undrained Triaxial, UU
- Unconfined Compression, UC
- I"Pilcon Vane Shear, PV
- I"Field Vane Shear, FV

Penetration Resistance (N)
- Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Loose, red, SAND. (FILL)	1		1		
	Very stiff, olive green and brown, SILTY, SANDY CLAY, some gravel.	2		2		USCS:CL
				3		
		3		4		
		4				
		5		5		
	End of Borehole at 5.03m.					



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. 62

BOREHOLE LOG

BOREHOLE No: B80-15
Sheet 1 of 1

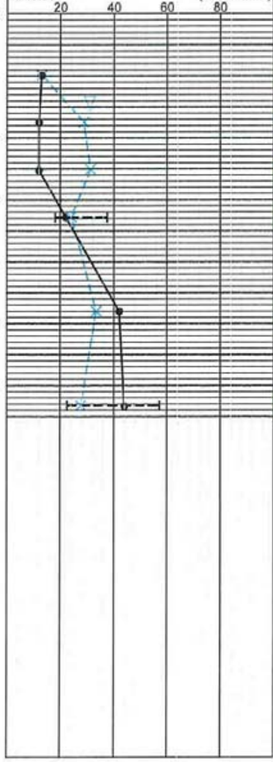
Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Vistabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 1/4/10 Completed on: 1/4/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
Ground Surface	0			
Medium dense, dark grey, SANDY GRAVEL. (FILL)	1	1		
Stiff to very stiff, light grey, SILTY, SANDY CLAY, some gravel.	2	2		
	3	3, 4		USCS:CL
Hard, light grey, SILTY CLAY, trace sand.	5	5		
	6	6		USCS:CH
End of Borehole at 6.56m.				

w% 20 40 60 80; Cu 50 100 150 200 (kPa); N-value 20 40 60 80 (Blows/0.3m)



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. 63

BOREHOLE LOG

BOREHOLE No: B80-17
Sheet 1 of 1

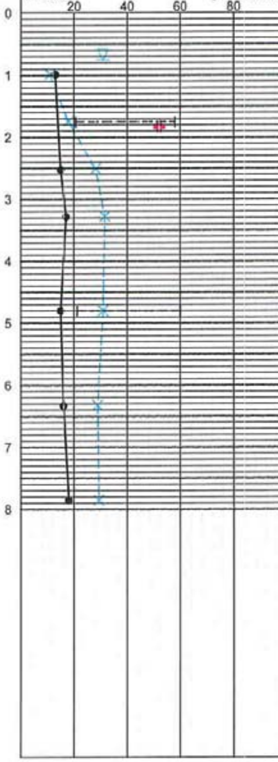
Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Vistabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 29/3/10 Completed on: 29/3/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Soil Description	Depth (m)	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
Ground Surface	0			
Medium dense, brown, SANDY GRAVEL. (FILL)	1	1		
Stiff to very stiff, grey and brown, SILTY CLAY, trace sand.	2	2		USCS:CH
	3	3, 4		
	5	5		USCS:CH
	6	6		
	7–8	7		
End of Borehole at 8.08m.				

w% 20 40 60 80; Cu 50 100 150 200 (kPa); N-value 20 40 60 80 (Blows/0.3m)



GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 64

BOREHOLE LOG

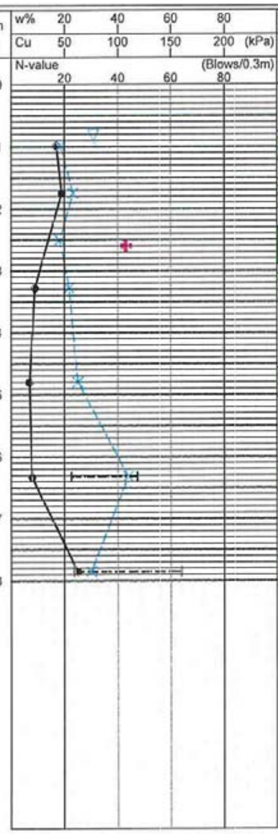
BOREHOLE No: B80-19
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Vistabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 1/4/10 Completed on: 1/4/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
I"Pilcon Vane Shear, PV
I"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)
	Ground Surface	0
	Medium dense, light brown, SILTY GRAVEL.	
	Stiff, light grey, SILTY CLAY, trace sand.	
	Medium stiff, dark grey, SANDY CLAY, with organic material.	
	Very stiff, light grey and brown, SILTY CLAY.	
	End of Borehole at 8.08m.	8



Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
1		
2		
3	21.36	
4		USCS:ML
5		
6		USCS:SC
7		USCS:CH

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TRINIDAD, WI

REPORT No. GA 07 326

ENCLOSURE No. 65

BOREHOLE LOG

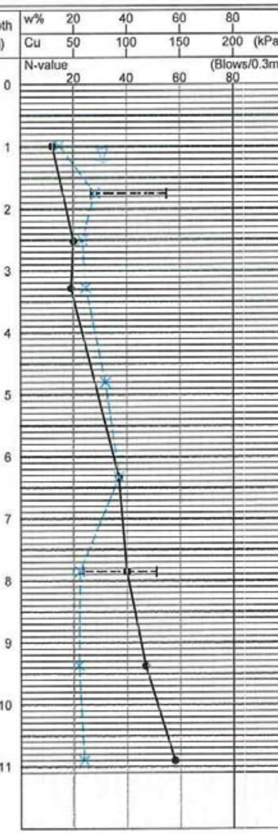
BOREHOLE No: B80-22
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Vistabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 17/2/10 Completed on: 17/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
I"Pilcon Vane Shear, PV
I"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)
	Ground Surface	0
	Stiff to very stiff, dark grey, SILTY CLAY, trace sand.	
	Hard, dark grey, CLAYEY SILT, some sand.	
	End of Borehole at 11.13m.	11



Sample Numb	Wet Density (kN/m3)	Additional Tests and Remarks
1		
2	18.49	USCS:CH
3		
4		
5	17.71	
6		
7		USCS:CH
8		
9		

GEOTECH ASSOCIATES LTD.
TRINIDAD, WI

REPORT No. GA 07 326 ENCLOSURE No. 66

BOREHOLE LOG

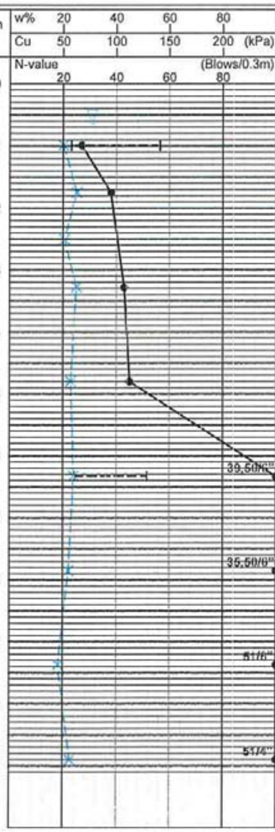
BOREHOLE No: B80-24
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Vistabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 17/2/10 Completed on: 17/2/10

Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Stiff, reddish brown and grey, CLAYEY SILT, some sand and gravel.	1		1		USCS:CH
	Hard, grey, CLAYEY, SANDY SILT.	2		2		
		3		3	19.05	
				4		
		5		5		
		6		6		USCS:CH
		8		7		
		9		8		
		11		9		
	End of Borehole at 11.13m.					



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REPORT No. GA 07 326 ENCLOSURE No. 67

BOREHOLE LOG

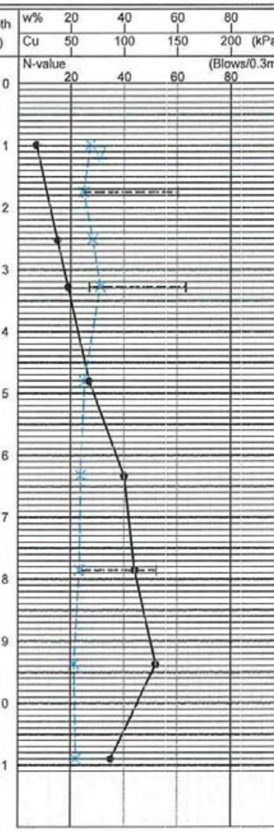
BOREHOLE No: B80-25
Sheet 1 of 1

Client: AECOM
Project: Geo. Services for Wastewater Treatment Pipeline
Location: Vistabella Catchment
Ground Elevation: m
Boring Method: Wash Boring
Prep by: M. Joab
Boring Started on: 16/2/10 Completed on: 16/2/10

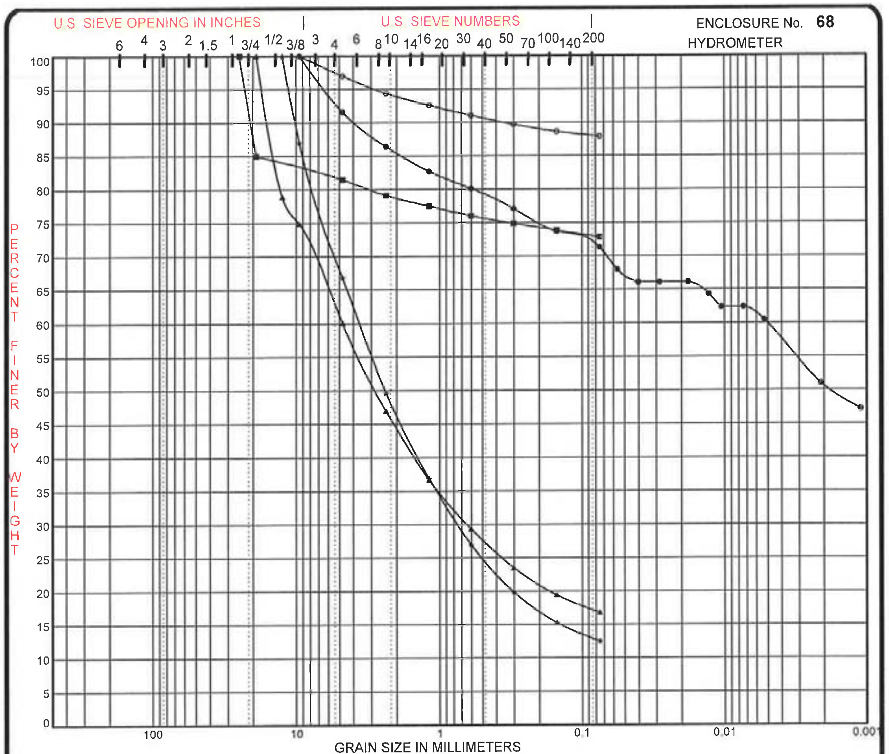
Drive, No Sample Collected
Disturbed Sample
Split Spoon Sample
Shelby Tube Sample
Core Sample
Water Level at End of Drilling
Water Level 24 hrs. or more

Water Content (W%)
Plastic and Liquid Limit
Natural Moisture Content
Shear Strength (Cu)
Unconsolidated Undrained Triaxial, UU
Unconfined Compression, UC
!"Pilcon Vane Shear, PV
!"Field Vane Shear, FV
Penetration Resistance (N)
Standard Penetration Test

Symbol	Soil Description	Depth (m)	Sample Type	Sample Numb	Wet Density kN/m3	Additional Tests and Remarks
	Ground Surface	0				
	Medium stiff, grey and brown, SILTY CLAY.	1		1		
	Stiff to very stiff, dark grey and brown, SILTY CLAY, trace sand.	2		2	17.26	USCS:CH
		3		3		
				4		USCS:CH
		5		5		
	Hard, dark grey, SILTY CLAY, trace sand.	6		6		
		8		7		USCS:CH
		9		8		
		11		9		
	End of Borehole at 11.13m.					



ENCLOSURE No. 68



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B 0-1/S 1	1.0	SILT with SAND ML		NP	NP	NP		
⊠	B 0-1/S 2	1.8	SILT with GRAVEL ML		NP	NP	NP		
▲	B 0-1/S 4	3.3							
★	B 0-1/S 5	4.8							
⊙	B 0-1/S 6	6.3	SILT ML		NP	NP	NP		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B 0-1/S 1	1.0	9.50	0.01	0.002		8.4	20.2	20.6	50.7
⊠	B 0-1/S 2	1.8	25.00				18.5	8.6	72.8	
▲	B 0-1/S 4	3.3	19.00	4.74	2.781	0.638	40.0	43.3	16.8	
★	B 0-1/S 5	4.8	12.50	3.60	2.399	0.738	33.2	54.3	12.5	
⊙	B 0-1/S 6	6.3	9.50				3.0	9.1	87.9	

PROJECT Geo. Services for Wastewater Treatment Pipeline -

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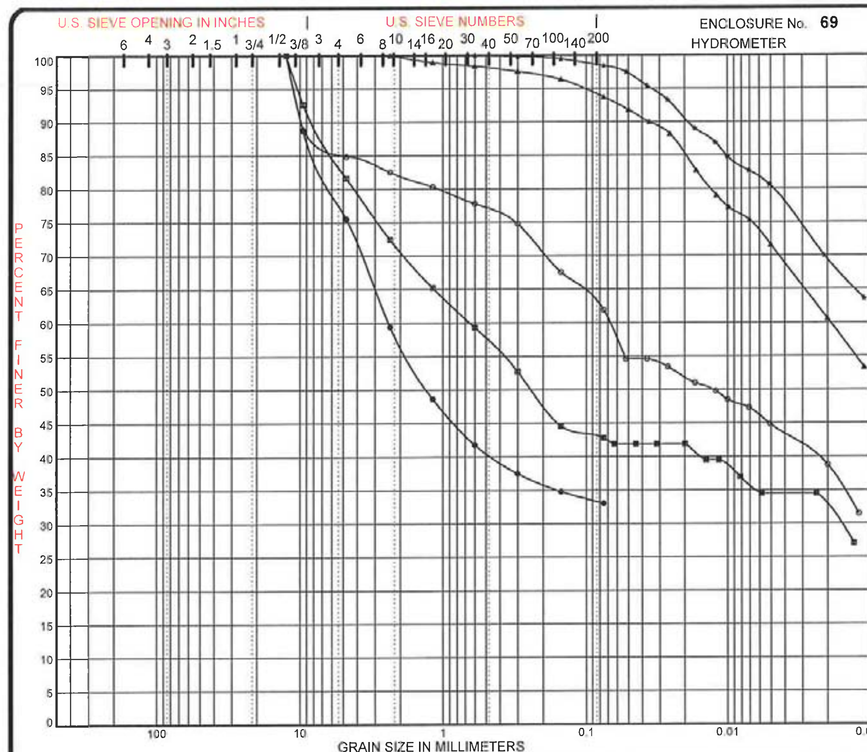
ENCLOSURE No. 69



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B 0-1/S 9	10.9	SILTY SAND with GRAVEL SM		NP	NP	NP		
⊠	B 0-2/S 1	1.0							
▲	B 0-2/S 4	3.3	FAT CLAY CH		65	25	39		
★	B 0-2/S 7	7.9	FAT CLAY CH		58	24	34		
⊙	B10-01/S 2	1.8	SANDY LEAN CLAY with GRAVEL CL		43	18	25		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B 0-1/S 9	10.9	12.50	2.42	1.287		24.5	42.5	33.1	
⊠	B 0-2/S 1	1.0	12.50	0.65	0.238	0.002	18.4	38.8	10.5	32.3
▲	B 0-2/S 4	3.3	2.36	0.00			0.0	6.3	33.1	60.6
★	B 0-2/S 7	7.9	0.60				0.0	1.6	28.9	69.5
⊙	B10-01/S 2	1.8	12.50	0.07	0.013		15.1	23.0	23.1	38.8

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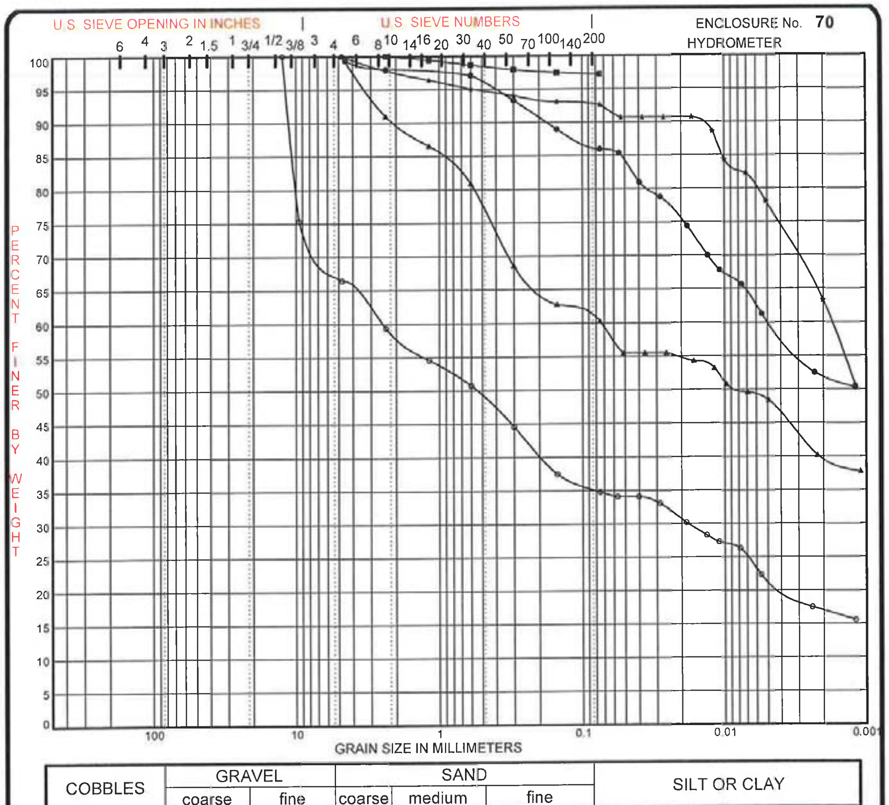
ENCLOSURE No. 70



	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B10-01/S 4	3.3	FAT CLAY CH		51	22	29		
⊠	B10-01/S 6	6.3	FAT CLAY CH		70	21	49		
▲	B10-03/S 2	1.8	SANDY ELASTIC SILT MH		52	29	23		
★	B10-03/S 4	3.3	FAT CLAY CH		54	19	35		
⊙	B10-04/S 3	2.5							

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B10-01/S 4	3.3	4.75	0.00			0.0	14.0	34.0	52.0
⊠	B10-01/S 6	6.3	2.36				0.0	2.8	97.2	
▲	B10-03/S 2	1.8	4.75	0.07	0.008		0.0	39.7	20.4	39.9
★	B10-03/S 4	3.3	4.75	0.00			0.0	7.4	29.3	63.3
⊙	B10-04/S 3	2.5	12.50	2.52	0.551	0.018	33.5	31.7	17.8	17.0

PROJECT Geo. Services for Wastewater Treatment Pipeline -

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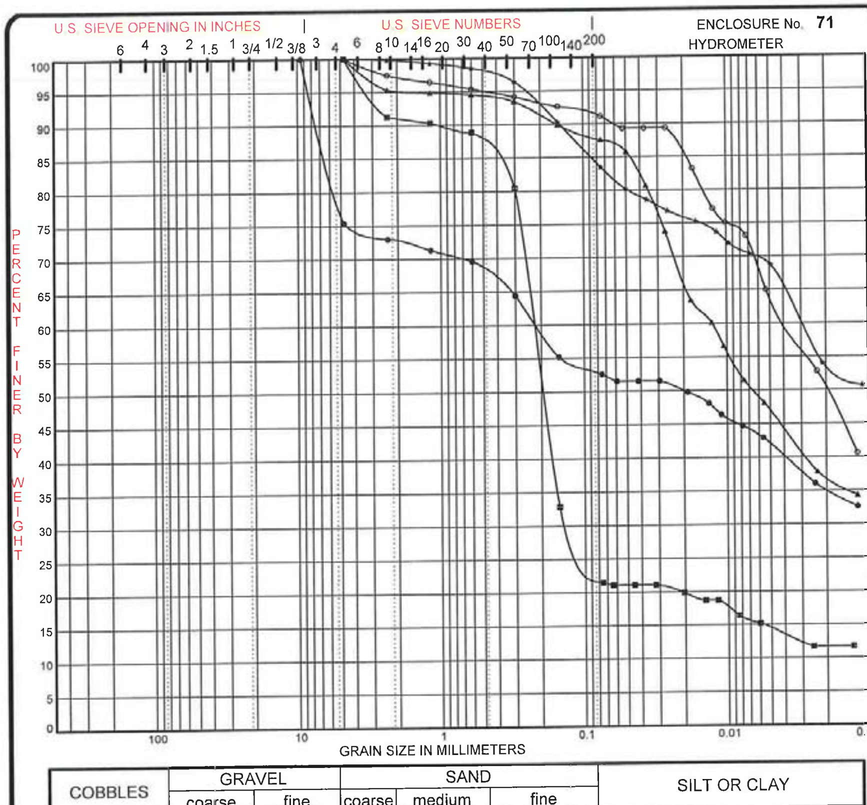
ENCLOSURE No. 71



	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B10-04/S 4	3.3	GRAVELLY LEAN CLAY with SAND CL		45	14	31		
⊠	B10-04/S 5	4.8							
▲	B10-04/S 6	6.3	LEAN CLAY CL		43	20	23		
★	B10-08/S 2	1.8	LEAN CLAY with SAND CL		38	14	24		
⊙	B10-08/S 5	4.8	FAT CLAY CH		54	21	33		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B10-04/S 4	3.3	9.50	0.22	0.020		24.6	22.8	17.4	35.2
⊠	B10-04/S 5	4.8	4.75	0.22	0.192	0.126	0.0	78.5	9.8	11.7
▲	B10-04/S 6	6.3	4.75	0.01	0.007		0.0	12.4	50.5	37.0
★	B10-08/S 2	1.8	4.75	0.00			0.0	16.5	29.8	53.8
⊙	B10-08/S 5	4.8	4.75	0.00	0.002		0.0	8.8	41.0	50.2

PROJECT Geo. Services for Wastewater Treatment Pipeline -

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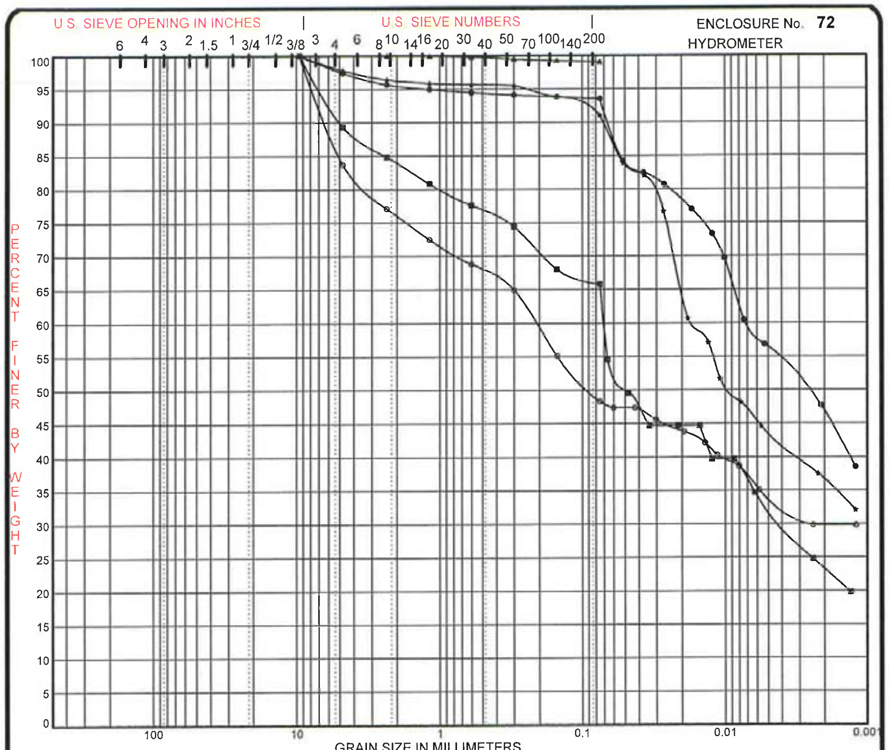
ENCLOSURE No. 72



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B10-13/S 6	6.3	FAT CLAY CH		50	22	27		
⊠	B10-15/S 1	1.0	SANDY SILT ML		NP	NP	NP		
▲	B10-15/S 3	2.5	FAT CLAY CH		68	30	39		
★	B10-15/S 6	6.3	LEAN CLAY CL		36	17	19		
⊙	B10-17/S 2	1.8	SILTY SAND with GRAVEL SM		NP	NP	NP		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B10-13/S 6	6.3	9.50	0.01	0.003		2.6	3.9	46.6	46.9
⊠	B10-15/S 1	1.0	9.50	0.07	0.049	0.004	10.7	23.5	42.5	23.3
▲	B10-15/S 3	2.5	2.36				0.0	0.9	99.1	
★	B10-15/S 6	6.3	9.50	0.02	0.009		2.2	6.8	54.4	36.7
⊙	B10-17/S 2	1.8	9.50	0.21	0.089	0.002	16.3	35.4	18.5	29.8

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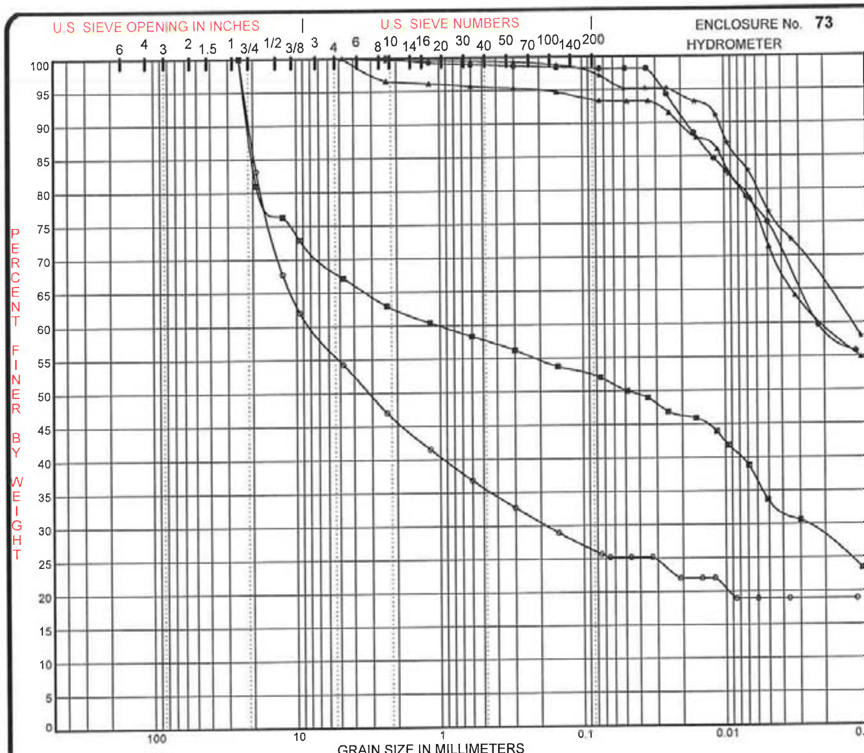
ENCLOSURE No. 73



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B10-17/S 5	4.8	FAT CLAY CH		61	23	38		
⊠	B10-20/S 1	1.0							
▲	B10-20/S 4	3.3	FAT CLAY CH		66	21	45		
★	B10-20/S 6	6.3	FAT CLAY CH		68	25	43		
⊙	B10-24/S 1	1.0	CLAYEY GRAVEL with SAND GC		52	20	33		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B10-17/S 5	4.8	2.36	0.00			0.0	1.8	39.1	59.1
⊠	B10-20/S 1	1.0	25.00	1.03	0.049	0.003	32.8	15.1	24.3	27.7
▲	B10-20/S 4	3.3	4.75	0.00			0.0	6.6	33.3	60.1
★	B10-20/S 6	6.3	4.75	0.00			0.0	2.8	31.5	65.7
⊙	B10-24/S 1	1.0	25.00	7.92	3.148	0.182	45.7	28.6	6.8	18.9

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GRADATION CURVES

Geotech Associates Limited

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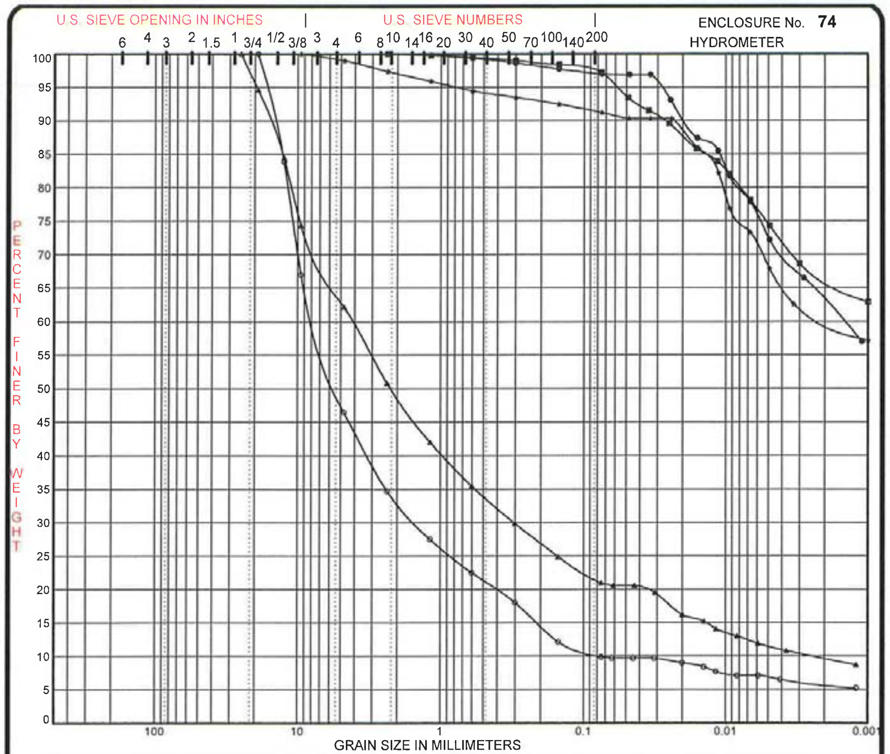
ENCLOSURE No. **74**



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B10-24/S 5	4.8	FAT CLAY CH		51	20	32		
⊠	B10-24/S 7	7.9	FAT CLAY CH		51	21	31		
▲	B10-27/S 2	1.8						9.28	1726.2
★	B10-27/S 5	4.8	FAT CLAY CH		55	22	34		
⊙	B10-30/S 2	1.8						3.84	96.4

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B10-24/S 5	4.8	2.36	0.00			0.0	3.0	33.9	63.1
⊠	B10-24/S 7	7.9	2.36				0.0	2.8	30.7	66.5
▲	B10-27/S 2	1.8	25.00	4.16	2.222	0.305	37.8	41.2	11.3	9.7
★	B10-27/S 5	4.8	9.50	0.00			1.0	7.8	30.9	60.3
⊙	B10-30/S 2	1.8	19.00	7.50	5.351	1.496	53.5	36.6	4.1	5.7

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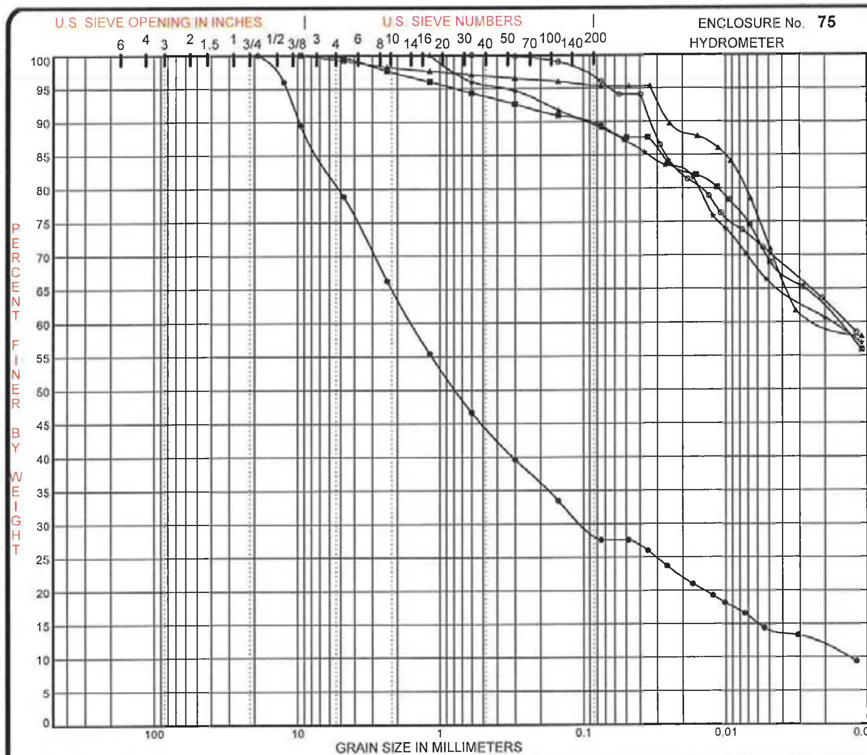
DATE May 2010

GRADATION CURVES

Geotech Associates Limited

GRSZL-2 07326.GPJ 4/5/10

ENCLOSURE No. **75**



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B10-30/S 5	4.8						4.51	1136.9
⊠	B10-30/S 6	6.3	FAT CLAY CH		58	24	34		
▲	B10-30/S 7	7.9	FAT CLAY CH		60	25	35		
★	B10-31/S 1	1.0	SILT ML		NP	NP	NP		
⊙	B10-31/S 4	3.3	LEAN CLAY CL		49	21	28		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B10-30/S 5	4.8	19.00	1.58	0.775	0.099	21.1	51.3	16.1	11.5
⊠	B10-30/S 6	6.3	9.50	0.00			0.4	10.2	27.7	61.7
▲	B10-30/S 7	7.9	9.50	0.00			0.8	3.9	35.3	60.0
★	B10-31/S 1	1.0	1.18	0.00			0.0	10.9	28.4	60.7
⊙	B10-31/S 4	3.3	0.60	0.00			0.0	3.9	32.9	63.2

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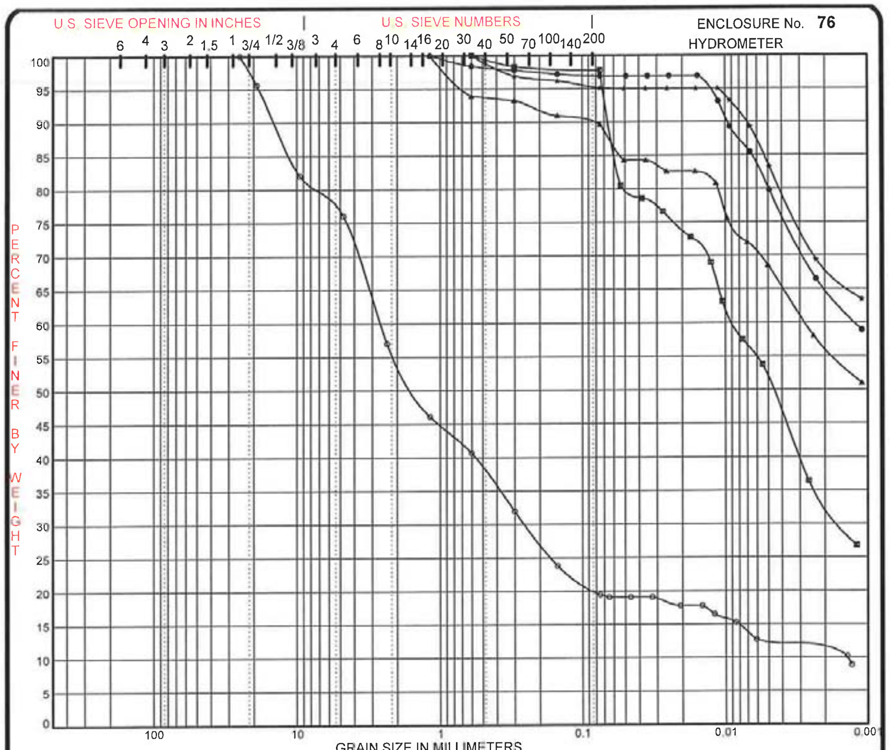
ENCLOSURE No. 76



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B15-02/S 2	1.8	FAT CLAY CH		57	26	31		
⌧	B15-02/S 4	3.3	LEAN CLAY CL		39	24	15		
▲	B15-04/S 1	1.0	FAT CLAY CH		53	24	29		
★	B15-04/S 5	4.8	LEAN CLAY CL		49	27	22		
⊙	B25-01/S 2	1.8	SILTY SAND with GRAVEL SM		NP	NP	NP	17.61	1902.4

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B15-02/S 2	1.8	1.18	0.00			0.0	3.1	31.9	65.1
⌧	B15-02/S 4	3.3	0.60	0.01	0.005	0.002	0.0	2.2	64.6	33.1
▲	B15-04/S 1	1.0	1.18	0.00			0.0	10.3	33.3	56.4
★	B15-04/S 5	4.8	0.60				0.0	4.9	26.9	68.3
⊙	B25-01/S 2	1.8	25.00	2.63	1.509	0.253	23.9	56.6	8.7	10.8

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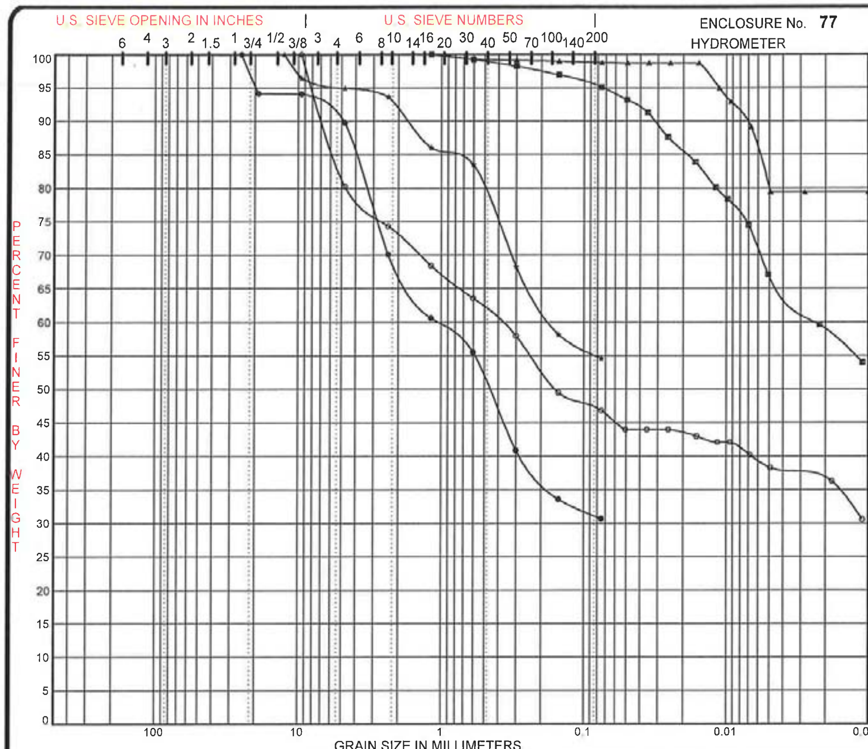
ENCLOSURE No. 77



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B25-01/S 4	3.3	CLAYEY SAND SC		57	24	34		
⌧	B25-03/S 3	2.5	FAT CLAY CH		59	23	36		
▲	B25-04/S 1	1.0	FAT CLAY CH		70	22	48		
★	B25-06/S 3	2.5							
⊙	B25-08/S 3	2.5	CLAYEY SAND with GRAVEL SC		40	17	23		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B25-01/S 4	3.3	25.00	1.09	0.462		10.2	59.1	30.7	
⌧	B25-03/S 3	2.5	1.18	0.00			0.0	4.9	36.2	58.8
▲	B25-04/S 1	1.0	1.18				0.0	1.2	19.4	79.4
★	B25-06/S 3	2.5	12.50	0.17			5.1	40.3	54.6	
⊙	B25-08/S 3	2.5	9.50	0.39	0.156		19.7	33.4	10.3	36.5

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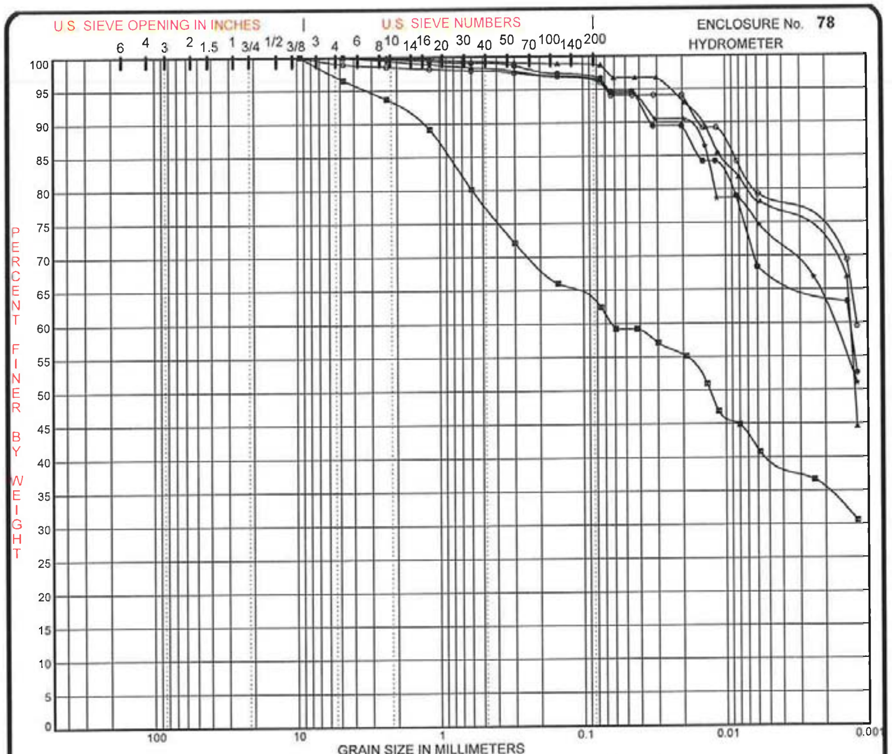
ENCLOSURE No. 78



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B25-10/S 3	2.5	FAT CLAY CH		71	20	51		
⊠	B25-12/S 1	1.0	SANDY LEAN CLAY CL		49	21	29		
▲	B25-12/S 3	2.5	FAT CLAY CH		74	19	55		
★	B25-12/S 4	3.3	FAT CLAY CH		74	23	50		
⊙	B25-15/S 3	2.5	FAT CLAY CH		69	23	46		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B25-10/S 3	2.5	4.75	0.00			0.0	3.3	32.2	64.5
⊠	B25-12/S 1	1.0	9.50	0.06	0.013		3.4	34.1	27.3	35.1
▲	B25-12/S 3	2.5	4.75	0.00	0.001		0.0	1.3	28.9	69.7
★	B25-12/S 4	3.3	9.50	0.00			0.1	3.6	33.6	62.7
⊙	B25-15/S 3	2.5	9.50	0.00			1.0	2.9	24.2	71.9

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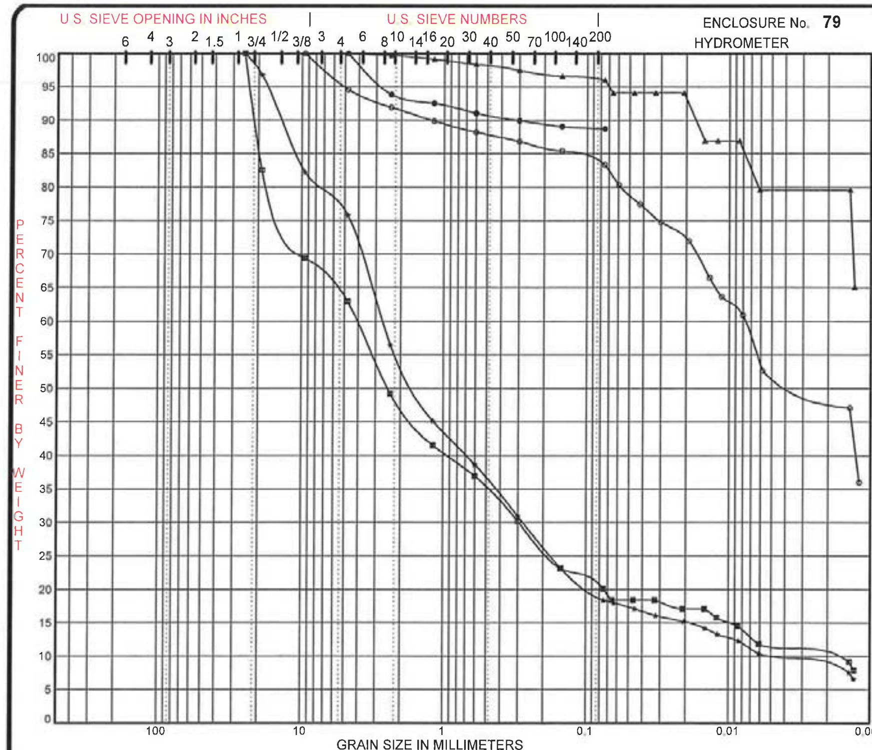
ENCLOSURE No. 79



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B25-17/S 3	2.5	FAT CLAY CH		75	25	50		
⊠	B25-19/S 1	1.0						9.59	1855.8
▲	B25-19/S 3	2.5	FAT CLAY CH		64	24	40		
★	B25-21/S 1	1.0						5.71	542.7
⊙	B25-21/S 3	2.5	FAT CLAY with SAND CH		63	25	38		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B25-17/S 3	2.5	4.75				0.0	11.3	88.7	
⊠	B25-19/S 1	1.0	25.00	4.09	2.459	0.294	37.0	42.9	10.3	9.8
▲	B25-19/S 3	2.5	4.75				0.0	4.0	16.4	79.6
★	B25-21/S 1	1.0	25.00	2.68	1.588	0.275	24.2	57.4	10.1	8.3
⊙	B25-21/S 3	2.5	9.50	0.01	0.003		5.4	11.2	34.9	48.5

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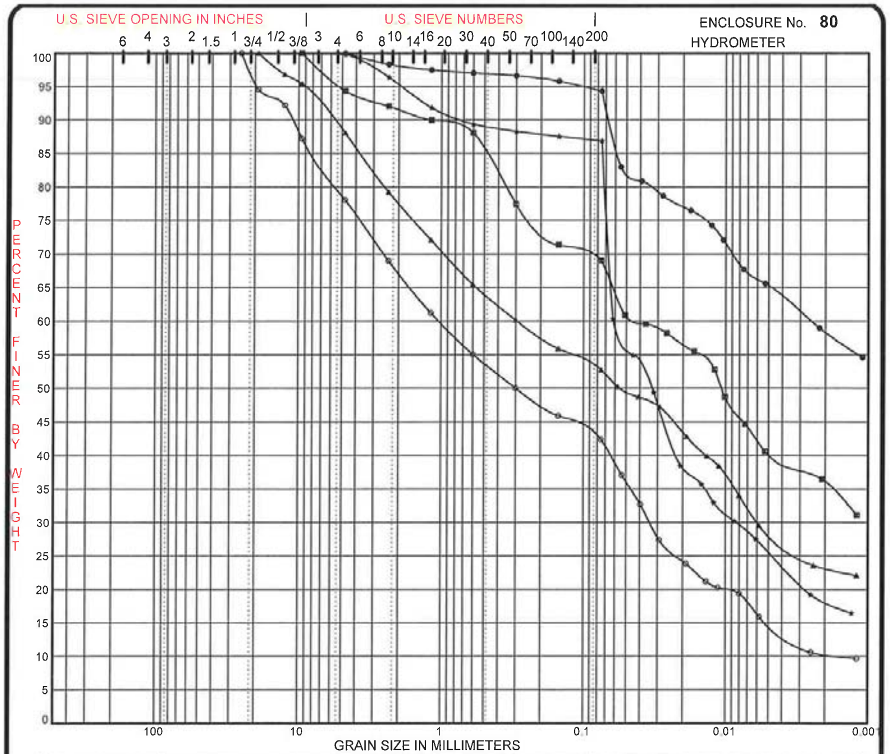
ENCLOSURE No. 80



Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
● B40-01/S 2	1.8	FAT CLAY CH		68	20	49		
⊠ B40-02/S 3	2.5	SANDY LEAN CLAY CL		49	19	30		
▲ B55-01/S 2	1.8							
★ B55-01/S 5	4.8	LEAN CLAY CL		47	20	27		
⊙ B55-03/S 2	1.8						0.73	672.5

Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
● B40-01/S 2	1.8	4.75	0.00			0.0	5.7	35.9	58.4
⊠ B40-02/S 3	2.5	9.50	0.04	0.011		5.7	25.3	33.0	36.0
▲ B55-01/S 2	1.8	19.00	0.29	0.055	0.006	11.9	35.3	29.5	23.2
★ B55-01/S 5	4.8	9.50	0.06	0.033	0.008	0.2	12.9	68.6	18.3
⊙ B55-03/S 2	1.8	25.00	1.03	0.299	0.034	21.9	35.7	32.0	10.3

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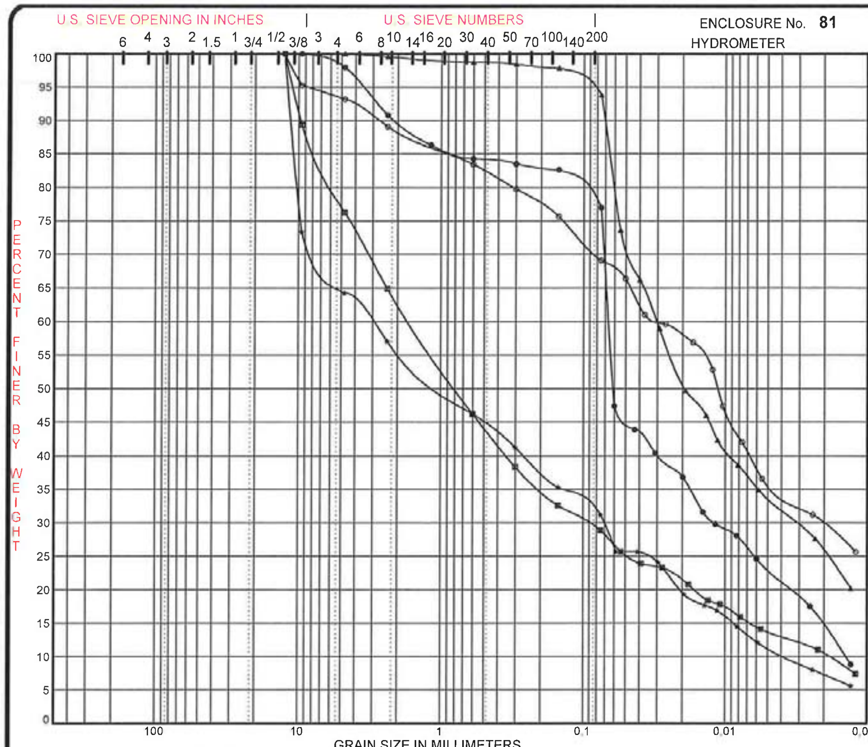
ENCLOSURE No. 81



Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
● B55-03/S 4	3.3						1.52	46.5
⊠ B55-05/S 1	1.0						2.78	886.9
▲ B55-05/S 5	4.8							
★ B55-07/S 1	1.0						0.43	844.7
⊙ B55-07/S 2	1.8							

Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
● B55-03/S 4	3.3	9.50	0.07	0.061	0.012	2.0	21.0	62.5	14.5
⊠ B55-05/S 1	1.0	12.50	1.65	0.791	0.092	23.7	47.4	18.5	10.4
▲ B55-05/S 5	4.8	4.75	0.03	0.019	0.003	0.0	6.2	68.0	25.8
★ B55-07/S 1	1.0	12.50	3.14	0.967	0.071	35.7	33.1	23.9	7.3
⊙ B55-07/S 2	1.8	12.50	0.03	0.011	0.002	6.8	24.1	39.4	29.8

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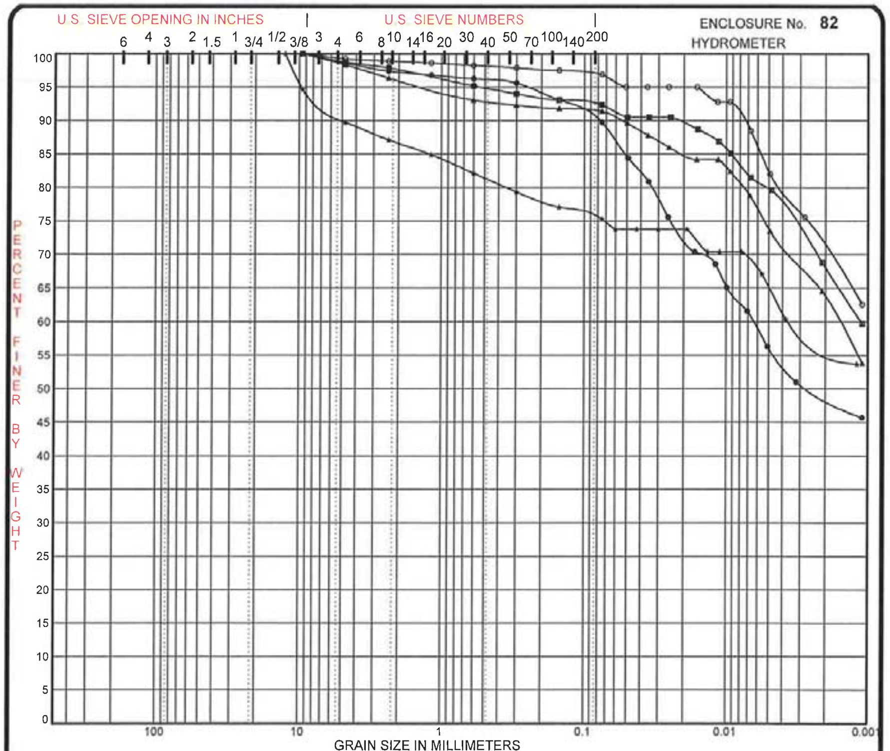
ENCLOSURE No. 82

HYDROMETER



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B55-07/S 3	2.5	LEAN CLAY CL		41	18	23		
⊠	B55-07/S 7	7.9	FAT CLAY CH		65	26	39		
▲	B55-07/S 8	9.4	FAT CLAY CH		64	26	38		
★	B55-09/S 2	1.8	FAT CLAY with SAND CH		50	21	29		
⊙	B55-09/S 4	3.3	FAT CLAY CH		57	21	36		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B55-07/S 3	2.5	9.50	0.01	0.003		1.4	8.9	41.1	48.7
⊠	B55-07/S 7	7.9	9.50	0.00			1.2	6.4	24.2	68.1
▲	B55-07/S 8	9.4	9.50	0.00			1.6	6.9	27.7	63.7
★	B55-09/S 2	1.8	12.50	0.00			10.3	14.4	18.6	56.7
⊙	B55-09/S 4	3.3	9.50				0.7	2.4	26.0	70.9

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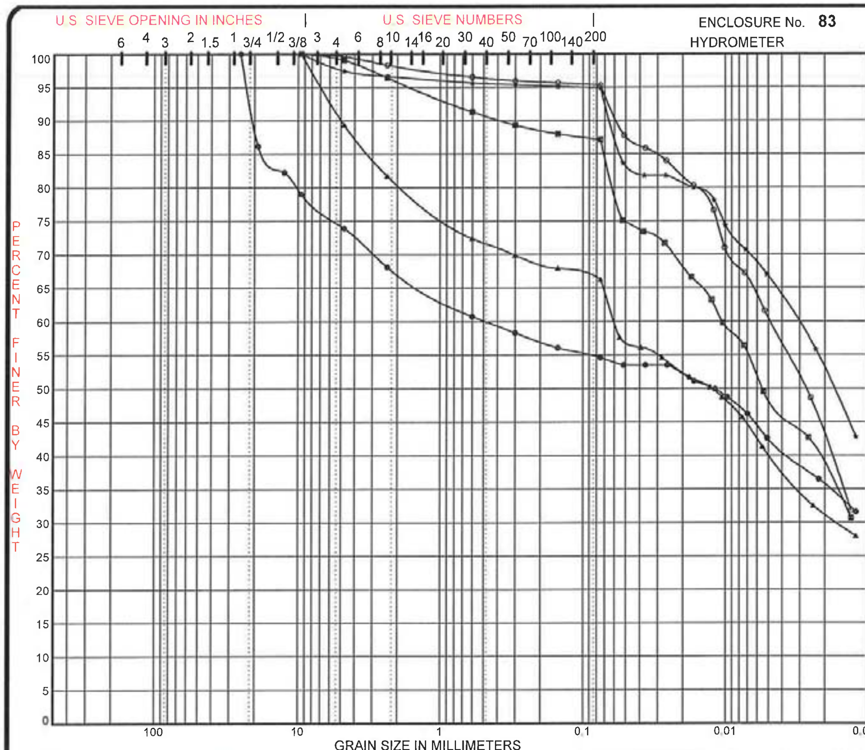
ENCLOSURE No. 83

HYDROMETER



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B55-10/S 1	1.0	GRAVELLY FAT CLAY with SAND CH		50	20	31		
⊠	B55-10/S 3	2.5	FAT CLAY CH		58	21	36		
▲	B55-10/S 4	3.3	SANDY LEAN CLAY CL		47	21	26		
★	B55-10/S 6	6.3	FAT CLAY CH		62	22	40		
⊙	B55-10/S 8	9.4	FAT CLAY CH		50	22	28		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B55-10/S 1	1.0	25.00	0.48	0.012		26.1	19.3	18.9	35.7
⊠	B55-10/S 3	2.5	9.50	0.01	0.006		0.9	11.9	49.0	38.2
▲	B55-10/S 4	3.3	9.50	0.06	0.012	0.002	10.6	23.1	34.9	31.3
★	B55-10/S 6	6.3	9.50	0.00	0.002		2.6	2.6	41.9	53.0
⊙	B55-10/S 8	9.4	9.50	0.00	0.003		0.4	4.3	52.4	42.9

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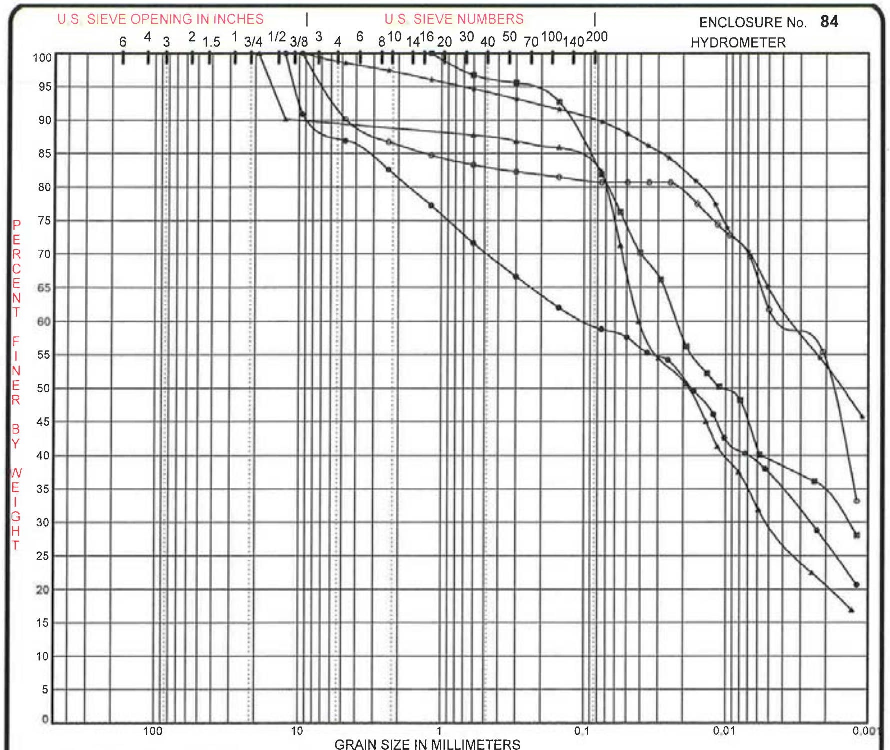
ENCLOSURE No. 84

HYDROMETER



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B55-11/S 2	1.8							
⌧	B55-11/S 3	2.5	SILT with SAND ML		NP	NP	NP		
▲	B55-11/S 5	4.8							
★	B55-12/S 2	1.8	FAT CLAY CH		56	22	35		
⊙	B55-12/S 5	4.8	SILT with GRAVEL ML		NP	NP	NP		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B55-11/S 2	1.8	12.50	0.10	0.017	0.003	13.1	28.1	31.7	27.1
⌧	B55-11/S 3	2.5	1.18	0.02	0.011	0.001	0.0	18.1	47.9	34.0
▲	B55-11/S 5	4.8	19.00	0.04	0.018	0.005	10.6	7.1	61.7	20.6
★	B55-12/S 2	1.8	9.50	0.00	0.002		1.4	8.8	36.5	53.3
⊙	B55-12/S 5	4.8	9.50	0.00	0.002		9.8	9.4	27.2	53.5

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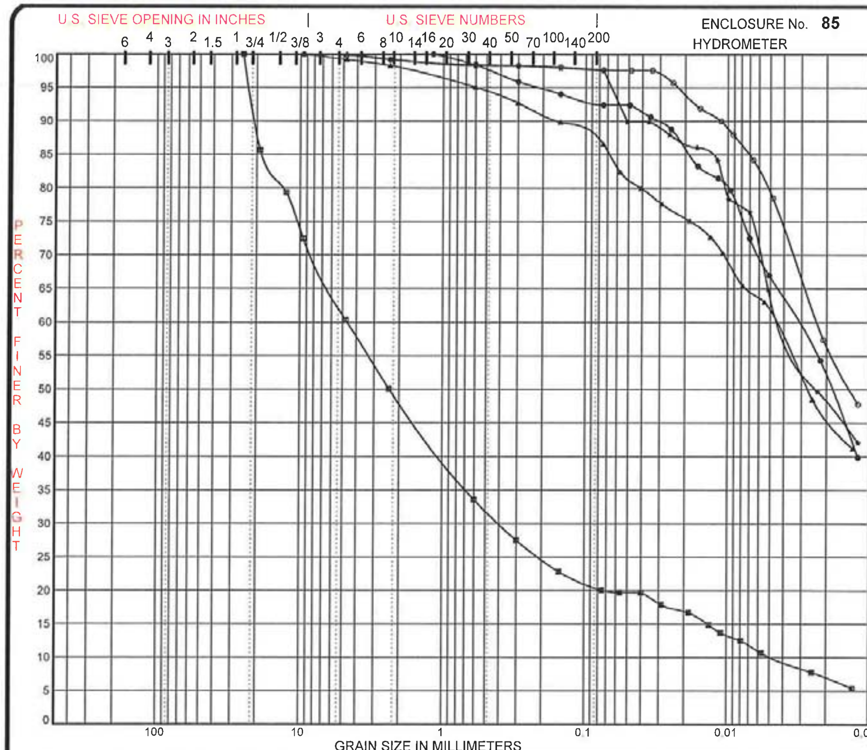
ENCLOSURE No. 85

HYDROMETER



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B55-12/S 8	9.4	FAT CLAY CH		58	24	34		
⌧	B55-13/S 1	1.0						7.30	993.2
▲	B55-13/S 2	1.8	FAT CLAY CH		61	23	38		
★	B55-13/S 4	3.3	FAT CLAY CH		61	22	40		
⊙	B55-13/S 6	6.3	FAT CLAY CH		63	25	38		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B55-12/S 8	9.4	1.18	0.00	0.002		0.0	7.6	40.4	52.0
⌧	B55-13/S 1	1.0	25.00	4.64	2.342	0.398	39.7	40.3	13.1	7.0
▲	B55-13/S 2	1.8	9.50	0.00	0.003		0.8	12.6	40.6	46.0
★	B55-13/S 4	3.3	4.75	0.00	0.002		0.0	2.4	49.5	48.1
⊙	B55-13/S 6	6.3	9.50	0.00	0.001		0.2	2.2	41.1	56.6

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GRADATION CURVES

Geotech Associates Limited

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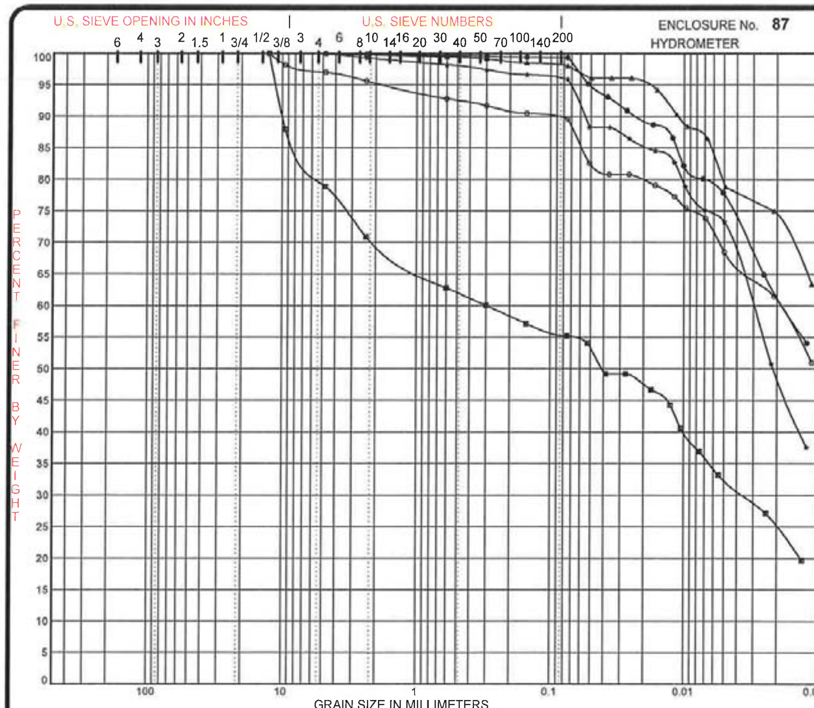
ENCLOSURE No. 87



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B55-15/S 9	10.9	FAT CLAY CH		65	27	38		
⊠	B55-16/S 1	1.0							
▲	B55-16/S 4	3.3	FAT CLAY CH		77	28	50		
★	B55-16/S 8	9.4	FAT CLAY CH		77	26	51		
⊙	B55-17/S 3	2.5	FAT CLAY CH		73	26	47		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B55-15/S 9	10.9	4.75	0.00			0.0	0.6	37.8	61.6
⊠	B55-16/S 1	1.0	12.50	0.30	0.041	0.004	21.1	23.7	30.3	24.9
▲	B55-16/S 4	3.3	4.75				0.0	1.9	23.9	74.1
★	B55-16/S 8	9.4	4.75	0.00	0.002		0.0	4.1	47.2	48.7
⊙	B55-17/S 3	2.5	12.50	0.00			3.0	7.4	28.9	60.7

PROJECT Geo. Services for Wastewater Treatment Plant -

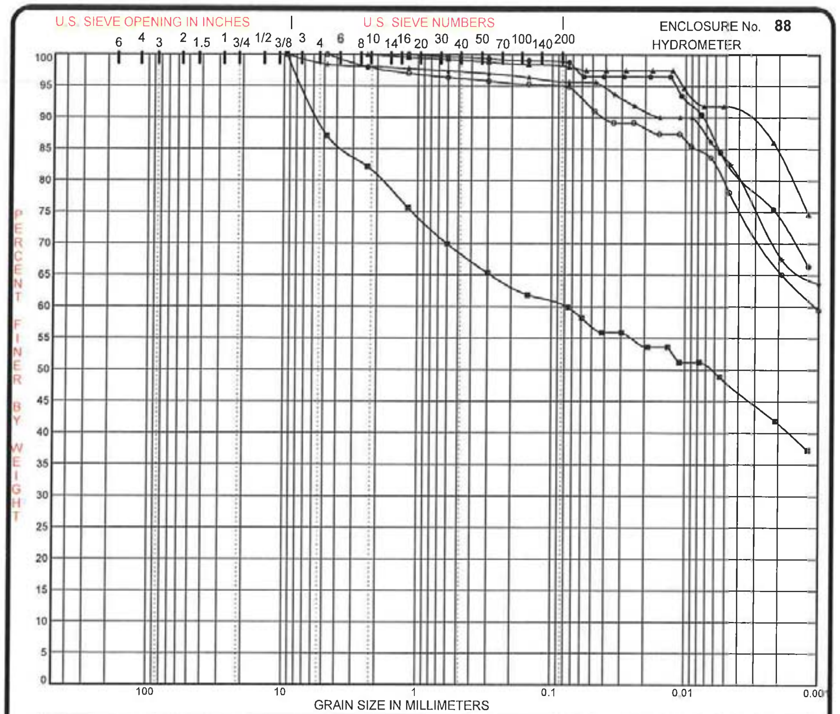
JOB NO. GA 07 326
DATE April 2010

GRADATION CURVES

Geotech Associates Limited

*GRSZL-2 07326.GPJ 29/4/10

ENCLOSURE No. 88



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B55-17/S 8	9.4	FAT CLAY CH		91	28	63		
⊠	B55-18/S 2	1.8	SANDY SILT ML		NP	NP	NP		
▲	B55-18/S 3	2.5	SILT ML		NP	NP	NP		
★	B55-18/S 7	7.9	FAT CLAY CH		69	26	43		
⊙	B55-18/S 9	10.9	FAT CLAY CH		79	32	47		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B55-17/S 8	9.4	1.18				0.0	1.2	24.8	74.0
⊠	B55-18/S 2	1.8	9.50	0.08	0.007		12.9	27.2	18.4	41.5
▲	B55-18/S 3	2.5	2.36				0.0	1.9	13.8	84.2
★	B55-18/S 7	7.9	9.50				1.6	2.8	27.3	68.4
⊙	B55-18/S 9	10.9	4.75	0.00			0.0	5.1	29.0	65.8

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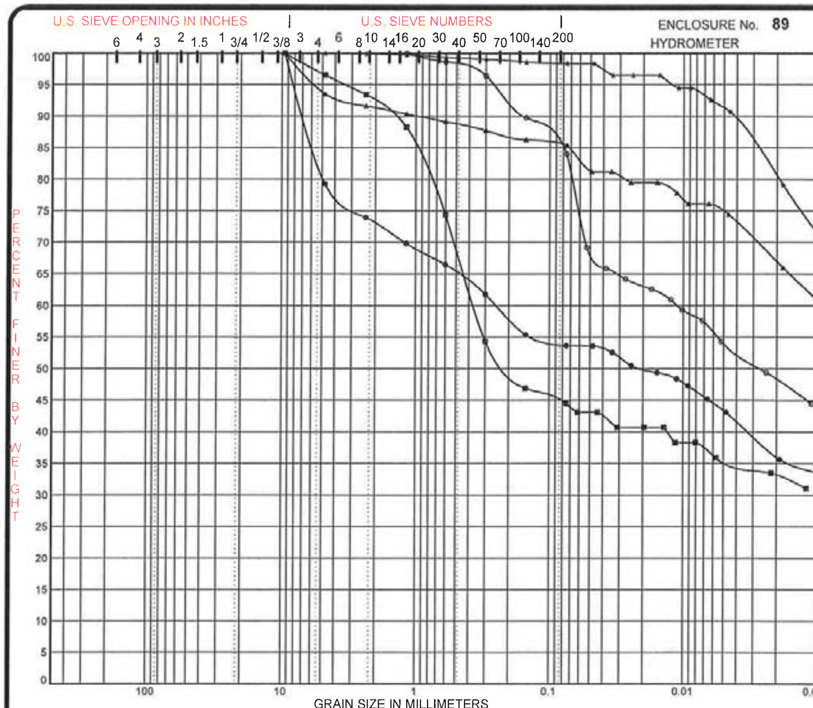
ENCLOSURE No. 89



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B55-19/S 2	1.8							
⊠	B55-19/S 4	3.3	SILTY SAND SM		NP	NP	NP		
▲	B55-19/S 8	9.4	FAT CLAY CH		65	27	38		
★	B55-19/S10	12.4	FAT CLAY CH		60	27	34		
⊙	B70-02/S 3	2.5	FAT CLAY with SAND CH		59	22	37		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B55-19/S 2	1.8	9.50	0.25	0.020		20.7	25.6	17.5	36.1
⊠	B55-19/S 4	3.3	9.50	0.36	0.200		3.5	52.0	11.4	33.1
▲	B55-19/S 8	9.4	9.50				6.5	8.1	18.5	66.9
★	B55-19/S10	12.4	4.75				0.0	1.6	18.0	80.4
⊙	B70-02/S 3	2.5	1.18	0.01	0.003		0.0	16.0	35.8	48.3

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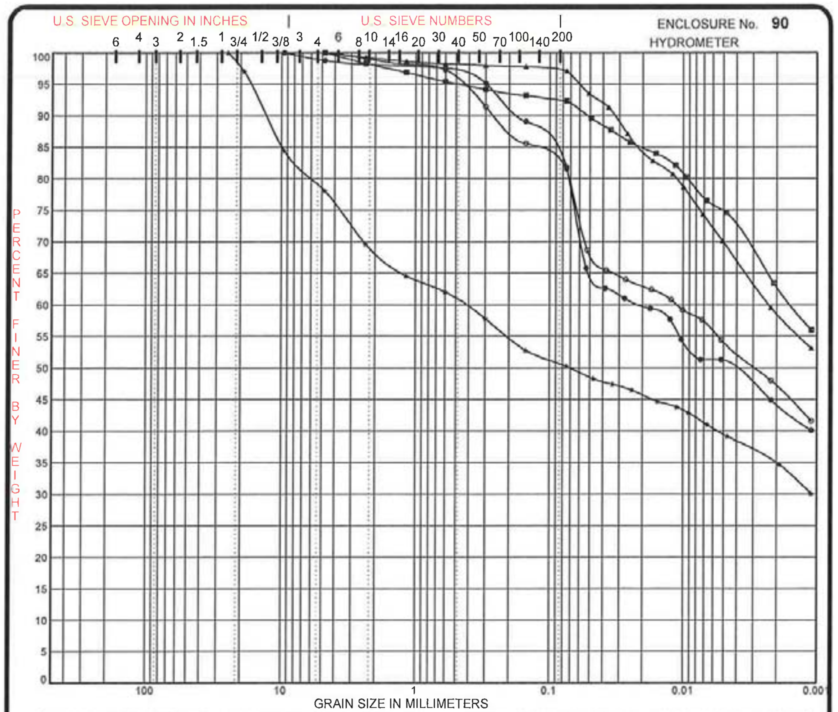
ENCLOSURE No. 90



COBBLES	GRAVEL coarse	GRAVEL fine	SAND coarse	SAND medium	SAND fine	SILT OR CLAY

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B70-02/S 5	4.8	FAT CLAY with SAND CH		58	23	35		
⊠	B70-04/S 3	2.5	FAT CLAY CH		67	27	40		
▲	B70-04/S 7	7.9	FAT CLAY CH		65	26	39		
★	B70-06/S 5	4.8	SANDY LEAN CLAY with GRAVEL CL		49	16	33		
⊙	B70-08/S 2	1.8	FAT CLAY with SAND CH		56	23	33		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B70-02/S 5	4.8	9.50	0.02	0.004		1.2	16.9	37.6	44.2
⊠	B70-04/S 3	2.5	4.75	0.00			0.0	7.6	29.5	62.8
▲	B70-04/S 7	7.9	4.75	0.00			0.0	2.9	38.5	58.6
★	B70-06/S 5	4.8	25.00	0.43	0.071		21.9	27.8	15.3	35.0
⊙	B70-08/S 2	1.8	4.75	0.01	0.003		0.0	18.4	34.5	47.1

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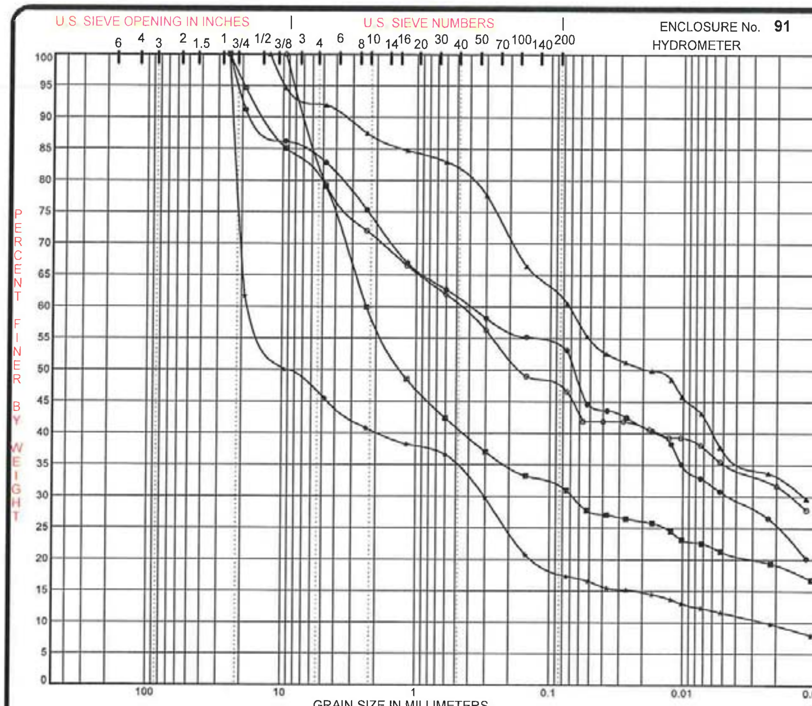
ENCLOSURE No. 91



COBBLES	GRAVEL coarse	GRAVEL fine	SAND coarse	SAND medium	SAND fine	SILT OR CLAY

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B70-08/S 4	3.3	SANDY SILT with GRAVEL ML		NP	NP	NP		
⊠	B70-08/S 5	4.8							
▲	B70-10/S 2	1.8	SANDY FAT CLAY CH		51	21	30		
★	B70-13/S 2	1.8						2.26	7082.3
⊙	B70-15/S 4	3.3							

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B70-08/S 4	3.3	25.00	0.40	0.066	0.005	17.2	29.7	27.9	25.2
⊠	B70-08/S 5	4.8	25.00	2.36	1.291	0.067	21.0	48.1	11.9	19.0
▲	B70-10/S 2	1.8	12.50	0.07	0.018	0.001	8.1	31.4	27.7	32.8
★	B70-13/S 2	1.8	25.00	17.14	9.487	0.306	54.5	28.2	7.8	9.6
⊙	B70-15/S 4	3.3	9.50	0.47	0.164	0.002	20.6	32.7	14.9	31.7

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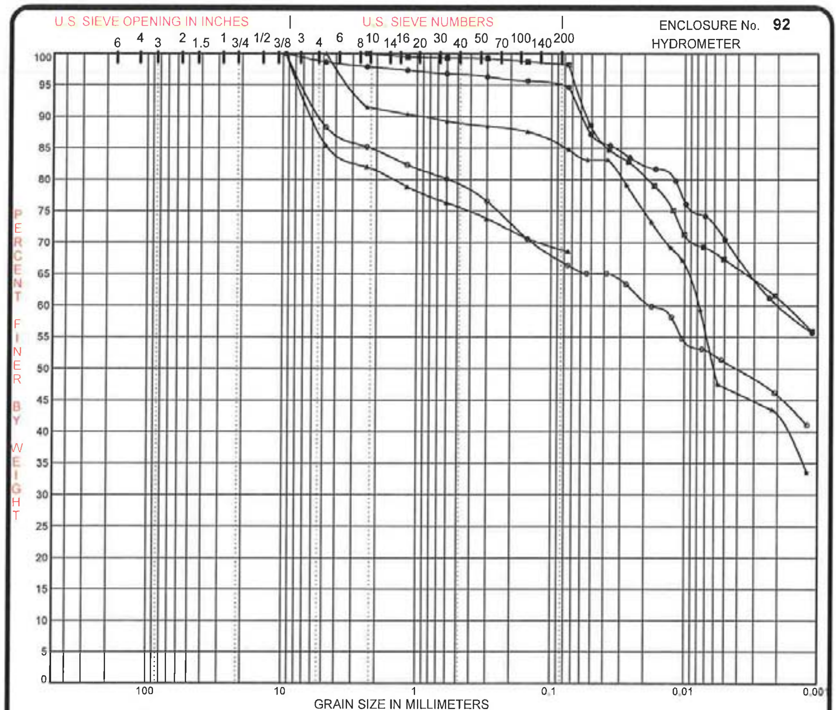
ENCLOSURE No. 92



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Symbol	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B70-17/S 1	1.0	FAT CLAY CH		63	18	45		
⌧	B70-17/S 4	3.3	FAT CLAY CH		53	19	34		
▲	B80-04/S 2	1.8	SANDY LEAN CLAY CL		44	19	25		
★	B80-04/S 4	3.3	FAT CLAY with SAND CH		50	18	32		
⊙	B80-11/S 2	1.8	SANDY LEAN CLAY CL		44	19	25		

Symbol	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B70-17/S 1	1.0	9.50	0.00			1.3	4.0	34.5	60.2
⌧	B70-17/S 4	3.3	2.36	0.00			0.0	1.7	37.1	61.2
▲	B80-04/S 2	1.8	9.50				14.6	16.8	68.6	
★	B80-04/S 4	3.3	4.75	0.01	0.006		0.0	15.2	42.8	41.9
⊙	B80-11/S 2	1.8	9.50	0.02	0.004		11.7	21.9	20.7	45.8

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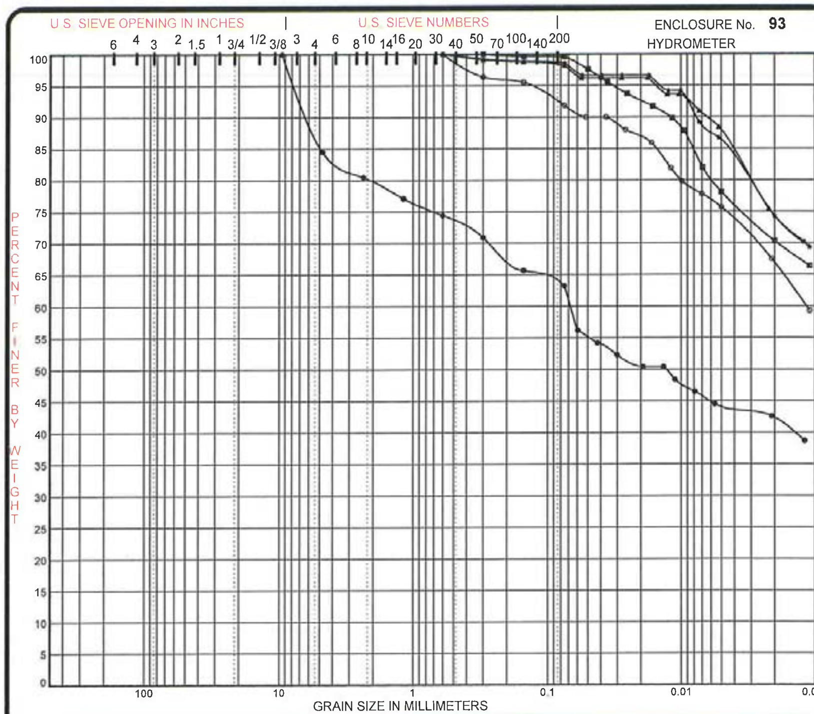
ENCLOSURE No. 93



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Symbol	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B80-15/S 4	3.3	SANDY LEAN CLAY with GRAVEL CL		37	18	19		
⌧	B80-15/S 6	6.3	FAT CLAY CH		57	23	35		
▲	B80-17/S 2	1.8	FAT CLAY CH		58	21	37		
★	B80-17/S 5	4.8	FAT CLAY CH		60	21	39		
⊙	B80-19/S 4	3.3	SILT ML		NP	NP	NP		

Symbol	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B80-15/S 4	3.3	9.50	0.07	0.013		15.5	21.3	21.0	42.3
⌧	B80-15/S 6	6.3	0.30				0.0	0.4	29.3	70.3
▲	B80-17/S 2	1.8	0.60				0.0	1.8	23.6	74.6
★	B80-17/S 5	4.8	0.60				0.0	1.4	24.3	74.3
⊙	B80-19/S 4	3.3	0.60	0.00			0.0	8.1	25.0	66.9

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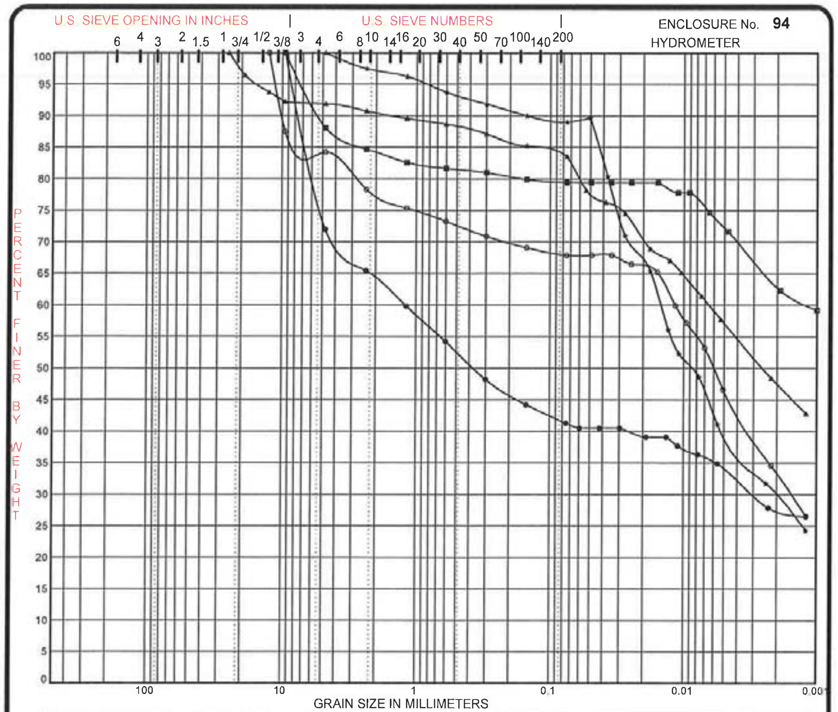
ENCLOSURE No. 94



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B80-19/S 6	6.3	CLAYEY SAND with GRAVEL SC		47	23	25		
⌧	B80-19/S 7	7.9	FAT CLAY with GRAVEL CH		64	24	40		
▲	B80-22/S 2	1.8	FAT CLAY with SAND CH		55	27	28		
★	B80-22/S 7	7.9	FAT CLAY CH		51	24	27		
⊙	B80-24/S 1	1.0	SANDY FAT CLAY with GRAVEL CH		56	23	33		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B80-19/S 6	6.3	9.50	1.21	0.369	0.003	28.0	30.7	13.7	27.6
⌧	B80-19/S 7	7.9	9.50	0.00			11.9	8.7	16.6	62.8
▲	B80-22/S 2	1.8	25.00	0.01	0.003		8.1	8.3	36.1	47.5
★	B80-22/S 7	7.9	4.75	0.01	0.009	0.002	0.0	10.9	59.2	29.8
⊙	B80-24/S 1	1.0	12.50	0.01	0.006	0.002	15.8	16.3	34.6	33.3

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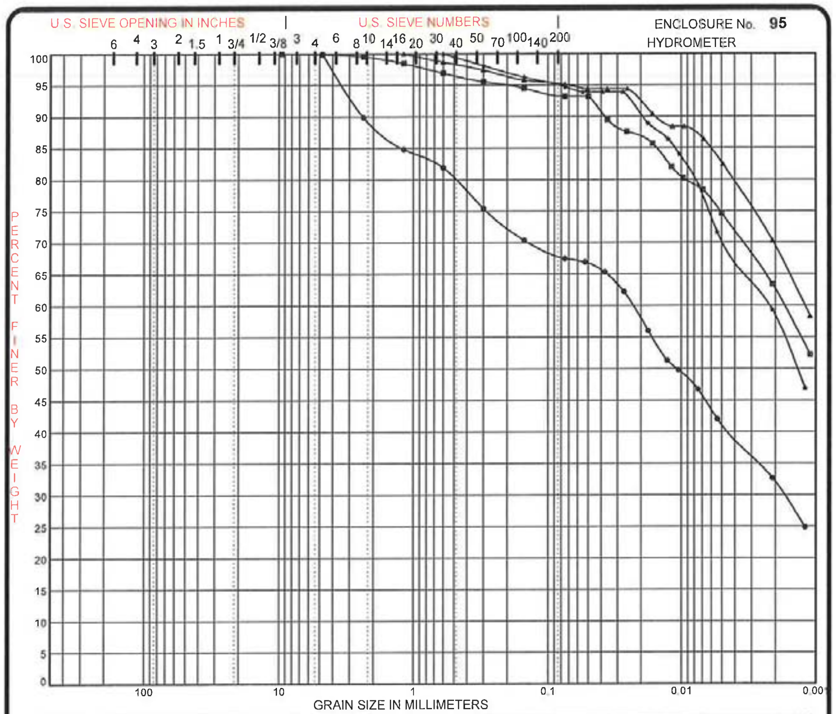
ENCLOSURE No. 95



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample Id.	Depth,m	Classification	MC%	LL	PL	PI	Cc	Cu
●	B80-24/S 6	6.3	SANDY FAT CLAY CH		52	24	28		
⌧	B80-25/S 2	1.8	FAT CLAY CH		60	24	36		
▲	B80-25/S 4	3.3	FAT CLAY CH		63	27	36		
★	B80-25/S 7	7.9	FAT CLAY CH		52	24	28		

	Sample Id.	Depth,m	D100	D60	D50	D30	%Gravel	%Sand	%Silt	%Clay
●	B80-24/S 6	6.3	4.75	0.02	0.011	0.002	0.0	32.5	35.4	32.0
⌧	B80-25/S 2	1.8	9.50	0.00			0.1	6.7	30.6	62.6
▲	B80-25/S 4	3.3	1.18	0.00			0.0	4.9	25.7	69.4
★	B80-25/S 7	7.9	0.60	0.00	0.001		0.0	5.2	36.5	58.2

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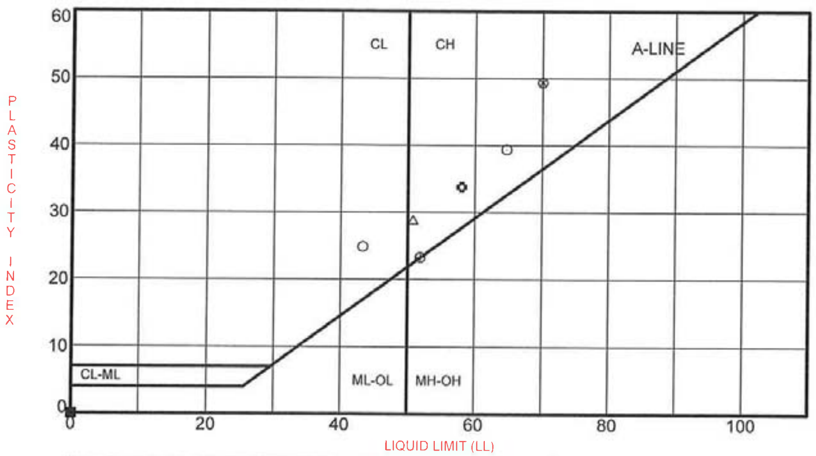
ENCLOSURE No. 96



CL - INORGANIC CLAYS, SILTY CLAYS, SANDY CLAYS OF LOW PLASTICITY
ML - INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, WITH SLIGHT PLASTICITY
OL - ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
CH - INORGANIC CLAYS OF HIGH PLASTICITY
MH - INORGANIC SILTS OF HIGH PLASTICITY
OH - ORGANIC CLAYS OF HIGH PLASTICITY

	Sample Id.	Depth,m	LL	PL	PI	Fines	Classification
●	B 0-1/S 1	1.0	NP	NP	NP	71.4	SILT with SAND ML
⊠	B 0-1/S 2	1.8	NP	NP	NP	72.8	SILT with GRAVEL ML
▲	B 0-1/S 6	6.3	NP	NP	NP	87.9	SILT ML
★	B 0-1/S 9	10.9	NP	NP	NP	33.1	SILTY SAND with GRAVEL SM
⊙	B 0-2/S 4	3.3	65	25	40	93.7	FAT CLAY CH
✪	B 0-2/S 7	7.9	58	24	34	98.4	FAT CLAY CH
○	B10-01/S 2	1.8	43	18	25	61.9	SANDY LEAN CLAY with GRAVEL CL
△	B10-01/S 4	3.3	51	22	29	86.0	FAT CLAY CH
⊗	B10-01/S 6	6.3	70	21	49	97.2	FAT CLAY CH
⊕	B10-03/S 2	1.8	52	29	23	60.3	SANDY ELASTIC SILT MH

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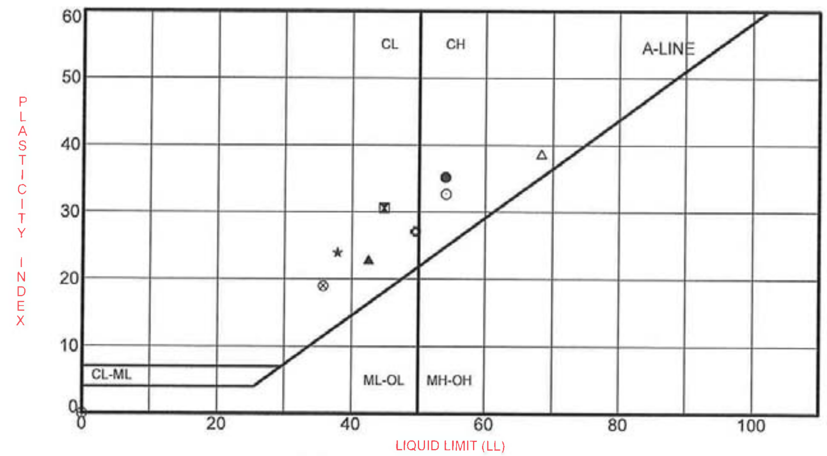
ENCLOSURE No. 97



CL - INORGANIC CLAYS, SILTY CLAYS, SANDY CLAYS OF LOW PLASTICITY
ML - INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, WITH SLIGHT PLASTICITY
OL - ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
CH - INORGANIC CLAYS OF HIGH PLASTICITY
MH - INORGANIC SILTS OF HIGH PLASTICITY
OH - ORGANIC CLAYS OF HIGH PLASTICITY

	Sample Id.	Depth,m	LL	PL	PI	Fines	Classification
●	B10-03/S 4	3.3	54	19	35	92.6	FAT CLAY CH
⊠	B10-04/S 4	3.3	45	14	31	52.6	GRAVELLY LEAN CLAY with SAND CL
▲	B10-04/S 6	6.3	43	20	22	87.6	LEAN CLAY CL
★	B10-08/S 2	1.8	38	14	24	83.5	LEAN CLAY with SAND CL
⊙	B10-08/S 5	4.8	54	21	33	91.2	FAT CLAY CH
✪	B10-13/S 6	6.3	50	22	28	93.5	FAT CLAY CH
○	B10-15/S 1	1.0	NP	NP	NP	65.8	SANDY SILT ML
△	B10-15/S 3	2.5	68	30	38	99.1	FAT CLAY CH
⊗	B10-15/S 6	6.3	36	17	19	91.0	LEAN CLAY CL
⊕	B10-17/S 2	1.8	NP	NP	NP	48.3	SILTY SAND with GRAVEL SM

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MODIFIED PLASTICITY CHART
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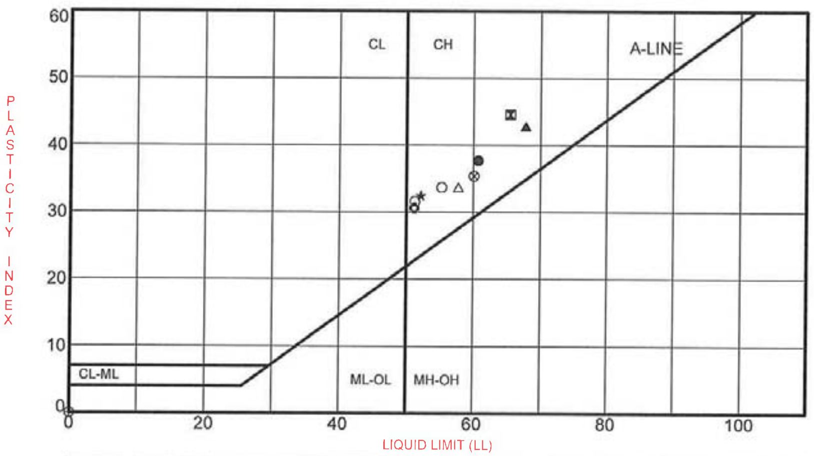
ENCLOSURE No. 98



CL - INORGANIC CLAYS, SILTY CLAYS, SANDY CLAYS OF LOW PLASTICITY
ML - INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, WITH SLIGHT PLASTICITY
OL - ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
CH - INORGANIC CLAYS OF HIGH PLASTICITY
MH - INORGANIC SILTS OF HIGH PLASTICITY
OH - ORGANIC CLAYS OF HIGH PLASTICITY

	Sample Id.	Depth,m	LL	PL	PI	Fines	Classification
●	B10-17/S 5	4.8	61	23	38	98.2	FAT CLAY CH
⊠	B10-20/S 4	3.3	66	21	45	93.4	FAT CLAY CH
▲	B10-20/S 6	6.3	68	25	43	97.2	FAT CLAY CH
★	B10-24/S 1	1.0	52	20	32	25.7	CLAYEY GRAVEL with SAND GC
⊙	B10-24/S 5	4.8	51	20	31	97.0	FAT CLAY CH
✪	B10-24/S 7	7.9	51	21	30	97.2	FAT CLAY CH
○	B10-27/S 5	4.8	55	22	33	91.2	FAT CLAY CH
△	B10-30/S 6	6.3	58	24	34	89.4	FAT CLAY CH
⊗	B10-30/S 7	7.9	60	25	35	95.3	FAT CLAY CH
⊕	B10-31/S 1	1.0	NP	NP	NP	89.1	SILT ML

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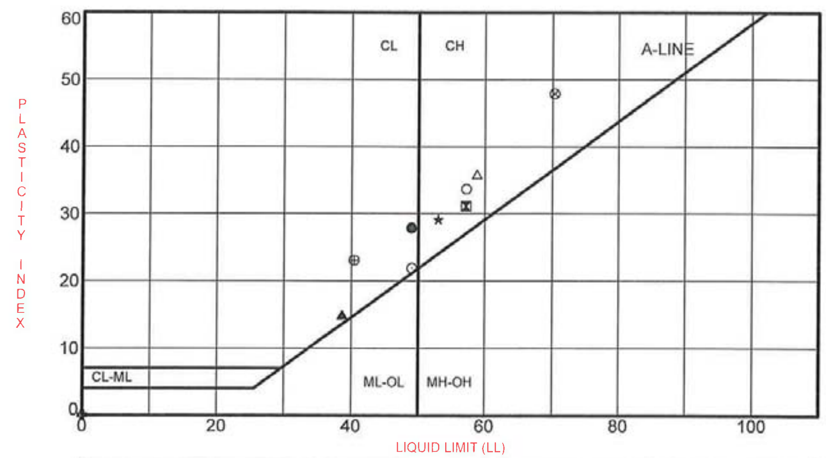
ENCLOSURE No. 99



CL - INORGANIC CLAYS, SILTY CLAYS, SANDY CLAYS OF LOW PLASTICITY
ML - INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, WITH SLIGHT PLASTICITY
OL - ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
CH - INORGANIC CLAYS OF HIGH PLASTICITY
MH - INORGANIC SILTS OF HIGH PLASTICITY
OH - ORGANIC CLAYS OF HIGH PLASTICITY

	Sample Id.	Depth,m	LL	PL	PI	Fines	Classification
●	B10-31/S 4	3.3	49	21	28	96.1	LEAN CLAY CL
⊠	B15-02/S 2	1.8	57	26	31	96.9	FAT CLAY CH
▲	B15-02/S 4	3.3	39	24	15	97.8	LEAN CLAY CL
★	B15-04/S 1	1.0	53	24	29	89.7	FAT CLAY CH
⊙	B15-04/S 5	4.8	49	27	22	95.1	LEAN CLAY CL
✪	B25-01/S 2	1.8	NP	NP	NP	19.5	SILTY SAND with GRAVEL SM
○	B25-01/S 4	3.3	57	24	33	30.7	CLAYEY SAND SC
△	B25-03/S 3	2.5	59	23	36	95.1	FAT CLAY CH
⊗	B25-04/S 1	1.0	70	22	48	98.8	FAT CLAY CH
⊕	B25-08/S 3	2.5	40	17	23	46.8	CLAYEY SAND with GRAVEL SC

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MODIFIED PLASTICITY CHART

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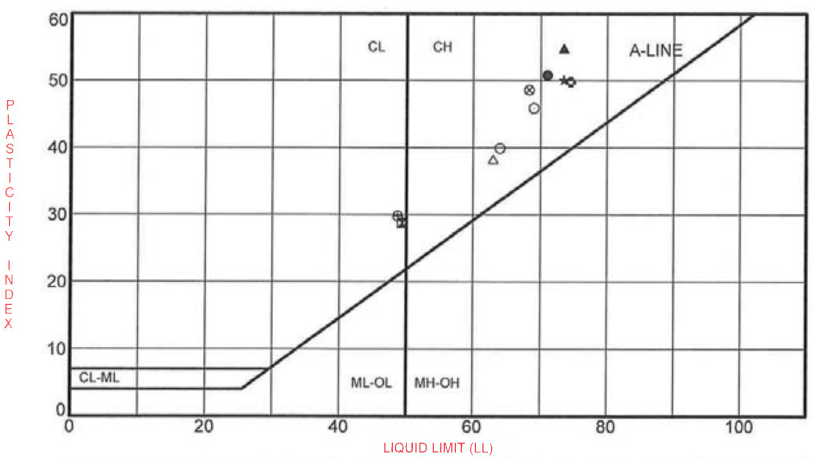
ENCLOSURE No. 100



CL - INORGANIC CLAYS, SILTY CLAYS, SANDY CLAYS OF LOW PLASTICITY
ML - INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, WITH SLIGHT PLASTICITY
OL - ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
CH - INORGANIC CLAYS OF HIGH PLASTICITY
MH - INORGANIC SILTS OF HIGH PLASTICITY
OH - ORGANIC CLAYS OF HIGH PLASTICITY

	Sample Id.	Depth,m	LL	PL	PI	Fines	Classification
●	B25-10/S 3	2.5	71	20	51	96.7	FAT CLAY CH
⊠	B25-12/S 1	1.0	49	21	28	62.4	SANDY LEAN CLAY CL
▲	B25-12/S 3	2.5	74	19	55	98.7	FAT CLAY CH
★	B25-12/S 4	3.3	74	23	51	96.3	FAT CLAY CH
⊙	B25-15/S 3	2.5	69	23	46	96.1	FAT CLAY CH
✪	B25-17/S 3	2.5	75	25	49	88.7	FAT CLAY CH
○	B25-19/S 3	2.5	64	24	40	96.0	FAT CLAY CH
△	B25-21/S 3	2.5	63	25	38	83.4	FAT CLAY with SAND CH
⊗	B40-01/S 2	1.8	68	20	48	94.3	FAT CLAY CH
⊕	B40-02/S 3	2.5	49	19	30	69.1	SANDY LEAN CLAY CL

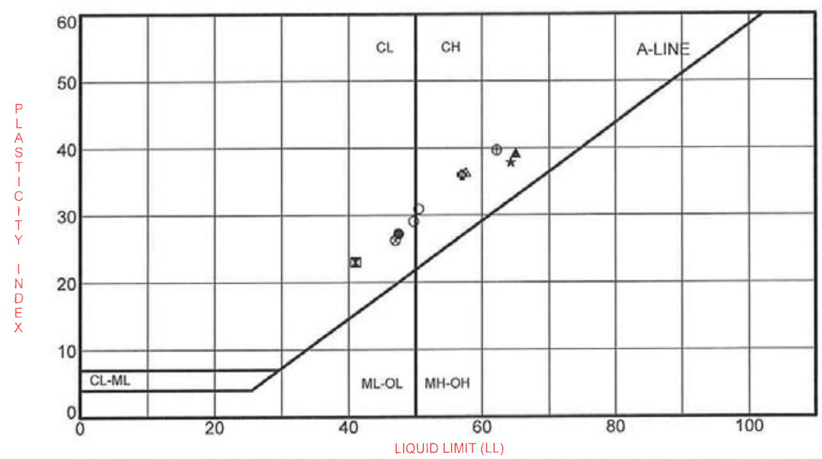
PROJECT Geo. Services for Wastewater Treatment Pipeline - JOB NO. GA 07 326 DATE May 2010

MODIFIED PLASTICITY CHART

Geotech Associates Limited

ATTBLSZ 07326.GPJ 4/5/10

ENCLOSURE No. 101



CL - INORGANIC CLAYS, SILTY CLAYS, SANDY CLAYS OF LOW PLASTICITY
ML - INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, WITH SLIGHT PLASTICITY
OL - ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
CH - INORGANIC CLAYS OF HIGH PLASTICITY
MH - INORGANIC SILTS OF HIGH PLASTICITY
OH - ORGANIC CLAYS OF HIGH PLASTICITY

	Sample Id.	Depth,m	LL	PL	PI	Fines	Classification
●	B55-01/S 5	4.8	47	20	27	86.9	LEAN CLAY CL
⊠	B55-07/S 3	2.5	41	18	23	89.7	LEAN CLAY CL
▲	B55-07/S 7	7.9	65	26	39	92.4	FAT CLAY CH
★	B55-07/S 8	9.4	64	26	38	91.4	FAT CLAY CH
⊙	B55-09/S 2	1.8	50	21	29	75.3	FAT CLAY with SAND CH
✪	B55-09/S 4	3.3	57	21	36	96.9	FAT CLAY CH
○	B55-10/S 1	1.0	50	20	30	54.6	GRAVELLY FAT CLAY with SAND CH
△	B55-10/S 3	2.5	58	21	37	87.1	FAT CLAY CH
⊗	B55-10/S 4	3.3	47	21	26	66.3	SANDY LEAN CLAY CL
⊕	B55-10/S 6	6.3	62	22	40	94.9	FAT CLAY CH

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MODIFIED PLASTICITY CHART

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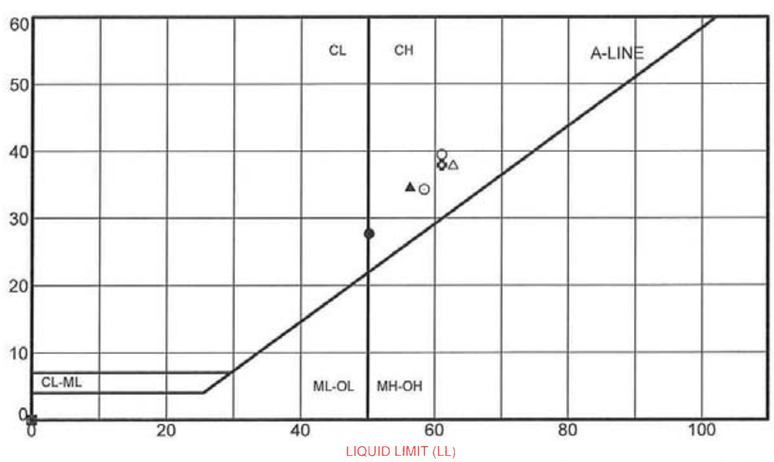
ATTBLSZ 07326.GPJ 4/5/10

ENCLOSURE No. 102



CL - INORGANIC CLAYS, SILTY CLAYS, SANDY CLAYS OF LOW PLASTICITY
ML - INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, WITH SLIGHT PLASTICITY
OL - ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
CH - INORGANIC CLAYS OF HIGH PLASTICITY
MH - INORGANIC SILTS OF HIGH PLASTICITY
OH - ORGANIC CLAYS OF HIGH PLASTICITY

	Sample Id.	Depth,m	LL	PL	PI	Fines	Classification
●	B55-10/S 8	9.4	50	22	28	95.3	FAT CLAY CH
⊠	B55-11/S 3	2.5	NP	NP	NP	81.9	SILT with SAND ML
▲	B55-12/S 2	1.8	56	22	34	89.8	FAT CLAY CH
★	B55-12/S 5	4.8	NP	NP	NP	80.7	SILT with GRAVEL ML
⊙	B55-12/S 8	9.4	58	24	34	92.4	FAT CLAY CH
✪	B55-13/S 2	1.8	61	23	38	86.6	FAT CLAY CH
○	B55-13/S 4	3.3	61	22	39	97.6	FAT CLAY CH
△	B55-13/S 6	6.3	63	25	38	97.7	FAT CLAY CH
⊗	B55-14/S 2	1.8	NP	NP	NP	85.9	SILT ML
⊕	B55-14/S 5	4.8	NP	NP	NP	92.6	SILT ML

PROJECT Geo. Services for Wastewater Treatment Pipeline -
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DATE May 2010

MODIFIED PLASTICITY CHART

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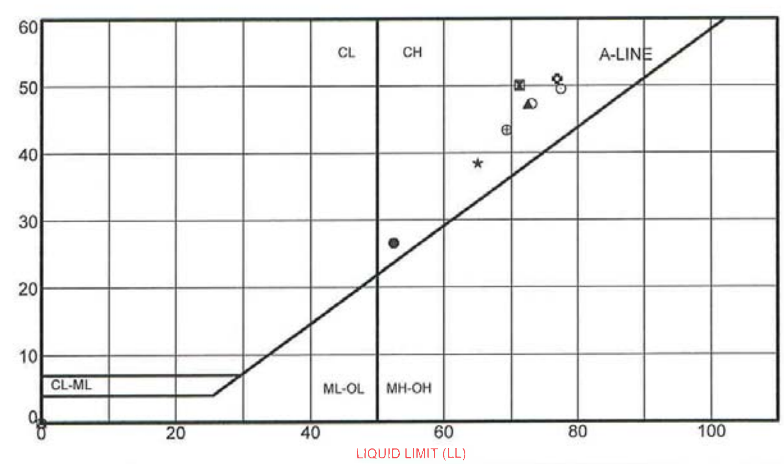
ENCLOSURE No. 103



CL - INORGANIC CLAYS, SILTY CLAYS, SANDY CLAYS OF LOW PLASTICITY
ML - INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, WITH SLIGHT PLASTICITY
OL - ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
CH - INORGANIC CLAYS OF HIGH PLASTICITY
MH - INORGANIC SILTS OF HIGH PLASTICITY
OH - ORGANIC CLAYS OF HIGH PLASTICITY

	Sample Id.	Depth,m	LL	PL	PI	Fines	Classification
●	B55-14/S 8	9.4	52	26	26	90.0	FAT CLAY CH
⊠	B55-15/S 4	3.3	71	21	50	99.1	FAT CLAY CH
▲	B55-15/S 7	7.9	73	25	47	94.7	FAT CLAY CH
★	B55-15/S 9	10.9	65	27	38	99.4	FAT CLAY CH
⊙	B55-16/S 4	3.3	77	28	49	98.1	FAT CLAY CH
✪	B55-16/S 8	9.4	77	26	51	95.9	FAT CLAY CH
○	B55-17/S 3	2.5	73	26	47	89.6	FAT CLAY CH
△	B55-18/S 2	1.8	NP	NP	NP	59.9	SANDY SILT ML
⊗	B55-18/S 3	2.5	NP	NP	NP	98.1	SILT ML
⊕	B55-18/S 7	7.9	69	26	43	95.6	FAT CLAY CH

PROJECT Geo. Services for Wastewater Treatment Pipeline -
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MODIFIED PLASTICITY CHART

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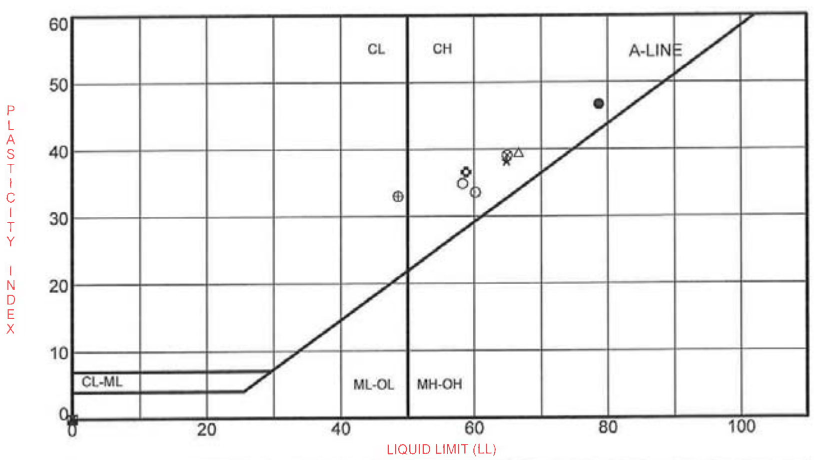
ENCLOSURE No. 104



CL - INORGANIC CLAYS, SILTY CLAYS, SANDY CLAYS OF LOW PLASTICITY
ML - INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, WITH SLIGHT PLASTICITY
OL - ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
CH - INORGANIC CLAYS OF HIGH PLASTICITY
MH - INORGANIC SILTS OF HIGH PLASTICITY
OH - ORGANIC CLAYS OF HIGH PLASTICITY

	Sample Id.	Depth,m	LL	PL	PI	Fines	Classification
●	B55-18/S 9	10.9	79	32	47	94.9	FAT CLAY CH
⊠	B55-19/S 1	1.0	NP	NP	NP		
▲	B55-19/S 4	3.3	NP	NP	NP	44.5	SILTY SAND SM
★	B55-19/S 8	9.4	65	27	39	85.4	FAT CLAY CH
○	B55-19/S10	12.4	60	27	33	98.4	FAT CLAY CH
✪	B70-02/S 3	2.5	59	22	37	84.0	FAT CLAY with SAND CH
○	B70-02/S 5	4.8	58	23	35	81.8	FAT CLAY with SAND CH
△	B70-04/S 3	2.5	67	27	40	92.4	FAT CLAY CH
⊗	B70-04/S 7	7.9	65	26	39	97.1	FAT CLAY CH
⊕	B70-06/S 5	4.8	49	16	33	50.3	SANDY LEAN CLAY with GRAVEL CL

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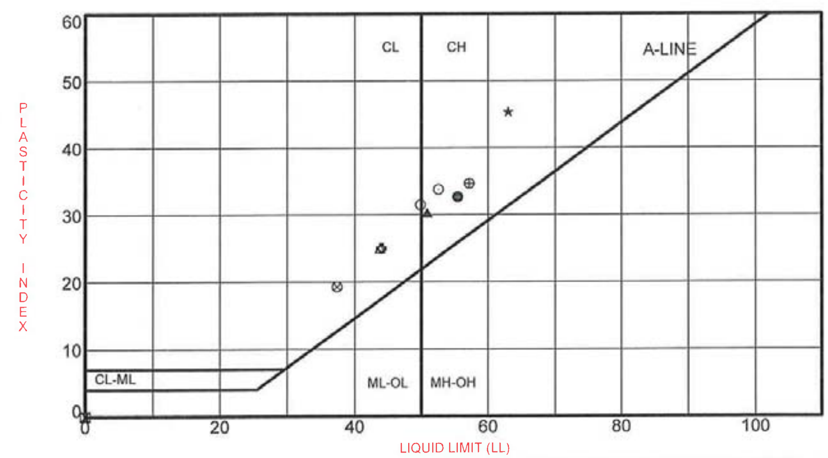
MODIFIED PLASTICITY CHART
Geotech Associates Limited

ENCLOSURE No. 105



CL - INORGANIC CLAYS, SILTY CLAYS, SANDY CLAYS OF LOW PLASTICITY
ML - INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, WITH SLIGHT PLASTICITY
OL - ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
CH - INORGANIC CLAYS OF HIGH PLASTICITY
MH - INORGANIC SILTS OF HIGH PLASTICITY
OH - ORGANIC CLAYS OF HIGH PLASTICITY

	Sample Id.	Depth,m	LL	PL	PI	Fines	Classification
●	B70-08/S 2	1.8	56	23	33	81.6	FAT CLAY with SAND CH
⊠	B70-08/S 4	3.3	NP	NP	NP	53.1	SANDY SILT with GRAVEL ML
▲	B70-10/S 2	1.8	51	21	30	60.5	SANDY FAT CLAY CH
★	B70-17/S 1	1.0	63	18	45	94.7	FAT CLAY CH
○	B70-17/S 4	3.3	53	19	34	98.3	FAT CLAY CH
✪	B80-04/S 2	1.8	44	19	25	68.6	SANDY LEAN CLAY CL
○	B80-04/S 4	3.3	50	18	32	84.8	FAT CLAY with SAND CH
△	B80-11/S 2	1.8	44	19	25	66.4	SANDY LEAN CLAY CL
⊗	B80-15/S 4	3.3	37	18	19	63.2	SANDY LEAN CLAY with GRAVEL CL
⊕	B80-15/S 6	6.3	57	23	35	99.6	FAT CLAY CH

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DATE May 2010

MODIFIED PLASTICITY CHART
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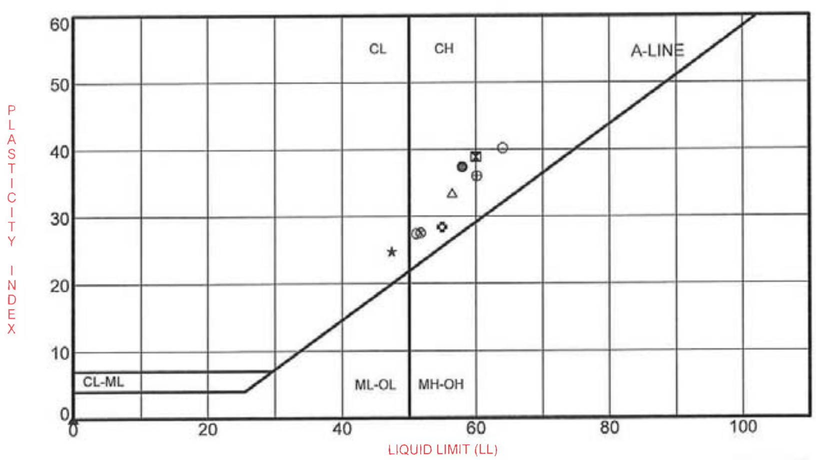
ENCLOSURE No. 106



CL - INORGANIC CLAYS, SILTY CLAYS, SANDY CLAYS OF LOW PLASTICITY
ML - INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, WITH SLIGHT PLASTICITY
OL - ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
CH - INORGANIC CLAYS OF HIGH PLASTICITY
MH - INORGANIC SILTS OF HIGH PLASTICITY
OH - ORGANIC CLAYS OF HIGH PLASTICITY

Sample Id.	Depth,m	LL	PL	PI	Fines	Classification
● B80-17/S 2	1.8	58	21	37	98.2	FAT CLAY CH
⊠ B80-17/S 5	4.8	60	21	39	98.6	FAT CLAY CH
▲ B80-19/S 4	3.3	NP	NP	NP	91.9	SILT ML
★ B80-19/S 6	6.3	47	23	24	41.3	CLAYEY SAND with GRAVEL SC
⊙ B80-19/S 7	7.9	64	24	40	79.4	FAT CLAY with GRAVEL CH
✿ B80-22/S 2	1.8	55	27	28	83.6	FAT CLAY with SAND CH
○ B80-22/S 7	7.9	51	24	27	89.1	FAT CLAY CH
△ B80-24/S 1	1.0	56	23	33	67.9	SANDY FAT CLAY with GRAVEL CH
⊗ B80-24/S 6	6.3	52	24	28	67.5	SANDY FAT CLAY CH
⊕ B80-25/S 2	1.8	60	24	36	93.2	FAT CLAY CH

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DATE May 2010

MODIFIED PLASTICITY CHART
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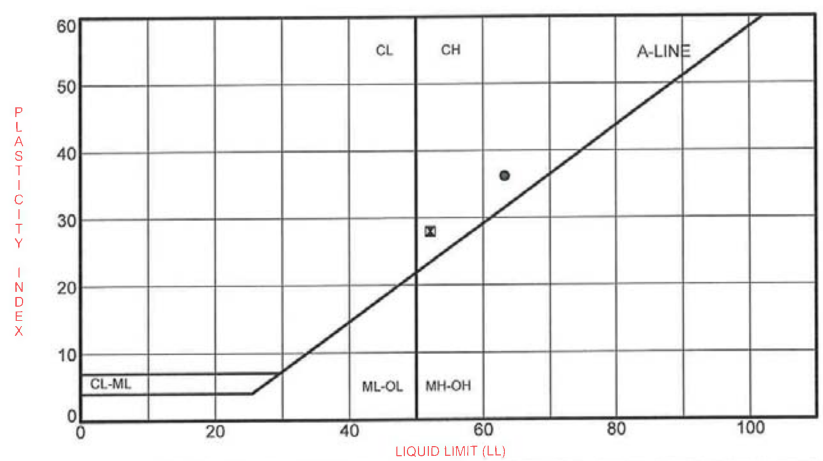
ENCLOSURE No. 107



CL - INORGANIC CLAYS, SILTY CLAYS, SANDY CLAYS OF LOW PLASTICITY
ML - INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, WITH SLIGHT PLASTICITY
OL - ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
CH - INORGANIC CLAYS OF HIGH PLASTICITY
MH - INORGANIC SILTS OF HIGH PLASTICITY
OH - ORGANIC CLAYS OF HIGH PLASTICITY

Sample Id.	Depth,m	LL	PL	PI	Fines	Classification
● B80-25/S 4	3.3	63	27	36	95.1	FAT CLAY CH
⊠ B80-25/S 7	7.9	52	24	28	94.8	FAT CLAY CH

PROJECT Geo. Services for Wastewater Treatment Pipeline -
JOB NO. GA 07 326
DATE May 2010

MODIFIED PLASTICITY CHART
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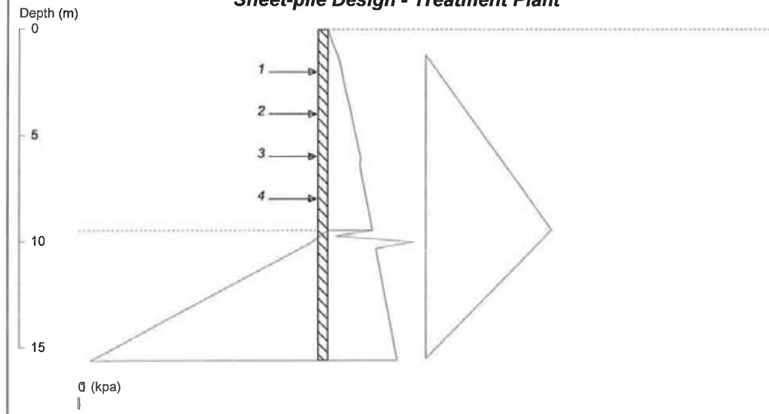
APPENDIX I

GA 07 326 - San Fernando WWT Pipeline

Sheet-pile Design - Treatment Plant



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Date: 29/04/2010 File Name: UNTITLED

WALL HEIGHT: 9.50 MIN. EMBEDMENT: 6.15 MIN. PILE LENGTH: 15.65
MAX. MOMENT: 333.95 AT DEPTH: 10.57

MIN. PILE SIZE AND TOP DEFLECTION - shown in ( ):
PZ32 (0.0) BZ20.7L (0.0) CZ141 (0.0) CZ148 (0.0) 4N (0.0) FSPZ25 (0.0) PZ38 (0.0)
BZ26 (0.0) AZ26 (0.0) H175 (0.0) PZ35 (0.0) H215 (0.0) BZ32 (0.0) FSPZ32 (0.0) AVƒ£A°r AR,‡Aâ‡Ì»Î94»¹Š)»DÌ!»¬Ì¦»âF»qÕ»×†¦»þ'Ú°ÄèΩ»ðcõº—þá°TJ×°$ðÛº 0
Required Min. Section Modulus = 2037.5 cm3/pile, Fy=36 ksi=248 MPa, Fb/Fy=0.66

BRACE, TIEBACK, OR DEADMEN ANCHOR (Spacing = 1):

No.	DEPTH	ANGLE	TOTAL	HORIZ.	VERT.	L_free	L_fixed
1	2.0	0.0	48.1*	48.1	0.0	N/A	N/A
2	4.0	0.0	81.5	81.5	0.0	N/A	N/A
3	6.0	0.0	135.2	135.2	0.0	N/A	N/A
4	8.0	0.0	341.1	341.1	0.0	N/A	N/A

TOTAL VERTICAL FORCE: 0.0 * 1st Brace increased by 15% (DM7.2-103)

DRIVING PRESSURE (ACTIVE, WATER, & SURCHARGE) X – Depth from wall top

No.	X top	Top Pres.	X bot.	Bot. Pres.	Spacing
1	0.00	0.00	0.61	2.74	1.00
2	0.61	2.74	1.22	6.40	1.00
3	1.22	6.40	1.52	7.67	1.00
4	1.52	7.67	1.83	8.50	1.00
5	1.83	8.50	3.05	11.93	1.00
6	3.05	11.93	3.35	13.30	1.00
7	3.35	13.30	3.66	14.22	1.00
8	3.66	14.22	3.96	15.13	1.00
9	3.96	15.13	4.27	16.04	1.00
10	4.27	16.04	4.57	16.95	1.00
11	4.57	16.95	4.88	17.85	1.00
12	4.88	17.85	5.18	18.76	1.00
13	5.18	18.76	5.49	19.66	1.00
14	5.49	19.66	5.79	20.57	1.00
15	5.79	20.57	6.10	21.47	1.00
16	6.10	21.47	6.40	20.86	1.00
17	6.40	20.86	6.71	21.64	1.00
18	6.71	21.64	7.01	22.44	1.00
19	7.01	22.44	7.62	24.03	1.00
20	7.62	24.03	8.23	25.63	1.00
21	8.23	25.63	8.53	26.44	1.00
22	8.53	26.44	8.84	27.24	1.00
23	8.84	27.24	9.45	28.83	1.00
24	9.45	28.83	9.50	28.97	1.00
25	1.20	0.00	9.50	81.34	1.00
26	9.50	81.34	15.57	0.00	1.00

ACTIVE PRESSURE (BELOW DREDGE LINE) Y - Depth from dredge level

No.	Y top	Top Pres.	Pres. Slope	Width
1	0.00	28.97	-94.82	1.00
2	0.25	4.92	164.77	1.00
3	0.56	55.15	-78.45	1.00
4	0.86	31.23	2.62	1.00
5	1.17	32.03	2.62	1.00
6	2.39	35.23	2.62	1.00
7	3.61	38.43	2.62	1.00
8	3.91	39.23	2.62	1.00
9	4.52	40.83	2.63	1.00
10	4.83	41.63	2.62	1.00
11	5.13	42.43	2.62	1.00
12	5.44	43.23	2.63	1.00
13	5.74	44.03	2.62	1.00
14	6.04	44.83	2.62	1.00

PASSIVE PRESSURE (BELOW DREDGE LINE) Y – Depth from dredge level

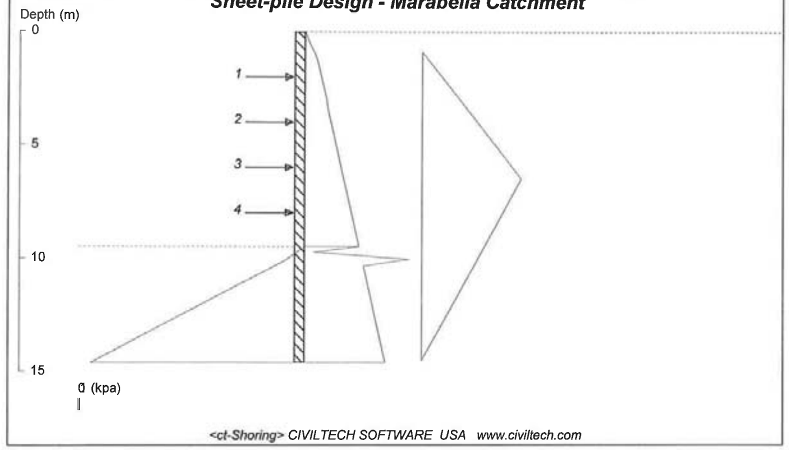
In the calculation, the following passive pressure are divided by a Factor of Safety =1.25

No.	Y top	Top Pres.	Pres. Slope	Width
1	0.00	0.00	19.21	1.00
2	0.61	11.71	25.62	1.00
3	5.49	136.64	25.61	1.00
4	5.79	144.45	25.62	1.00

UNITS: Length/Depth - m, Force - kN, Moment - kN-m, Pressure - kPa, Pres. Slope - kN/m3, Deflection - cm

GA 07 326 - San Fernando WWT Pipeline

Sheet-pile Design - Marabella Catchment



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Date: 29/04/2010 File Name: UNTITLED

WALL HEIGHT: 9.50 MIN. EMBEDMENT: 5.12 MIN. PILE LENGTH: 14.62

MAX. MOMENT: 159.03 AT DEPTH: 10.28

MIN. PILE SIZE AND TOP DEFLECTION - shown in ( ):

PZ22 (0.0) SPZ22 (0.0) CZ113 (0.0) SPZ23.5 (0.0) SZ22 (0.0) SZ22 (0.0) 2NRD3 (0.0)

2N (0.0) BZ12 (0.0) H116 (0.0) BZ12.1L (0.0) AZ13 (0.0) FSP6L (0.0) SZ222 (0.0) AV♫£A°r AR¸¢Aã®V9§Pk9 ;y9Ã$_9}U=9}U=9┬vC9×|794K*9ÓÞ$9oà9|"û8ø┴æ7ÎÊÒ8 ⁻L °× € k € ðýÎ

Required Min. Section Modulus = 970.2 cm3/pile, Fy=36 ksi=248 MPa, Fb/Fy=0.66

BRACE, TIEBACK, OR DEADMEN ANCHOR (Spacing = 1):

No.	DEPTH	ANGLE	TOTAL	HORIZ.	VERT.	L_free	L_fixed
1	2.0	0.0	56.1*	56.1	0.0	N/A	N/A
2	4.0	0.0	85.1	85.1	0.0	N/A	N/A
3	6.0	0.0	135.4	135.4	0.0	N/A	N/A
4	8.0	0.0	218.1	218.1	0.0	N/A	N/A

TOTAL VERTICAL FORCE: 0.0 * 1st Brace increased by 15% (DM7.2-103)

DRIVING PRESSURE (ACTIVE, WATER, & SURCHARGE)   X – Depth from wall top

No.	X top	Top Pres.	X bot.	Bot. Pres.	Spacing
1	0.00	0.00	0.61	3.09	1.00
2	0.61	3.09	0.91	5.15	1.00
3	0.91	5.15	1.22	6.60	1.00
4	1.22	6.60	1.52	7.54	1.00
5	1.52	7.54	3.05	12.14	1.00
6	3.05	12.14	3.35	12.53	1.00
7	3.35	12.53	3.66	13.40	1.00
8	3.66	13.40	3.96	14.26	1.00
9	3.96	14.26	4.27	15.13	1.00
10	4.27	15.13	4.57	15.99	1.00
11	4.57	15.99	5.49	18.59	1.00
12	5.49	18.59	6.10	20.32	1.00
13	6.10	20.32	7.01	22.92	1.00
14	7.01	22.92	7.92	25.52	1.00
15	7.92	25.52	9.50	30.00	1.00
16	0.90	0.00	6.50	54.88	1.00
17	6.50	54.88	14.53	0.00	1.00

ACTIVE PRESSURE (BELOW DREDGE LINE)   Y - Depth from dredge level

No.	Y top	Top Pres.	Pres. Slope	Width
1	0.00	30.00	-98.18	1.00
2	0.25	5.10	170.95	1.00
3	0.56	57.21	-81.21	1.00
4	0.86	32.45	2.85	1.00
5	1.17	33.32	2.85	1.00
6	2.69	37.66	2.85	1.00
7	3.00	38.53	2.85	1.00
8	3.30	39.39	2.85	1.00
9	4.83	43.73	2.85	1.00

PASSIVE PRESSURE (BELOW DREDGE LINE)   Y – Depth from dredge level

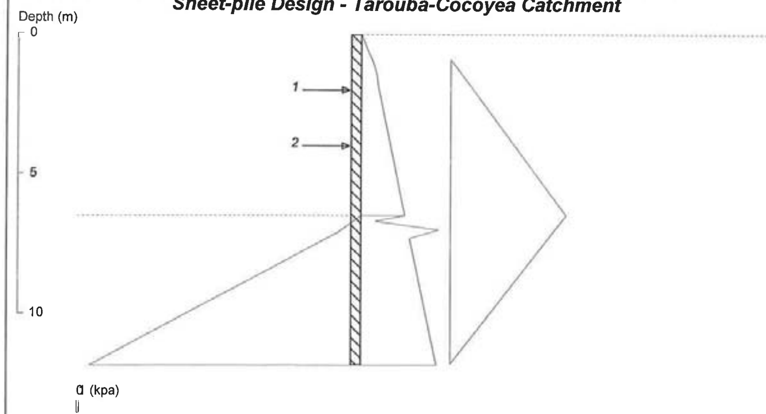
In the calculation, the following passive pressure are divided by a Factor of Safety =1.25

No.	Y top	Top Pres.	Pres. Slope	Width
1	0.00	0.00	17.73	1.00
2	0.61	10.81	23.63	1.00
3	4.88	111.65	23.63	1.00

UNITS: Length/Depth - m, Force - kN, Moment - kN-m, Pressure - kPa, Pres. Slope - kN/m3, Deflection - cm

GA 07 326 - San Fernando WWT Pipeline

Sheet-pile Design - Tarouba-Cocoyea Catchment



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Date: 29/04/2010   File Name: UNTITLED

WALL HEIGHT: 6.50   MIN. EMBEDMENT: 5.36   MIN. PILE LENGTH: 11.86

MAX. MOMENT: 278.89   AT DEPTH: 6.93

MIN. PILE SIZE AND TOP DEFLECTION - shown in ( ):

SZ27 (0.0) SZ27 (0.0) PLZ25 (0.0) 6L (0.0) AZ18 (0.0) SPZ26 (0.0) L6 (0.0)

CZ128 (0.0) 6M (0.0) 6H (0.0) RZ11 (0.0) H155 (0.0) PZ32 (0.0) BZ20.7L (0.0) AV/ÆA*r AR,¢Ac ô9c ô9×Àá9ië¶9-RÉ9 rØ9>§¹9¼¶Ô9#Ù|9I[÷8x-ã9Ösâ9F'ä9C

Required Min. Section Modulus = 1701.5 cm3/pile, Fy=36 ksi=248 MPa, Fb/Fy=0.66

BRACE, TIEBACK, OR DEADMEN ANCHOR (Spacing = 1):

No.	DEPTH	ANGLE	TOTAL	HORIZ.	VERT.	L_free	L_fixed
1	2.0	0.0	54.3*	54.3	0.0	N/A	N/A
2	4.0	0.0	208.5	208.5	0.0	N/A	N/A

TOTAL VERTICAL FORCE: 0.0   * 1st Brace increased by 15% (DM7.2-103)

DRIVING PRESSURE (ACTIVE, WATER, & SURCHARGE) X – Depth from wall top

No.	X top	Top Pres.	X bot.	Bot. Pres.	Spacing
1	0.00	0.00	0.61	2.97	1.00
2	0.61	2.97	0.91	4.95	1.00
3	0.91	4.95	1.22	6.34	1.00
4	1.22	6.34	1.52	7.22	1.00
5	1.52	7.22	1.83	7.74	1.00
6	1.83	7.74	2.13	8.56	1.00
7	2.13	8.56	2.44	9.38	1.00
8	2.44	9.38	2.74	10.21	1.00
9	2.74	10.21	3.05	11.04	1.00
10	3.05	11.04	3.35	11.87	1.00
11	3.35	11.87	3.66	12.70	1.00
12	3.66	12.70	3.96	13.53	1.00
13	3.96	13.53	4.27	14.36	1.00
14	4.27	14.36	4.57	15.19	1.00
15	4.57	15.19	5.18	16.86	1.00
16	5.18	16.86	6.10	19.35	1.00
17	6.10	19.35	6.40	20.19	1.00
18	6.40	20.19	6.50	20.46	1.00
19	0.90	0.00	6.50	54.88	1.00
20	6.50	54.88	11.83	0.00	1.00

ACTIVE PRESSURE (BELOW DREDGE LINE) Y – Depth from dredge level

No.	Y top	Top Pres.	Pres. Slope	Width
1	0.00	20.46	-66.68	1.00
2	0.21	6.75	96.37	1.00
3	0.51	36.12	-44.09	1.00
4	0.82	22.69	2.73	1.00
5	1.12	23.52	2.73	1.00
6	1.42	24.35	2.73	1.00
7	2.64	27.68	2.73	1.00
8	3.25	29.35	2.73	1.00
9	3.56	30.18	2.73	1.00
10	3.86	31.02	2.73	1.00
11	4.17	31.85	2.73	1.00
12	4.47	32.68	2.73	1.00
13	4.78	33.51	2.73	1.00
14	5.08	34.35	2.73	1.00

PASSIVE PRESSURE (BELOW DREDGE LINE) Y – Depth from dredge level

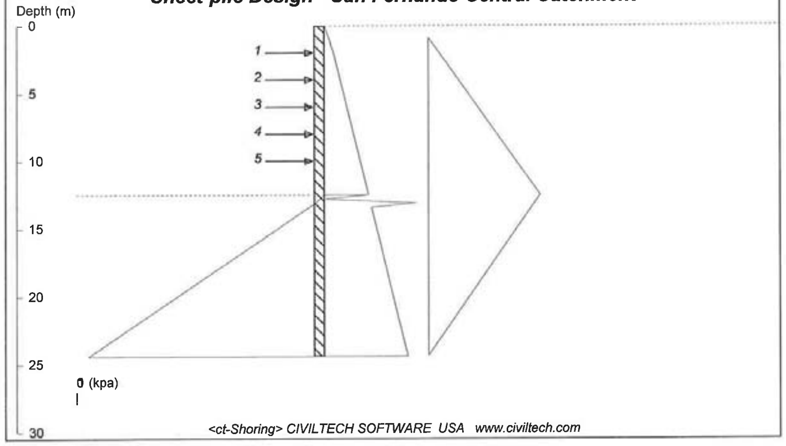
In the calculation, the following passive pressure are divided by a Factor of Safety =1.25

No.	Y top	Top Pres.	Pres. Slope	Width
1	0.00	0.00	18.45	1.00
2	0.61	11.25	24.60	1.00

UNITS: Length/Depth - m, Force - kN, Moment - kN-m, Pressure - kPa, Pres. Slope - kN/m3, Deflection - cm

GA 07 326 - San Fernando WWT Pipeline

Sheet-pile Design - San Fernando Central Catchment



<ct-Shoring> CIVILTECH SOFTWARE USA www.civiltech.com

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Date: 29/04/2010 File Name: UNTITLED

WALL HEIGHT: 12.50 MIN. EMBEDMENT: 11.91 MIN. PILE LENGTH: 24.41

MAX. MOMENT: 1613.94 AT DEPTH: 14.88

Movement is to large! No pile can be selected!

Required Min. Section Modulus = 9846.9 cm3/pile, Fy=36 ksi=248 MPa, Fb/Fy=0.66

BRACE, TIEBACK, OR DEADMEN ANCHOR (Spacing = 1):

No.	DEPTH	ANGLE	TOTAL	HORIZ.	VERT.	L_free	L_fixed
1	2.0	0.0	55.3*	55.3	0.0	N/A	N/A
2	4.0	0.0	88.3	88.3	0.0	N/A	N/A
3	6.0	0.0	145.0	145.0	0.0	N/A	N/A
4	8.0	0.0	197.6	197.6	0.0	N/A	N/A
5	10.0	0.0	788.3	788.3	0.0	N/A	N/A

TOTAL VERTICAL FORCE: 0.0 * 1st Brace increased by 15% (DM7.2-103)

DRIVING PRESSURE (ACTIVE, WATER, & SURCHARGE)   X – Depth from wall top

No.	X top	Top Pres.	X bot.	Bot. Pres.	Spacing
1	0.00	0.00	0.61	2.74	1.00
2	0.61	2.74	0.91	4.57	1.00
3	0.91	4.57	1.22	5.86	1.00
4	1.22	5.86	1.52	6.76	1.00
5	1.52	6.76	1.83	8.49	1.00
6	1.83	8.49	2.13	9.56	1.00
7	2.13	9.56	2.44	10.61	1.00
8	2.44	10.61	2.74	11.64	1.00
9	2.74	11.64	3.05	12.67	1.00
10	3.05	12.67	3.35	13.70	1.00
11	3.35	13.70	3.66	14.72	1.00
12	3.66	14.72	3.96	15.74	1.00
13	3.96	15.74	4.27	16.76	1.00
14	4.27	16.76	4.57	17.78	1.00
15	4.57	17.78	4.88	18.79	1.00
16	4.88	18.79	5.18	19.81	1.00
17	5.18	19.81	5.49	20.83	1.00
18	5.49	20.83	5.79	21.85	1.00
19	5.79	21.85	6.10	22.86	1.00
20	6.10	22.86	6.71	24.90	1.00
21	6.71	24.90	7.32	26.93	1.00
22	7.32	26.93	8.23	29.97	1.00
23	8.23	29.97	9.45	34.03	1.00
24	9.45	34.03	9.75	35.04	1.00
25	9.75	35.04	10.36	37.07	1.00
26	10.36	37.07	11.58	41.13	1.00
27	11.58	41.13	11.89	42.15	1.00
28	11.89	42.15	12.19	43.16	1.00
29	12.19	43.16	12.50	44.19	1.00
30	0.90	0.00	12.50	113.68	1.00
31	12.50	113.68	24.34	0.00	1.00

ACTIVE PRESSURE (BELOW DREDGE LINE)   Y - Depth from dredge level

No.	Y top	Top Pres.	Pres. Slope	Width
1	0.00	44.19	-144.95	1.00
2	0.30	0.47	296.77	1.00
3	0.61	90.92	-143.39	1.00
4	0.91	47.22	3.33	1.00
5	1.22	48.23	3.33	1.00
6	2.13	51.28	3.33	1.00
7	2.44	52.29	3.34	1.00
8	2.74	53.31	3.33	1.00
9	3.04	54.32	3.33	1.00
10	3.35	55.34	3.33	1.00
11	3.65	56.35	3.33	1.00
12	4.26	58.38	3.33	1.00
13	4.57	59.40	3.33	1.00
14	4.87	60.41	3.33	1.00
15	5.18	61.42	3.33	1.00
16	5.48	62.44	3.33	1.00
17	5.79	63.45	3.32	1.00
18	6.09	64.47	3.33	1.00
19	6.40	65.48	3.33	1.00
20	6.70	66.50	3.33	1.00
21	7.01	67.51	3.33	1.00
22	7.31	68.53	3.33	1.00
23	7.62	69.54	3.33	1.00
24	7.92	70.55	3.33	1.00
25	8.53	72.58	3.32	1.00
26	8.84	73.60	3.33	1.00
27	9.14	74.61	3.33	1.00
28	9.45	75.63	3.33	1.00
29	9.75	76.64	3.33	1.00
30	10.06	77.65	3.33	1.00
31	10.36	78.67	3.32	1.00
32	10.66	79.68	3.33	1.00
33	10.97	80.70	3.33	1.00
34	11.27	81.71	3.33	1.00
35	11.58	82.73	3.33	1.00
36	11.88	83.74	3.33	1.00

PASSIVE PRESSURE (BELOW DREDGE LINE)   Y – Depth from dredge level

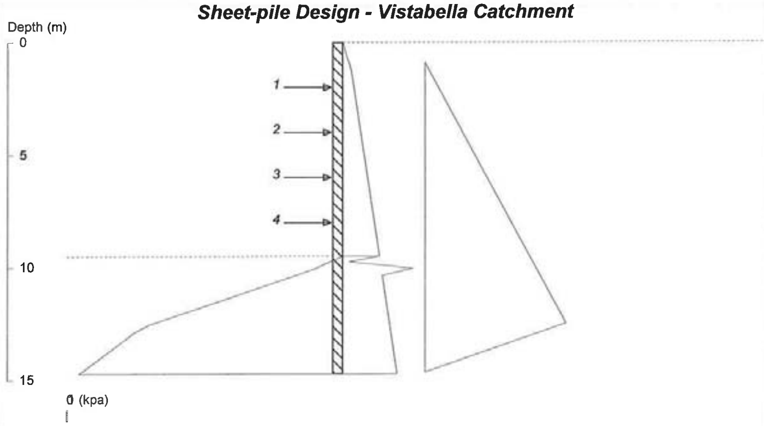
In the calculation, the following passive pressure are divided by a Factor of Safety =1.25

No.	Y top	Top Pres.	Pres. Slope	Width
1	0.00	0.00	15.15	1.00
2	0.61	9.24	20.20	1.00
3	7.92	157.04	20.19	1.00
4	8.23	163.19	20.21	1.00
5	8.53	169.35	20.20	1.00
6	8.84	175.51	20.21	1.00
7	9.14	181.67	20.20	1.00
8	9.45	187.82	20.21	1.00
9	9.75	193.98	20.20	1.00
10	10.36	206.30	20.21	1.00
11	10.97	218.62	20.19	1.00
12	11.28	224.77	20.21	1.00
13	11.58	230.93	20.20	1.00

UNITS: Length/Depth - m, Force - kN, Moment - kN-m, Pressure - kPa, Pres. Slope - kN/m3, Deflection - cm

GA 07 326 - San Fernando WWT Pipeline

Sheet-pile Design - Vistabella Catchment



<ct-Shoring> CIVILTECH SOFTWARE USA www.civiltech.com

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Date: 29/04/2010 File Name: C:\Shoring7\07326e.sho

WALL HEIGHT: 9.50 MIN. EMBEDMENT: 5.23 MIN. PILE LENGTH: 14.73

MAX. MOMENT: 331.50 AT DEPTH: 10.47

MIN. PILE SIZE AND TOP DEFLECTION - shown in ( ):

PZ32 (0.0) BZ20.7L (0.0) CZ141 (0.0) CZ148 (0.0) 4N (0.0) FSPZ25 (0.0) PZ38 (0.0)

BZ26 (0.0) AZ26 (0.0) H175 (0.0) PZ35 (0.0) H215 (0.0) BZ32 (0.0) FSPZ32 (0.0) AV#£A°r AR,¢AãèE9èb197Þ&9®@9è`┴9È-9ãV-9KI└9õ›Ö8"À–9<†ñ8↑oÞ8¬æÓ8‼yØ8

Required Min. Section Modulus = 2022.5 cm3/pile, Fy=36 ksi=248 MPa, Fb/Fy=0.66

BRACE, TIEBACK, OR DEADMEN ANCHOR (Spacing = 1):

No	DEPTH	ANGLE	TOTAL	HORIZ.	VERT.	L_free	L_fixed
1	2.0	0.0	55.9*	55.9	0.0	N/A	N/A
2	4.0	0.0	85.0	85.0	0.0	N/A	N/A
3	6.0	0.0	139.8	139.8	0.0	N/A	N/A
4	8.0	0.0	348.2	348.2	0.0	N/A	N/A

TOTAL VERTICAL FORCE: 0.0 * 1st Brace increased by 15% (DM7.2-103)

DRIVING PRESSURE (ACTIVE, WATER, & SURCHARGE) X – Depth from wall top

No.	X top	Top Pres.	X bot.	Bot. Pres.	Spacing
1	0.00	0.00	0.61	3.09	1.00
2	0.61	3.09	0.91	5.15	1.00
3	0.91	5.15	1.22	6.60	1.00
4	1.22	6.60	1.52	7.54	1.00
5	1.52	7.54	6.40	21.06	1.00
6	6.40	21.06	6.71	21.87	1.00
7	6.71	21.87	7.01	22.70	1.00
8	7.01	22.70	7.32	23.53	1.00
9	7.32	23.53	7.62	24.37	1.00
10	7.62	24.37	7.92	25.20	1.00
11	7.92	25.20	9.50	29.50	1.00
12	0.90	0.00	12.50	113.68	1.00
13	12.50	113.68	14.65	0.00	1.00

ACTIVE PRESSURE (BELOW DREDGE LINE) Y - Depth from dredge level

No.	Y top	Top Pres.	Pres. Slope	Width
1	0.00	29.50	-96.56	1.00
2	0.25	5.01	167.95	1.00
3	0.56	56.21	-79.88	1.00
4	0.86	31.86	2.73	1.00
5	1.17	32.69	2.74	1.00
6	3.00	37.69	2.73	1.00
7	3.30	38.53	2.73	1.00
8	3.61	39.36	2.73	1.00
9	3.91	40.19	2.73	1.00
10	4.52	41.86	2.73	1.00
11	4.83	42.69	2.73	1.00
12	5.13	43.53	2.73	1.00

PASSIVE PRESSURE (BELOW DREDGE LINE) Y -- Depth from dredge level

In the calculation, the following passive pressure are divided by a Factor of Safety =1.25

No.	Y top	Top Pres.	Pres. Slope	Width
1	0.00	0.00	40.50	1.00
2	0.61	24.69	53.96	1.00
3	3.05	156.25	35.03	1.00
4	3.35	166.93	24.60	1.00
5	3.66	174.43	24.60	1.00
6	5.18	211.92	24.60	1.00

UNITS: Length/Depth - m, Force - kN, Moment - kN-m, Pressure - kPa, Pres. Slope - kN/m3, Deflection - cm

APPENDIX II

THE UNIVERSITY OF THE WEST INDIES
FACULTY OF ENGINEERING
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
ENVIRONMENTAL ENGINEERING LABORATORY

Soil Test Report

Client: Geotech and Associates Ltd

Date Rec'd April, 2010

Report Date: 22 April, 2010

Project: **GA – 07362 – Wastewater Treatment Plant Marabella**

No.	Sample Source	pH	Sulphate %	Chlorides %
1	BH 10 - 3 SA 03 7.5 – 9.0	7.44	0.010	0.009
2	BH 70 - 4 SA 04 10.0 – 11.5	7.22	0.038	0.013
3	BH 80 - 11 SA 04 10.0 – 11.5	7.22	0.061	0.029
4	BH 55 - 18 SA 04 10.0 – 11.5	7.64	0.004	0.003
5	BH 10-31 SA 05 15.0 – 16.5	6.69	0.004	0.059

Sample was tested in accordance with BS: 1377: Part 3: 1990 – Total (acid Soluble) Sulfate, Electrometric- water soluble pH and Mercuric chloride – water soluble Chloride method

Althea Richardson
Senior Laboratory Technician
UWI

THE UNIVERSITY OF THE WEST INDIES
FACULTY OF ENGINEERING
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
ENVIRONMENTAL ENGINEERING LABORATORY

Soil Test Report

Client: Geotech and Associates Ltd

Date Rec'd February, 2010

Report Date: 26 February, 2010

Project: **GA 07326 – Wastewater System**

No.	Sample Source	pH	Sulphate %	Chlorides %
1	BH 80 - 24 SA 7 55.0′ – 2 6.5′	8.64	0.010	0.020
2	BH 17 SA 4 10.0′ – 11.5′	7.83	0.021	0.018

Sample was tested in accordance with BS: 1377: Part 3: 1990 – Total (acid Soluble) Sulfate, Electrometric- water soluble pH and Mercuric chloride – water soluble Chloride method

Althea Richardson
Senior Laboratory Technician
UWI

THE UNIVERSITY OF THE WEST INDIES
FACULTY OF ENGINEERING
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
ENVIRONMENTAL ENGINEERING LABORATORY

Soil Test Report

Client: Geotech and Associates Ltd

Date Rec'd March, 2010

Report Date: 17 March, 2010

Project: **GA 07326 – Wastewater System**

No.	Sample Source	pH	Sulphate %	Chlorides %
1	BH B55 -14 SA 4 10.0′ – 11.5′	7.79	0.295	0.028
2	BH 25 - 6 SA 5 15.0′ – 17.0′	7.89	0.007	0.011
3	BH 25 -1 SA 3 7.0′ – 9.0′	8.02	0.004	0.006
4	BH 10 - 24 SA 6 20.0′ – 21.5′	7.29	0.044	0.014
5	BH 10 - 30 SA 8 30.0′ – 31.5′	6.42	0.004	0.103
6	BH A1 SA 3 7.5′ – 9.0′	7.49	0.002	0.008
7	BH 10 -15 SA 4 10.0′ – 11.5′	7.53	0.005	0.052

Sample was tested in accordance with BS: 1377: Part 3: 1990 – Total (acid Soluble) Sulfate, Electrometric- water soluble pH and Mercuric chloride – water soluble Chloride method

Althea Richardson
Senior Laboratory Technician
UWI

Appendix D

Biophysical Baseline Data

D.2 Water Quality Data

TESTMARK Laboratories Ltd.

Committed to Quality and Service

Analytical Report

Client:	Natalie Wilson	**Work Order Number:**	**92047**
Company:	AECOM - Trinidad	**Date Order Received:**	10/22/09
Address:	26 Kelly Kenny Street	**Regulation:**	Information not provided
	Woodbrook, W.I.,	**PO #:**	
Phone:	(868) 628-9710	**Project #:**	110882
Fax:	(868) 628-0862		
Email:	natalie.wilson@aecom.com		

Analyses were performed on the following samples submitted with your order.
The results relate only to the items tested.

Sample Name	Lab #	Matrix	Type	Comments	Date Collected	Time Collected
Guaracaro River Gulf	255512	Water	Grab		10/20/09	7:40
Guaracaro River Inland	255513	Water	Grab		10/20/09	9:50
Marabella River Gulf	255514	Water	Grab		10/20/09	7:00
Marabella River Inland	255515	Water	Grab		10/20/09	8:30
Vistabella River Gulf	255516	Water	Grab		10/20/09	11:00
Vistabella River Inland	255517	Water	Grab		10/20/09	10:40
Cipero River Gulf	255518	Water	Grab		10/20/09	11:40
Cipero River Mid-way	255519	Water	Grab		10/20/09	12:40
Cipero River Inland	255520	Water	Grab		10/20/09	13:00
Alley's Creek River	255521	Water	Grab		10/20/09	12:20

TESTMARK Laboratories Ltd.

Committed to Quality and Service

The following instrumentation and reference methods were used for your sample(s)

Method Name	Description	Reference
AmmoniaFIA	Determination of Ammonia/Ammonium by Flow Analysis **Instrument group:** Skalar San++ FIA	Mod. APHA-4500
Anions Water	Determination of Anions by Ion Chromatography **Instrument group:** Dionex IC	Mod. SW846-9056
BOD	Determination of Biochemical Oxygen Demand **Instrument group:** YSI DO Meter	Mod. APHA-5210
CN Total Water FIA	Determination of Total Cyanide in Water by Flow Injection Analysis **Instrument group:** Skalar San++ FIA	Mod. APHA-4500
COD	Determination of Chemical Oxygen Demand **Instrument group:** Bausch & Lomb Spectrometer	Mod. APHA-5220
FC (MF) SSM	Determination of Thermotolerent Coliforms in water by Membrane Filtration **Instrument group:** Subcontracted	Mod. MOE E3433
ICPMS Water	Determination of Metals in Water by ICP/MS **Instrument group:** Perkin Elmer ICPMS	Mod. SW846-6020
TP FIA Water	Determination of Total Phosphorus by FIA/UV Digestion **Instrument group:** Skalar San++ FIA	Mod. APHA-4500
TSS - 500	Determination of Total Suspended Solids in water by gravimetry **Instrument group:** Mettler Toledo Balance	Mod. APHA-2540

This report has been approved by:

f. Lamontagne   Brad Halvorson

Mariane Lamontagne, B.Sc.	Brad Halvorson, B. Sc.	Mark Charbonneau, Ph.D.
Senior Microbiologist	Inorganic Section Head	Metals Section Head

Sample Data:

Sample Name: Guaracaro River Gulf **Date: 10/20/09** **Matrix: Water** **Lab #: 255512**

AmmoniaFIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Ammonia (as N)	0.01	0.432	mg/L	20091027.R42.1A

Anions Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Nitrate (as N)	10	<10	mg/L	20091028.R5A
Nitrate (as N) (Dup)	10	<10	mg/L	20091028.R5A

BOD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
BOD (5 day)	0.5	3.8	mg/L	20091023.BOD1

CN Total Water FIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Cyanide	0.001	<0.001	mg/L	20091023.R43.1B

COD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Chemical Oxygen Demand	5	52	mg/L	20091026.R4A

FC (MF) SSM				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Fecal Coliforms	1000	32000	CFU/100mL	20091022.SBAC1F

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	1	1200	ug/L	20091023.R13na
Antimony	0.5	<0.5	ug/L	20091023.R13na
Arsenic	1	22.1	ug/L	20091023.R13na
Barium	1	43	ug/L	20091023.R13na
Beryllium	0.5	<0.5	ug/L	20091023.R13na
Bismuth	1	<1	ug/L	20091023.R13na
Boron	2	467	ug/L	20091023.R13na
Cadmium	0.1	<0.1	ug/L	20091023.R13na
Calcium	50	119000	ug/L	20091023.R13na
Cerium	1	2.1	ug/L	20091023.R13na
Cesium	1	<1	ug/L	20091023.R13na
Chromium	1	5.6	ug/L	20091023.R13na
Cobalt	0.1	0.71	ug/L	20091023.R13na
Copper	1	38	ug/L	20091023.R13na
Europium	1	<1	ug/L	20091023.R13na
Gallium	1	<1	ug/L	20091023.R13na
Iron	20	505	ug/L	20091023.R13na
Lanthanum	1	<1	ug/L	20091023.R13na
Lead	1	1.8	ug/L	20091023.R13na
Lithium	5	22	ug/L	20091023.R13na
Magnesium	4	167000	ug/L	20091023.R13na
Manganese	1	35.4	ug/L	20091023.R13na

Sample Name: Guaracaro River Gulf **Date: 10/20/09** **Matrix: Water** **Lab #: 255512**

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Mercury	0.1	<0.1	ug/L	20091023.R13na
Molybdenum	1	2.6	ug/L	20091023.R13na
Nickel	1	5.4	ug/L	20091023.R13na
Niobium	1	<1	ug/L	20091023.R13na
Rubidium	1	15.4	ug/L	20091023.R13na
Scandium	1	2.4	ug/L	20091023.R13na
Selenium	1	63	ug/L	20091023.R13na
Silicon	2	8810	ug/L	20091023.R13na
Silver	0.1	<0.1	ug/L	20091023.R13na
Strontium	1	1270	ug/L	20091023.R13na
Sulfur	800	167000	ug/L	20091023.R13na
Thallium	0.1	<0.1	ug/L	20091023.R13na
Thorium	1	<1	ug/L	20091023.R13na
Tin	1	<1	ug/L	20091023.R13na
Titanium	1	55.9	ug/L	20091023.R13na
Tungsten	1	<1	ug/L	20091023.R13na
Uranium	1	<1	ug/L	20091023.R13na
Vanadium	1	32.5	ug/L	20091023.R13na
Yttrium	1	<1	ug/L	20091023.R13na
Zinc	1	11	ug/L	20091023.R13na
Zirconium	1	<1	ug/L	20091023.R13na

TP FIA Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Phosphorus (as P)	0.002	0.162	mg/L	20091027.R23.2A

TSS - 500				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Suspended Solids	2	38	mg/L	20091023.R27D

Sample Name: Guaracaro River Inland **Date: 10/20/09** **Matrix: Water** **Lab #: 255513**

AmmoniaFIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Ammonia (as N)	0.01	0.089	mg/L	20091027.R42.1A
Ammonia (as N) (Dup)	0.01	0.081	mg/L	20091027.R42.1A

Anions Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Nitrate (as N)	0.1	0.15	mg/L	20091027.R5C

BOD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
BOD (5 day)	0.5	4.4	mg/L	20091023.BOD1

CN Total Water FIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Cyanide	0.001	<0.001	mg/L	20091023.R43.1B

Sample Name: Guaracaro River Inland Date: 10/20/09 Matrix: Water Lab #: 255513

COD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Chemical Oxygen Demand	5	34	mg/L	20091026.R4A

FC (MF) SSM				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Fecal Coliforms	1000	8000	CFU/100mL	20091022.SBAC1F

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	1	757	ug/L	20091023.R13na
Antimony	0.5	<0.5	ug/L	20091023.R13na
Arsenic	1	1.5	ug/L	20091023.R13na
Barium	1	44.5	ug/L	20091023.R13na
Beryllium	0.5	<0.5	ug/L	20091023.R13na
Bismuth	1	<1	ug/L	20091023.R13na
Boron	2	63	ug/L	20091023.R13na
Cadmium	0.1	<0.1	ug/L	20091023.R13na
Calcium	500	43800	ug/L	20091023.R13na
Cerium	1	2	ug/L	20091023.R13na
Cesium	1	<1	ug/L	20091023.R13na
Chromium	1	3.2	ug/L	20091023.R13na
Cobalt	0.1	1.26	ug/L	20091023.R13na
Copper	1	8.9	ug/L	20091023.R13na
Europium	1	<1	ug/L	20091023.R13na
Gallium	1	<1	ug/L	20091023.R13na
Iron	20	509	ug/L	20091023.R13na
Lanthanum	1	<1	ug/L	20091023.R13na
Lead	1	2.2	ug/L	20091023.R13na
Lithium	5	<5	ug/L	20091023.R13na
Magnesium	4	7980	ug/L	20091023.R13na
Manganese	1	88.1	ug/L	20091023.R13na
Mercury	0.1	<0.1	ug/L	20091023.R13na
Molybdenum	1	<1	ug/L	20091023.R13na
Nickel	1	4.9	ug/L	20091023.R13na
Niobium	1	<1	ug/L	20091023.R13na
Rubidium	1	1.8	ug/L	20091023.R13na
Scandium	1	2	ug/L	20091023.R13na
Selenium	1	<1	ug/L	20091023.R13na
Silicon	2	8050	ug/L	20091023.R13na
Silver	0.1	<0.1	ug/L	20091023.R13na
Strontium	10	199	ug/L	20091023.R13na
Sulfur	800	20800	ug/L	20091023.R13na
Thallium	0.1	<0.1	ug/L	20091023.R13na
Thorium	1	<1	ug/L	20091023.R13na
Tin	1	<1	ug/L	20091023.R13na
Titanium	1	26.2	ug/L	20091023.R13na
Tungsten	1	<1	ug/L	20091023.R13na
Uranium	1	<1	ug/L	20091023.R13na

Sample Name: Guaracaro River Inland Date: 10/20/09 Matrix: Water Lab #: 255513

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Vanadium	1	2.8	ug/L	20091023.R13na
Yttrium	1	1	ug/L	20091023.R13na
Zinc	1	46	ug/L	20091023.R13na
Zirconium	1	<1	ug/L	20091023.R13na

TP FIA Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Phosphorus (as P)	0.002	0.274	mg/L	20091027.R23.2A
Total Phosphorus (as P) (Dup)	0.002	0.271	mg/L	20091027.R23.2A

TSS - 500				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Suspended Solids	2	402	mg/L	20091023.R27D

Sample Name: Marabella River Gulf Date: 10/20/09 Matrix: Water Lab #: 255514

AmmoniaFIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Ammonia (as N)	0.01	0.747	mg/L	20091027.R42.1A

Anions Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Nitrate (as N)	10	<10	mg/L	20091028.R5A

BOD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
BOD (5 day)	0.5	3.3	mg/L	20091023.BOD1

CN Total Water FIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Cyanide	0.001	<0.001	mg/L	20091023.R43.1B

COD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Chemical Oxygen Demand	5	52	mg/L	20091026.R4A

FC (MF) SSM				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Fecal Coliforms	1000	46000	CFU/100mL	20091022.SBAC1F

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	10	890	ug/L	20091023.R13na
Antimony	0.5	<0.5	ug/L	20091023.R13na
Arsenic	1	18.3	ug/L	20091023.R13na
Barium	1	34	ug/L	20091023.R13na
Beryllium	0.5	<0.5	ug/L	20091023.R13na
Bismuth	1	<1	ug/L	20091023.R13na
Boron	2	389	ug/L	20091023.R13na
Cadmium	0.1	<0.1	ug/L	20091023.R13na

AECOM - Trinidad Work Order: 92047

Sample Name: Marabella River Gulf **Date: 10/20/09** **Matrix: Water** **Lab #: 255514**

ICPMS Water

Parameter	MDL	Result	Units	QAQCID
Calcium	500	113000	ug/L	20091023.R13na
Cerium	1	1.6	ug/L	20091023.R13na
Cesium	1	<1	ug/L	20091023.R13na
Chromium	1	6.7	ug/L	20091023.R13na
Cobalt	0.1	0.55	ug/L	20091023.R13na
Copper	1	29.5	ug/L	20091023.R13na
Europium	1	<1	ug/L	20091023.R13na
Gallium	1	<1	ug/L	20091023.R13na
Iron	20	753	ug/L	20091023.R13na
Lanthanum	1	<1	ug/L	20091023.R13na
Lead	1	<1	ug/L	20091023.R13na
Lithium	5	17	ug/L	20091023.R13na
Magnesium	40	119000	ug/L	20091023.R13na
Manganese	1	53.8	ug/L	20091023.R13na
Mercury	0.1	<0.1	ug/L	20091023.R13na
Molybdenum	1	2.4	ug/L	20091023.R13na
Nickel	1	5.1	ug/L	20091023.R13na
Niobium	1	<1	ug/L	20091023.R13na
Rubidium	1	12.5	ug/L	20091023.R13na
Scandium	1	2.6	ug/L	20091023.R13na
Selenium	1	45.7	ug/L	20091023.R13na
Silicon	20	12000	ug/L	20091023.R13na
Silver	0.1	<0.1	ug/L	20091023.R13na
Strontium	10	1030	ug/L	20091023.R13na
Sulfur	800	143000	ug/L	20091023.R13na
Thallium	0.1	<0.1	ug/L	20091023.R13na
Thorium	1	<1	ug/L	20091023.R13na
Tin	1	<1	ug/L	20091023.R13na
Titanium	1	68.4	ug/L	20091023.R13na
Tungsten	1	<1	ug/L	20091023.R13na
Uranium	1	<1	ug/L	20091023.R13na
Vanadium	1	27.9	ug/L	20091023.R13na
Yttrium	1	<1	ug/L	20091023.R13na
Zinc	1	15	ug/L	20091023.R13na
Zirconium	1	<1	ug/L	20091023.R13na

TP FIA Water

Parameter	MDL	Result	Units	QAQCID
Total Phosphorus (as P)	0.002	0.391	mg/L	20091027.R23.2A

TSS - 500

Parameter	MDL	Result	Units	QAQCID
Total Suspended Solids	2	27	mg/L	20091023.R27D

AECOM - Trinidad Work Order: 92047

Sample Name: Marabella River Inland **Date: 10/20/09** **Matrix: Water** **Lab #: 255515**

AmmoniaFIA

Parameter	MDL	Result	Units	QAQCID
Ammonia (as N)	0.01	0.124	mg/L	20091027.R42.1A

Anions Water

Parameter	MDL	Result	Units	QAQCID
Nitrate (as N)	0.1	0.11	mg/L	20091027.R5C

BOD

Parameter	MDL	Result	Units	QAQCID
BOD (5 day)	0.5	2.2	mg/L	20091023.BOD1

CN Total Water FIA

Parameter	MDL	Result	Units	QAQCID
Total Cyanide	0.001	<0.001	mg/L	20091023.R43.1B

COD

Parameter	MDL	Result	Units	QAQCID
Chemical Oxygen Demand	5	42	mg/L	20091026.R4A

FC (MF) SSM

Parameter	MDL	Result	Units	QAQCID
Fecal Coliforms	1000	11000	CFU/100mL	20091022.SBAC1F

ICPMS Water

Parameter	MDL	Result	Units	QAQCID
Aluminum	10	1320	ug/L	20091023.R13na
Antimony	0.5	<0.5	ug/L	20091023.R13na
Arsenic	1	2.5	ug/L	20091023.R13na
Barium	1	36.3	ug/L	20091023.R13na
Beryllium	0.5	<0.5	ug/L	20091023.R13na
Bismuth	1	<1	ug/L	20091023.R13na
Boron	2	93.8	ug/L	20091023.R13na
Cadmium	0.1	<0.1	ug/L	20091023.R13na
Calcium	500	119000	ug/L	20091023.R13na
Cerium	1	2	ug/L	20091023.R13na
Cesium	1	<1	ug/L	20091023.R13na
Chromium	1	5.8	ug/L	20091023.R13na
Cobalt	0.1	0.56	ug/L	20091023.R13na
Copper	1	5.2	ug/L	20091023.R13na
Europium	1	<1	ug/L	20091023.R13na
Gallium	1	<1	ug/L	20091023.R13na
Iron	20	775	ug/L	20091023.R13na
Lanthanum	1	1.3	ug/L	20091023.R13na
Lead	1	<1	ug/L	20091023.R13na
Lithium	5	7.6	ug/L	20091023.R13na
Magnesium	40	13500	ug/L	20091023.R13na
Manganese	1	33.8	ug/L	20091023.R13na
Mercury	0.1	<0.1	ug/L	20091023.R13na
Molybdenum	1	1.8	ug/L	20091023.R13na
Nickel	1	4.9	ug/L	20091023.R13na

Sample Name: Marabella River Inland   Date: 10/20/09   Matrix: Water   Lab #: 255515

ICPMS Water

Parameter	MDL	Result	Units	QAQCID
Niobium	1	<1	ug/L	20091023.R13na
Rubidium	1	3.2	ug/L	20091023.R13na
Scandium	1	2.9	ug/L	20091023.R13na
Selenium	1	2.3	ug/L	20091023.R13na
Silicon	20	15000	ug/L	20091023.R13na
Silver	0.1	<0.1	ug/L	20091023.R13na
Strontium	10	583	ug/L	20091023.R13na
Sulfur	800	78900	ug/L	20091023.R13na
Thallium	0.1	<0.1	ug/L	20091023.R13na
Thorium	1	<1	ug/L	20091023.R13na
Tin	1	<1	ug/L	20091023.R13na
Titanium	1	84.1	ug/L	20091023.R13na
Tungsten	1	<1	ug/L	20091023.R13na
Uranium	1	<1	ug/L	20091023.R13na
Vanadium	1	4.6	ug/L	20091023.R13na
Yttrium	1	<1	ug/L	20091023.R13na
Zinc	1	10.3	ug/L	20091023.R13na
Zirconium	1	1.1	ug/L	20091023.R13na

TP FIA Water

Parameter	MDL	Result	Units	QAQCID
Total Phosphorus (as P)	0.002	0.219	mg/L	20091027.R23.2A

TSS - 500

Parameter	MDL	Result	Units	QAQCID
Total Suspended Solids	2	54	mg/L	20091023.R27D

Sample Name: Vistabella River Gulf   Date: 10/20/09   Matrix: Water   Lab #: 255516

AmmoniaFIA

Parameter	MDL	Result	Units	QAQCID
Ammonia (as N)	0.01	2.91	mg/L	20091027.R42.1A

Anions Water

Parameter	MDL	Result	Units	QAQCID
Nitrate (as N)	10	<10	mg/L	20091028.R5A

BOD

Parameter	MDL	Result	Units	QAQCID
BOD (5 day)	0.5	7.7	mg/L	20091023.BOD1

CN Total Water FIA

Parameter	MDL	Result	Units	QAQCID
Total Cyanide	0.001	<0.001	mg/L	20091023.R43.1B

COD

Parameter	MDL	Result	Units	QAQCID
Chemical Oxygen Demand	5	79.9	mg/L	20091026.R4A

Sample Name: Vistabella River Gulf   Date: 10/20/09   Matrix: Water   Lab #: 255516

FC (MF) SSM

Parameter	MDL	Result	Units	QAQCID
Fecal Coliforms	1000	TNTC	CFU/100mL	20091022.SBAC1F

ICPMS Water

Parameter	MDL	Result	Units	QAQCID
Aluminum	1	90.7	ug/L	20091023.R13na
Antimony	0.5	<0.5	ug/L	20091023.R13na
Arsenic	1	34.4	ug/L	20091023.R13na
Barium	1	47.7	ug/L	20091023.R13na
Beryllium	0.5	<0.5	ug/L	20091023.R13na
Bismuth	1	<1	ug/L	20091023.R13na
Boron	2	620	ug/L	20091023.R13na
Cadmium	0.1	<0.1	ug/L	20091023.R13na
Calcium	500	220000	ug/L	20091023.R13na
Cerium	1	<1	ug/L	20091023.R13na
Cesium	1	<1	ug/L	20091023.R13na
Chromium	1	7.8	ug/L	20091023.R13na
Cobalt	0.1	0.89	ug/L	20091023.R13na
Copper	1	56	ug/L	20091023.R13na
Europium	1	<1	ug/L	20091023.R13na
Gallium	1	<1	ug/L	20091023.R13na
Iron	20	202	ug/L	20091023.R13na
Lanthanum	1	<1	ug/L	20091023.R13na
Lead	1	<1	ug/L	20091023.R13na
Lithium	5	29	ug/L	20091023.R13na
Magnesium	4	<4	ug/L	20091023.R13na
Manganese	1	99.6	ug/L	20091023.R13na
Mercury	0.1	0.13	ug/L	20091023.R13na
Molybdenum	1	4.1	ug/L	20091023.R13na
Nickel	1	7.7	ug/L	20091023.R13na
Niobium	1	<1	ug/L	20091023.R13na
Rubidium	1	28.9	ug/L	20091023.R13na
Scandium	1	1.8	ug/L	20091023.R13na
Selenium	1	118	ug/L	20091023.R13na
Silicon	2	6220	ug/L	20091023.R13na
Silver	0.1	<0.1	ug/L	20091023.R13na
Strontium	10	2440	ug/L	20091023.R13na
Sulfur	8000	286000	ug/L	20091023.R13na
Thallium	0.1	<0.1	ug/L	20091023.R13na
Thorium	1	<1	ug/L	20091023.R13na
Tin	1	<1	ug/L	20091023.R13na
Titanium	1	15.2	ug/L	20091023.R13na
Tungsten	1	<1	ug/L	20091023.R13na
Uranium	1	1.1	ug/L	20091023.R13na
Vanadium	1	44.7	ug/L	20091023.R13na
Yttrium	1	<1	ug/L	20091023.R13na
Zinc	1	9.4	ug/L	20091023.R13na

Sample Name: Vistabella River Gulf **Date: 10/20/09** **Matrix: Water** **Lab #: 255516**

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Zirconium	1	<1	ug/L	20091023.R13na

TP FIA Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Phosphorus (as P)	0.002	0.727	mg/L	20091027.R23.2A

TSS - 500				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Suspended Solids	2	20	mg/L	20091023.R27D

Sample Name: Vistabella River Inland **Date: 10/20/09** **Matrix: Water** **Lab #: 255517**

AmmoniaFIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Ammonia (as N)	0.01	1.21	mg/L	20091027.R42.1A

Anions Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Nitrate (as N)	0.1	0.33	mg/L	20091027.R5C

BOD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
BOD (5 day)	0.5	5.1	mg/L	20091023.BOD1

CN Total Water FIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Cyanide	0.001	<0.001	mg/L	20091023.R43.1B

COD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Chemical Oxygen Demand	5	38	mg/L	20091026.R4A

FC (MF) SSM				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Fecal Coliforms	1000	11000	CFU/100mL	20091022.SBAC1F

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	1	548	ug/L	20091023.R13na
Antimony	0.5	<0.5	ug/L	20091023.R13na
Arsenic	1	2.8	ug/L	20091023.R13na
Barium	1	40.1	ug/L	20091023.R13na
Beryllium	0.5	<0.5	ug/L	20091023.R13na
Bismuth	1	<1	ug/L	20091023.R13na
Boron	2	97.7	ug/L	20091023.R13na
Cadmium	0.1	<0.1	ug/L	20091023.R13na
Calcium	500	79400	ug/L	20091023.R13na
Cerium	1	<1	ug/L	20091023.R13na
Cesium	1	<1	ug/L	20091023.R13na
Chromium	1	5	ug/L	20091023.R13na

Sample Name: Vistabella River Inland **Date: 10/20/09** **Matrix: Water** **Lab #: 255517**

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Cobalt	0.1	0.37	ug/L	20091023.R13na
Copper	1	6.1	ug/L	20091023.R13na
Europium	1	<1	ug/L	20091023.R13na
Gallium	1	<1	ug/L	20091023.R13na
Iron	20	375	ug/L	20091023.R13na
Lanthanum	1	<1	ug/L	20091023.R13na
Lead	1	<1	ug/L	20091023.R13na
Lithium	5	7.6	ug/L	20091023.R13na
Magnesium	40	10800	ug/L	20091023.R13na
Manganese	1	58.1	ug/L	20091023.R13na
Mercury	0.1	<0.1	ug/L	20091023.R13na
Molybdenum	1	<1	ug/L	20091023.R13na
Nickel	1	3.9	ug/L	20091023.R13na
Niobium	1	<1	ug/L	20091023.R13na
Rubidium	1	3.3	ug/L	20091023.R13na
Scandium	1	2.2	ug/L	20091023.R13na
Selenium	1	1.6	ug/L	20091023.R13na
Silicon	20	10300	ug/L	20091023.R13na
Silver	0.1	<0.1	ug/L	20091023.R13na
Strontium	10	460	ug/L	20091023.R13na
Sulfur	800	67200	ug/L	20091023.R13na
Thallium	0.1	<0.1	ug/L	20091023.R13na
Thorium	1	<1	ug/L	20091023.R13na
Tin	1	<1	ug/L	20091023.R13na
Titanium	1	35.9	ug/L	20091023.R13na
Tungsten	1	<1	ug/L	20091023.R13na
Uranium	1	<1	ug/L	20091023.R13na
Vanadium	1	3.3	ug/L	20091023.R13na
Yttrium	1	<1	ug/L	20091023.R13na
Zinc	1	6.9	ug/L	20091023.R13na
Zirconium	1	<1	ug/L	20091023.R13na

TP FIA Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Phosphorus (as P)	0.002	0.489	mg/L	20091027.R23.2A

TSS - 500				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Suspended Solids	2	21	mg/L	20091023.R27D

Sample Name: Cipero River Gulf **Date: 10/20/09** **Matrix: Water** **Lab #: 255518**

AmmoniaFIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Ammonia (as N)	0.01	0.163	mg/L	20091027.R42.1A

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Sample Name: Cipero River Gulf **Date: 10/20/09** **Matrix: Water** **Lab #: 255518**

Anions Water

Parameter	MDL	Result	Units	QAQCID
Nitrate (as N)	10	<10	mg/L	20091028.R5A

BOD

Parameter	MDL	Result	Units	QAQCID
BOD (5 day)	75	350	mg/L	20091023.BOD1

CN Total Water FIA

Parameter	MDL	Result	Units	QAQCID
Total Cyanide	0.001	<0.001	mg/L	20091023.R43.1B

COD

Parameter	MDL	Result	Units	QAQCID
Chemical Oxygen Demand	50	799	mg/L	20091026.R4A

FC (MF) SSM

Parameter	MDL	Result	Units	QAQCID
Fecal Coliforms	1000	TNTC	CFU/100mL	20091022.SBAC1F

ICPMS Water

Parameter	MDL	Result	Units	QAQCID
Aluminum	1	505	ug/L	20091023.R13na
Antimony	0.5	<0.5	ug/L	20091023.R13na
Arsenic	1	13.3	ug/L	20091023.R13na
Barium	1	134	ug/L	20091023.R13na
Beryllium	0.5	<0.5	ug/L	20091023.R13na
Bismuth	1	<1	ug/L	20091023.R13na
Boron	2	446	ug/L	20091023.R13na
Cadmium	0.1	<0.1	ug/L	20091023.R13na
Calcium	500	157000	ug/L	20091023.R13na
Cerium	1	2.2	ug/L	20091023.R13na
Cesium	1	<1	ug/L	20091023.R13na
Chromium	1	11.2	ug/L	20091023.R13na
Cobalt	0.1	3.52	ug/L	20091023.R13na
Copper	1	39.4	ug/L	20091023.R13na
Europium	1	<1	ug/L	20091023.R13na
Gallium	1	1.7	ug/L	20091023.R13na
Iron	200	9470	ug/L	20091023.R13na
Lanthanum	1	<1	ug/L	20091023.R13na
Lead	1	<1	ug/L	20091023.R13na
Lithium	5	14	ug/L	20091023.R13na
Magnesium	40	93900	ug/L	20091023.R13na
Manganese	10	815	ug/L	20091023.R13na
Mercury	0.1	<0.1	ug/L	20091023.R13na
Molybdenum	1	<1	ug/L	20091023.R13na
Nickel	1	8.9	ug/L	20091023.R13na
Niobium	1	<1	ug/L	20091023.R13na
Rubidium	1	8.4	ug/L	20091023.R13na
Scandium	1	2.2	ug/L	20091023.R13na

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Sample Name: Cipero River Gulf **Date: 10/20/09** **Matrix: Water** **Lab #: 255518**

ICPMS Water

Parameter	MDL	Result	Units	QAQCID
Selenium	1	35.4	ug/L	20091023.R13na
Silicon	2	9810	ug/L	20091023.R13na
Silver	0.1	<0.1	ug/L	20091023.R13na
Strontium	10	958	ug/L	20091023.R13na
Sulfur	8000	166000	ug/L	20091023.R13na
Thallium	0.1	<0.1	ug/L	20091023.R13na
Thorium	1	<1	ug/L	20091023.R13na
Tin	1	<1	ug/L	20091023.R13na
Titanium	1	15.6	ug/L	20091023.R13na
Tungsten	1	<1	ug/L	20091023.R13na
Uranium	1	<1	ug/L	20091023.R13na
Vanadium	1	22.1	ug/L	20091023.R13na
Yttrium	1	1	ug/L	20091023.R13na
Zinc	1	20.6	ug/L	20091023.R13na
Zirconium	1	<1	ug/L	20091023.R13na

TP FIA Water

Parameter	MDL	Result	Units	QAQCID
Total Phosphorus (as P)	0.02	1.46	mg/L	20091029.R23.2A

TSS - 500

Parameter	MDL	Result	Units	QAQCID
Total Suspended Solids	8	704	mg/L	20091023.R27D

Sample Name: Cipero River Mid-way **Date: 10/20/09** **Matrix: Water** **Lab #: 255519**

AmmoniaFIA

Parameter	MDL	Result	Units	QAQCID
Ammonia (as N)	0.01	0.052	mg/L	20091027.R42.1A

Anions Water

Parameter	MDL	Result	Units	QAQCID
Nitrate (as N)	0.1	<0.1	mg/L	20091027.R5C

BOD

Parameter	MDL	Result	Units	QAQCID
BOD (5 day)	30	416	mg/L	20091028.BOD1

CN Total Water FIA

Parameter	MDL	Result	Units	QAQCID
Total Cyanide	0.001	<0.001	mg/L	20091023.R43.1B

COD

Parameter	MDL	Result	Units	QAQCID
Chemical Oxygen Demand	50	827	mg/L	20091026.R4A

FC (MF) SSM

Parameter	MDL	Result	Units	QAQCID
Fecal Coliforms	1000	TNTC	CFU/100mL	20091022.SBAC1F

Sample Name: Cipero River Mid-way — **Date: 10/20/09** — **Matrix: Water** — **Lab #: 255519**

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	1	951	ug/L	20091023.R13na
Antimony	0.5	<0.5	ug/L	20091023.R13na
Arsenic	1	2.9	ug/L	20091023.R13na
Barium	1	79	ug/L	20091023.R13na
Beryllium	0.5	<0.5	ug/L	20091023.R13na
Bismuth	1	<1	ug/L	20091023.R13na
Boron	2	53.7	ug/L	20091023.R13na
Cadmium	0.1	<0.1	ug/L	20091023.R13na
Calcium	500	111000	ug/L	20091023.R13na
Cerium	1	1.2	ug/L	20091023.R13na
Cesium	1	<1	ug/L	20091023.R13na
Chromium	1	8.6	ug/L	20091023.R13na
Cobalt	0.1	1.58	ug/L	20091023.R13na
Copper	1	8	ug/L	20091023.R13na
Europium	1	<1	ug/L	20091023.R13na
Gallium	1	1.5	ug/L	20091023.R13na
Iron	200	1900	ug/L	20091023.R13na
Lanthanum	1	<1	ug/L	20091023.R13na
Lead	1	<1	ug/L	20091023.R13na
Lithium	5	5.7	ug/L	20091023.R13na
Magnesium	4	7540	ug/L	20091023.R13na
Manganese	1	421	ug/L	20091023.R13na
Mercury	0.1	<0.1	ug/L	20091023.R13na
Molybdenum	1	<1	ug/L	20091023.R13na
Nickel	1	4.9	ug/L	20091023.R13na
Niobium	1	<1	ug/L	20091023.R13na
Rubidium	1	2.9	ug/L	20091023.R13na
Scandium	1	2.3	ug/L	20091023.R13na
Selenium	1	3	ug/L	20091023.R13na
Silicon	20	15900	ug/L	20091023.R13na
Silver	0.1	<0.1	ug/L	20091023.R13na
Strontium	10	349	ug/L	20091023.R13na
Sulfur	800	19400	ug/L	20091023.R13na
Thallium	0.1	1.09	ug/L	20091023.R13na
Thorium	1	<1	ug/L	20091023.R13na
Tin	1	<1	ug/L	20091023.R13na
Titanium	1	53	ug/L	20091023.R13na
Tungsten	1	<1	ug/L	20091023.R13na
Uranium	1	<1	ug/L	20091023.R13na
Vanadium	1	3	ug/L	20091023.R13na
Yttrium	1	<1	ug/L	20091023.R13na
Zinc	1	15.5	ug/L	20091023.R13na
Zirconium	1	<1	ug/L	20091023.R13na

Sample Name: Cipero River Mid-way — **Date: 10/20/09** — **Matrix: Water** — **Lab #: 255519**

TP FIA Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Phosphorus (as P)	0.002	0.148	mg/L	20091027.R23.2A

TSS - 500				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Suspended Solids	2	67	mg/L	20091023.R27D

Sample Name: Cipero River Inland — **Date: 10/20/09** — **Matrix: Water** — **Lab #: 255520**

AmmoniaFIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Ammonia (as N)	0.01	0.067	mg/L	20091027.R42.1A

Anions Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Nitrate (as N)	0.1	<0.1	mg/L	20091027.R5C

BOD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
BOD (5 day)	30	> 479	mg/L	20091028.BOD1

CN Total Water FIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Cyanide	0.001	<0.001	mg/L	20091023.R43.1B

COD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Chemical Oxygen Demand	50	1060	mg/L	20091026.R4A

FC (MF) SSM				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Fecal Coliforms	1000	198000	CFU/100mL	20091022.SBAC1F

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	10	2050	ug/L	20091023.R13na
Antimony	0.5	<0.5	ug/L	20091023.R13na
Arsenic	1	3	ug/L	20091023.R13na
Barium	1	66	ug/L	20091023.R13na
Beryllium	0.5	<0.5	ug/L	20091023.R13na
Bismuth	1	<1	ug/L	20091023.R13na
Boron	2	62.9	ug/L	20091023.R13na
Cadmium	0.1	<0.1	ug/L	20091023.R13na
Calcium	500	83100	ug/L	20091023.R13na
Cerium	1	1.9	ug/L	20091023.R13na
Cesium	1	<1	ug/L	20091023.R13na
Chromium	1	11	ug/L	20091023.R13na
Cobalt	0.1	0.55	ug/L	20091023.R13na
Copper	1	8.8	ug/L	20091023.R13na
Europium	1	<1	ug/L	20091023.R13na
Gallium	1	1.7	ug/L	20091023.R13na

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Sample Name: Cipero River Inland | **Date: 10/20/09** | **Matrix: Water** | **Lab #: 255520**

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Iron	200	1200	ug/L	20091023.R13na
Lanthanum	1	<1	ug/L	20091023.R13na
Lead	1	<1	ug/L	20091023.R13na
Lithium	5	7.6	ug/L	20091023.R13na
Magnesium	4	7290	ug/L	20091023.R13na
Manganese	1	47.9	ug/L	20091023.R13na
Mercury	0.1	<0.1	ug/L	20091023.R13na
Molybdenum	1	1.1	ug/L	20091023.R13na
Nickel	1	5	ug/L	20091023.R13na
Niobium	1	<1	ug/L	20091023.R13na
Rubidium	1	4.7	ug/L	20091023.R13na
Scandium	1	3.2	ug/L	20091023.R13na
Selenium	1	2.9	ug/L	20091023.R13na
Silicon	20	15100	ug/L	20091023.R13na
Silver	0.1	<0.1	ug/L	20091023.R13na
Strontium	10	277	ug/L	20091023.R13na
Sulfur	800	24100	ug/L	20091023.R13na
Thallium	0.1	0.28	ug/L	20091023.R13na
Thorium	1	<1	ug/L	20091023.R13na
Tin	1	<1	ug/L	20091023.R13na
Titanium	1	99.4	ug/L	20091023.R13na
Tungsten	1	<1	ug/L	20091023.R13na
Uranium	1	<1	ug/L	20091023.R13na
Vanadium	1	9.6	ug/L	20091023.R13na
Yttrium	1	<1	ug/L	20091023.R13na
Zinc	1	17.3	ug/L	20091023.R13na
Zirconium	1	1.8	ug/L	20091023.R13na

TP FIA Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Phosphorus (as P)	0.002	0.137	mg/L	20091027.R23.2A

TSS - 500				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Suspended Solids	2	69	mg/L	20091023.R27D

Sample Name: Alley's Creek River | **Date: 10/20/09** | **Matrix: Water** | **Lab #: 255521**

AmmoniaFIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Ammonia (as N)	0.01	2.34	mg/L	20091027.R42.1A

Anions Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Nitrate (as N)	0.1	0.22	mg/L	20091027.R5C

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Sample Name: Alley's Creek River | **Date: 10/20/09** | **Matrix: Water** | **Lab #: 255521**

BOD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
BOD (5 day)	3	22	mg/L	20091023.BOD1

CN Total Water FIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Cyanide	0.001	0.0118	mg/L	20091023.R43.1B
Total Cyanide (Dup)	0.001	0.0118	mg/L	20091023.R43.1B

COD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Chemical Oxygen Demand	5	38	mg/L	20091026.R4A

FC (MF) SSM				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Fecal Coliforms	1000	112000	CFU/100mL	20091022.SBAC1F

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	1	283	ug/L	20091023.R13na
Antimony	0.5	<0.5	ug/L	20091023.R13na
Arsenic	1	2.8	ug/L	20091023.R13na
Barium	1	47.7	ug/L	20091023.R13na
Beryllium	0.5	<0.5	ug/L	20091023.R13na
Bismuth	1	<1	ug/L	20091023.R13na
Boron	2	415	ug/L	20091023.R13na
Cadmium	0.1	<0.1	ug/L	20091023.R13na
Calcium	500	70600	ug/L	20091023.R13na
Cerium	1	<1	ug/L	20091023.R13na
Cesium	1	<1	ug/L	20091023.R13na
Chromium	1	4.9	ug/L	20091023.R13na
Cobalt	0.1	0.44	ug/L	20091023.R13na
Copper	1	4.8	ug/L	20091023.R13na
Europium	1	<1	ug/L	20091023.R13na
Gallium	1	<1	ug/L	20091023.R13na
Iron	20	269	ug/L	20091023.R13na
Lanthanum	1	<1	ug/L	20091023.R13na
Lead	1	<1	ug/L	20091023.R13na
Lithium	5	5.4	ug/L	20091023.R13na
Magnesium	4	8150	ug/L	20091023.R13na
Manganese	1	63	ug/L	20091023.R13na
Mercury	0.1	<0.1	ug/L	20091023.R13na
Molybdenum	1	1.1	ug/L	20091023.R13na
Nickel	1	3.7	ug/L	20091023.R13na
Niobium	1	<1	ug/L	20091023.R13na
Rubidium	1	5	ug/L	20091023.R13na
Scandium	1	1.8	ug/L	20091023.R13na
Selenium	1	3.2	ug/L	20091023.R13na
Silicon	2	8580	ug/L	20091023.R13na
Silver	0.1	<0.1	ug/L	20091023.R13na

Sample Name: Alley's Creek River **Date: 10/20/09** **Matrix: Water** **Lab #: 255521**

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Strontium	10	294	ug/L	20091023.R13na
Sulfur	800	17000	ug/L	20091023.R13na
Thallium	0.1	0.25	ug/L	20091023.R13na
Thorium	1	<1	ug/L	20091023.R13na
Tin	1	<1	ug/L	20091023.R13na
Titanium	1	35.2	ug/L	20091023.R13na
Tungsten	1	<1	ug/L	20091023.R13na
Uranium	1	<1	ug/L	20091023.R13na
Vanadium	1	3.5	ug/L	20091023.R13na
Yttrium	1	<1	ug/L	20091023.R13na
Zinc	1	29.7	ug/L	20091023.R13na
Zirconium	1	<1	ug/L	20091023.R13na

TP FIA Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Phosphorus (as P)	0.002	0.801	mg/L	20091027.R23.2A

TSS - 500				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Suspended Solids	2	10	mg/L	20091023.R27D

MDL Method detection limit or minimum reporting limit.
% Rec Surrogate compounds are added to the sample in some cases and the recovery is reported as a percent recovered.
QAQCID This is a unique reference to the quality control data set used to generate the reported value.
Data reported for organic analysis in soil samples are corrected for moisture content
Matrix If the matrix is a leachate, the sample was extracted according to regulation 558.
INT Interferences
TNTC Too numerous to count
ND Not detected

Quality Control Data:

AmmoniaFIA

1.0 ppm Control						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Ammonia (as N)	0.01	mg/L	1.2	1.09	0.8	20091027.R42.1A

Blank						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Ammonia (as N)	0.01	mg/L	0.03	<0.01	<0.01	20091027.R42.1A

Anions Water

Blank (IC-2)						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Nitrate (as N)	0.1	mg/L	0.5	<0.1	<0.1	20091027.R5C
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Nitrate (as N)	0.1	mg/L	0.5	<0.1	<0.1	20091028.R5A

Control (IC-2)						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Nitrate (as N)	0.1	mg/L	57.5	50	40	20091027.R5C
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Nitrate (as N)	0.1	mg/L	57.5	48.9	40	20091028.R5A

BOD

BOD Blank						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
BOD (5 day)	0.2	mg/L	0.2	<0.2	<0.2	20091023.BOD1
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
BOD (5 day)	0.2	mg/L	0.2	<0.2	<0.2	20091028.BOD1

BOD Control						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
BOD (5 day)	100	mg/L	230	220	167.5	20091023.BOD1
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
BOD (5 day)	100	mg/L	230	230	167.5	20091028.BOD1

CN Total Water FIA

0.05 mg/L Control						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Total Cyanide	0.002	mg/L	0.06	0.054	0.04	20091023.R43.1B

Blank						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Total Cyanide	0.002	mg/L	<0.002	<0.002	<0.002	20091023.R43.1B

COD

100 ppm control						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Chemical Oxygen Demand	5	mg/L	120	119	80	20091026.R4A

Blank						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Chemical Oxygen Demand	5	mg/L	15	<5	<5	20091026.R4A

ICPMS Water

Blank						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Aluminum	1	ug/L	1	<1	<1	20091023.R13na
Antimony	0.5	ug/L	0.5	<0.5	<0.5	20091023.R13na
Arsenic	1	ug/L	1	<1	<1	20091023.R13na
Barium	0.5	ug/L	0.5	<0.5	<0.5	20091023.R13na
Beryllium	1	ug/L	1	<1	<1	20091023.R13na
Bismuth	1	ug/L	3	<1	<1	20091023.R13na
Boron	1	ug/L	1	<1	<1	20091023.R13na
Cadmium	1	ug/L	1	<1	<1	20091023.R13na
Calcium	50	ug/L	150	<50	<50	20091023.R13na
Cerium	0.1	ug/L	0.1	<0.1	<0.1	20091023.R13na
Cesium	1	ug/L	1	<1	<1	20091023.R13na
Chromium	1	ug/L	1	<1	<1	20091023.R13na
Cobalt	1	ug/L	1	<1	<1	20091023.R13na
Europium	1	ug/L	1	<1	<1	20091023.R13na
Gallium	1	ug/L	1	<1	<1	20091023.R13na
Iron	20	ug/L	20	<20	<20	20091023.R13na
Lanthanum	1	ug/L	1	<1	<1	20091023.R13na
Lead	1	ug/L	1	<1	<1	20091023.R13na
Lithium	5	ug/L	5	<5	<5	20091023.R13na
Magnesium	4	ug/L	4	<4	<4	20091023.R13na
Manganese	1	ug/L	1	<1	<1	20091023.R13na
Mercury	0.1	ug/L	0.1	<0.1	<0.1	20091023.R13na
Molybdenum	1	ug/L	1	<1	<1	20091023.R13na
Nickel	1	ug/L	1	<1	<1	20091023.R13na
Niobium	1	ug/L	1	<1	<1	20091023.R13na
Rubidium	1	ug/L	1	<1	<1	20091023.R13na
Scandium	1	ug/L	1	<1	<1	20091023.R13na
Selenium	1	ug/L	1	<1	<1	20091023.R13na
Silver	0.1	ug/L	0.1	<0.1	<0.1	20091023.R13na
Strontium	1	ug/L	1	<1	<1	20091023.R13na
Thallium	1	ug/L	1	<1	<1	20091023.R13na
Thorium	1	ug/L	1	<1	<1	20091023.R13na
Tin	1	ug/L	1	<1	<1	20091023.R13na
Titanium	0.1	ug/L	0.1	<0.1	<0.1	20091023.R13na
Tungsten	1	ug/L	1	<1	<1	20091023.R13na
Uranium	1	ug/L	1	<1	<1	20091023.R13na
Vanadium	1	ug/L	1	<1	<1	20091023.R13na

ICPMS Water

Blank						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Yttrium	1	ug/L	1	<1	<1	20091023.R13na
Zinc	1	ug/L	1	<1	<1	20091023.R13na
Zirconium	1	ug/L	1	<1	<1	20091023.R13na

Positive Control (1011)						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Aluminum	1	ug/L	600	505	400	20091023.R13na
Arsenic	1	ug/L	120	101	80	20091023.R13na
Barium	1	ug/L	120	94.7	80	20091023.R13na
Beryllium	1	ug/L	125	100	75	20091023.R13na
Boron	2	ug/L	110	104	90	20091023.R13na
Cadmium	1	ug/L	120	97.3	80	20091023.R13na
Calcium	50	ug/L	1200	1060	800	20091023.R13na
Chromium	1	ug/L	110	98.7	90	20091023.R13na
Cobalt	1	ug/L	120	104	80	20091023.R13na
Copper	1	ug/L	120	94.5	80	20091023.R13na
Iron	20	ug/L	600	494	400	20091023.R13na
Lead	1	ug/L	120	98	80	20091023.R13na
Magnesium	4	ug/L	1200	1040	800	20091023.R13na
Manganese	1	ug/L	120	92.8	80	20091023.R13na
Molybdenum	1	ug/L	120	106	80	20091023.R13na
Nickel	1	ug/L	120	99.3	80	20091023.R13na
Selenium	1	ug/L	120	99.9	80	20091023.R13na
Thallium	1	ug/L	120	101	80	20091023.R13na
Vanadium	1	ug/L	120	96.4	80	20091023.R13na
Zinc	1	ug/L	120	91.3	80	20091023.R13na

TP FIA Water

Blank						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Total Phosphorus (as P)	0.002	mg/L	0.005	<0.002	<0.002	20091027.R23.2A
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Total Phosphorus (as P)	0.002	mg/L	0.005	<0.002	<0.002	20091029.R23.2A

Control (0.05 mg/L)						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Total Phosphorus (as P)	0.002	mg/L	0.06	0.0492	0.04	20091027.R23.2A
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Total Phosphorus (as P)	0.002	mg/L	0.06	0.051	0.04	20091029.R23.2A

TSS - 500

160 mg/L Control						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Total Suspended Solids	6	mg/L	192	165	128	20091023.R27D

AECOM - Trinidad   Work Order: 92047

TSS - 500

Blank						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Total Suspended Solids	1.2	mg/L	<1.2	<1.2	<1.2	20091023.R27D

UCL Upper Control Limit
LCL Lower Control Limit

WATER SAMPLE RESULTS TAKEN FROM YSI AUTOMATIC SAMPLER
20-Oct-09

Sample Site: Cipero River (Gulf) (CIG)
**Values omitted from average calculation

Minute interval	Time	Temp. (°C)	Sp. Cond. (mS/cm)	DO Conc.(mg/L)	pH	pHmV (mV)
1	11:48:34	28.86	5.082	**6.29	7.4	**-42
	11:49:04	28.82	5.076	1.37	7.02	-19.9
2	11:49:34	28.84	5.067	0.82	6.9	-13.3
	11:50:04	28.85	5.055	0.64	6.84	-9.6
3	11:50:34	28.85	5.045	0.54	6.8	-7.4
	11:51:04	28.88	5.036	0.46	6.77	-5.8
4	11:51:34	28.9	5.031	0.41	6.76	-4.8
	11:52:04	28.89	5.028	0.37	6.74	-3.6
5	11:52:34	28.89	5.026	0.34	6.73	-3.4
	11:53:04	28.89	5.025	0.3	6.73	-3.1
Average		**28.87**	**5.04**	**0.49**	**6.78**	**-6.38**

Sample Site: Cipero River (Midway) (CIM)

Minute interval	Time	Temp. (°C)	Sp. Cond. (mS/cm)	DO Conc.(mg/L)	pH	pHmV (mV)
1	12:43:19	27.72	0.557	1.04	7.33	-38.1
	12:43:49	27.73	0.438	1.38	7.13	-26.4
2	12:44:19	27.67	0.517	3.44	7	-19.1
	12:44:49	27.66	0.326	3.44	6.97	-16.8
3	12:45:19	27.66	0.557	1.26	6.95	-16.1
	12:45:49	27.7	0.556	0.79	6.94	-15.5
4	12:46:19	27.72	0.557	0.71	6.93	-14.9
	12:46:49	27.77	0.557	0.67	6.93	-14.5
5	12:47:19	27.85	0.557	0.7	6.92	-14.2
	12:47:49	27.91	0.557	0.71	6.92	-14
Average		**27.77**	**0.56**	**0.81**	**6.93**	**-14.87**

Sample Site: Cipero River (Inland) (CII)

Minute interval	Time	Temp. (°C)	Sp. Cond. (mS/cm)	DO Conc.(mg/L)	pH	pHmV (mV)
1	13:00:34	26.49	0.871	4.63	7.54	-49.7
	13:01:04	26.49	0.87	4.76	7.52	-48.8
2	13:01:34	26.49	0.871	4.89	7.51	-48
	13:02:04	26.49	0.872	4.78	7.5	-47.4
3	13:02:34	26.49	0.872	4.84	7.5	-47.4
	13:03:04	26.49	0.873	4.77	7.5	-47.5
4	13:03:34	26.49	0.874	4.75	7.51	-47.8
	13:04:04	26.49	0.877	4.77	7.52	-48.5
5	13:04:34	26.49	0.88	4.85	7.52	-48.7
	13:05:04	26.49	0.881	4.75	7.52	-48.7
Average		**26.49**	**0.87**	**4.78**	**7.51**	**-48.25**

WATER SAMPLE RESULTS TAKEN FROM YSI AUTOMATIC SAMPLER
20-Oct-09

Sample Site: Guaracara River (Gulf) (GUG)

Minute interval	Time	Temp. (°C)	Sp. Cond. (mS/cm)	DO Conc.(mg/L)	pH	pHmV (mV)
	7:38:39	26.8	8.368	4.65	7.52	-48.9
1	7:39:09	26.82	8.367	4.35	7.51	-48.3
	7:39:39	26.82	8.366	3.86	7.5	-47.7
2	7:40:09	26.8	8.368	3.63	7.49	-47.2
	7:40:39	26.81	8.366	3.54	7.49	-46.9
3	7:41:09	26.79	8.368	3.51	7.49	-46.7
	7:41:39	26.78	8.369	3.45	7.48	-46.6
4	7:42:09	26.78	8.369	3.39	7.48	-46.4
	7:42:39	26.78	8.368	3.34	7.48	-46.3
5	7:43:09	26.76	8.37	3.28	7.48	-46.2
Average		**26.79**	**8.37**	**3.50**	**7.49**	**-46.75**

Sample Site: Guaracara River (Inland) (GUI)

Minute interval	Time	Temp. (°C)	Sp. Cond. (mS/cm)	DO Conc.(mg/L)	pH	pHmV (mV)
	9:48:33	25.13	0.355	5.96	7.69	-58.6
1	9:49:03	25.14	0.356	5.75	7.69	-55.8
	9:49:33	25.14	0.356	5.47	7.6	-53.4
2	9:50:03	25.14	0.358	5.22	7.58	-51.9
	9:50:33	25.14	0.356	5.48	7.56	-50.8
3	9:51:03	25.14	0.358	5.25	7.54	-50
	9:51:33	25.15	0.355	5.57	7.53	-49.1
4	9:52:03	25.15	0.356	5.28	7.52	-48.7
	9:52:33	25.15	0.356	5.51	7.51	-48.2
5	9:53:03	25.15	0.355	5.53	7.51	-47.8
Average		**25.15**	**0.36**	**5.44**	**7.53**	**-49.10**

Sample Site: Marabella River (Gulf) (MAG)

Minute interval	Time	Temp. (°C)	Sp. Cond. (mS/cm)	DO Conc.(mg/L)	pH	pHmV (mV)
	6:58:41	25.81	6.109	1.96	7.29	-35.4
1	6:59:31	25.8	6.046	1.97	7.28	-34.8
	7:00:01	25.79	6.109	2	7.27	-34.4
2	7:00:31	25.78	6.11	2.03	7.27	-34.2
	7:01:01	25.72	6.109	2.38	7.26	-33.8
3	7:01:31	25.73	6.108	2.22	7.25	-33.4
	7:02:01	25.73	6.108	2.09	7.25	-33.1
4	7:02:31	25.73	6.108	2.04	7.25	-32.9
	7:03:01	25.73	6.108	2.03	7.24	-32.8
5	7:03:31	25.72	6.108	2.02	7.24	-32.7
Average		**25.75**	**6.10**	**2.07**	**7.26**	**-33.75**

WATER SAMPLE RESULTS TAKEN FROM YSI AUTOMATIC SAMPLER
20-Oct-09

WATER SAMPLE RESULTS TAKEN FROM YSI AUTOMATIC SAMPLER
20-Oct-09

Sample Site: Marabella River (Inland) (MAI)

Minute interval	Time	Temp. (°C)	Sp. Cond. (mS/cm)	DO Conc.(mg/L)	pH	pHmV (mV)
	8:25:11	25.17	0.662	4.43	7.76	-62.5
1	8:25:41	25.1	0.663	4.01	7.72	-60
	8:26:11	25.03	0.663	3.91	7.69	-58.1
2	8:26:41	24.87	0.665	3.92	7.67	-57.1
	8:27:11	24.89	0.664	3.87	7.66	-56.3
3	8:27:41	24.95	0.664	3.79	7.64	-55.6
	8:28:11	24.98	0.664	3.76	7.63	-55
4	8:28:41	24.99	0.664	3.75	7.63	-54.6
	8:29:11	25.01	0.664	3.72	7.62	-54.3
5	8:29:41	25.04	0.664	3.67	7.62	-54
Average		**24.98**	**0.66**	**3.76**	**7.63**	**-54.97**

Sample Site: Vistabella River (Inland) (VII)

Minute interval	Time	Temp. (°C)	Sp. Cond. (mS/cm)	DO Conc.(mg/L)	pH	pHmV (mV)
	10:41:01	26.35	0.644	3.8	7.49	-47.2
1	10:41:31	26.36	0.644	3.5	7.47	-45.6
	10:42:01	26.36	0.643	3.34	7.45	-44.8
2	10:42:31	26.37	0.644	3.21	7.45	-44.5
	10:43:01	26.37	0.644	3.17	7.44	-44.1
3	10:43:31	26.38	0.643	3.01	7.43	-43.7
	10:44:01	26.37	0.643	2.94	7.43	-43.5
4	10:44:31	26.4	0.644	2.92	7.43	-43.6
	10:45:01	26.39	0.644	2.92	7.43	-43.6
5	10:45:31	26.38	0.643	3.02	7.42	-43.2
Average		**26.38**	**0.64**	**3.00**	**7.43**	**-43.62**

Sample Site: Vistabella River (Gulf) (VIG)

Minute interval	Time	Temp. (°C)	Sp. Cond. (mS/cm)	DO Conc.(mg/L)	pH	pHmV (mV)
	11:10:32	27.65	45.96	1.16	7.09	-23.8
1	11:11:02	27.63	46.094	0.61	7.15	-27.6
	11:11:32	27.62	46.179	0.35	7.2	-30.4
2	11:12:02	27.65	46.222	0.35	7.22	-31.7
	11:12:32	27.65	46.333	0.27	7.24	-32.7
3	11:13:02	27.62	46.373	0.22	7.26	-33.9
	11:13:32	27.61	46.394	0.24	7.27	-34.6
4	11:14:02	27.62	46.394	0.2	7.28	-34.9
	11:14:32	27.63	46.407	0.2	7.28	-35.3
5	11:15:02	27.61	45.456	0.16	7.3	-35.9
Average		**27.62**	**46.23**	**0.22**	**7.27**	**-34.55**

WATER SAMPLE RESULTS TAKEN FROM YSI AUTOMATIC SAMPLER
20-Oct-09

Sample Site: Alley's Creek River (ACR)

Minute interval	Time	Temp. (°C)	Sp. Cond. (mS/cm)	DO Conc.(mg/L)	pH	pHmV (mV)
	12:21:57	29.49	0.65	4.32	7.74	-61.6
1	12:22:27	29.55	0.648	4.19	7.73	-61.1
	12:22:57	29.51	0.651	4.35	7.71	-60.2
2	12:23:27	29.54	0.651	4.24	7.72	-60.6
	12:23:57	29.56	0.651	4.34	7.72	-60.4
3	12:24:27	29.55	0.654	4.31	7.72	-60.5
	12:24:57	29.57	0.653	4.38	7.71	-60.1
4	12:25:27	29.76	0.649	4.41	7.72	-60.5
	12:25:57	29.83	0.642	4.56	7.73	-61.1
5	12:26:27	29.68	0.648	4.24	7.72	-60.5
Average		**29.63**	**0.65**	**4.35**	**7.72**	**-60.49**

TESTMARK Laboratories Ltd.

Committed to Quality and Service

Analytical Report

Client:	Natalie Wilson	**Work Order Number:**	**81656**
Company:	AECOM - Trinidad	**Date Order Received:**	06/09/09
Address:	26 Kelly Kenny Street Woodbrook, W.I.,	**Regulation:**	Information not provided
		PO #:	
Phone:	(868) 628-9710	**Project #:**	
Fax:	(868) 628-0862		
Email:	natalie.wilson@aecom.com		

Analyses were performed on the following samples submitted with your order.
The results relate only to the items tested.

Sample Name	Lab #	Matrix	Type	Comments	Date Collected	Time Collected
GUI	231013	Water	Grab		06/03/09	9:36
GUG	231014	Water	Grab		06/03/09	7:09
MAI	231015	Water	Grab		06/03/09	10:24
MAG	231073	Water	Grab		06/03/09	6:34
CII	231074	Water	Grab		06/03/09	8:49
CIG	231075	Water	Grab		06/03/09	8:01

TESTMARK Laboratories Ltd.

Committed to Quality and Service

The following instrumentation and reference methods were used for your sample(s)

Method Name	Description	Reference
AmmoniaFIA	Determination of Ammonia/Ammonium by Flow Analysis **Instrument group:** Skalar San++ FIA	Mod. APHA-4500
Anions Water	Determination of Anions by Ion Chromatography **Instrument group:** Dionex IC	Mod. SW846-9056
BOD	Determination of Biochemical Oxygen Demand **Instrument group:** YSI DO Meter	Mod. APHA-5210
CN Total Water FIA	Determination of Total Cyanide in Water by Flow Injection Analysis **Instrument group:** Skalar San++ FIA	Mod. APHA-4500
COD	Determination of Chemical Oxygen Demand **Instrument group:** Bausch & Lomb Spectrometer	Mod. APHA-5220
FC (MF)	Determination of Thermotolerent Coliforms in water by Membrane Filtration **Instrument group:** Subcontracted Analysis	Mod. MOE E3433
ICPMS Water	Determination of Metals in Water by ICP/MS **Instrument group:** Perkin Elmer ICPMS	Mod. SW846-6020
TP FIA Water	Determination of Total Phosphorus by FIA/UV Digestion **Instrument group:** Skalar San++ FIA	Mod. APHA-4500
TSS	Determination of Total Suspended Solids in water by gravimetry **Instrument group:** Mettler Toledo Balance	Mod. APHA-2540

This report has been approved by:

M. Lamontagne

Mariane Lamontagne, B.Sc.
Senior Microbiologist

Brad Halvorson

Brad Halvorson, B. Sc.
Inorganic Section Head

Sample Data:

Sample Name: GUI **Date: 06/03/09** **Matrix: Water** **Lab #: 231013**

AmmoniaFIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Ammonia (as N)	0.01	0.219	mg/L	20090611.R42.1A

Anions Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Nitrate (as N)	0.1	0.57	mg/L	20090614.R5B

BOD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
BOD (5 day)	0.5	1.3	mg/L	20090610.BOD1

CN Total Water FIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Cyanide	0.001	<0.001	mg/L	20090611.R43.1A

COD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Chemical Oxygen Demand	5	8.8	mg/L	20090610.R4A

FC (MF)				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Fecal Coliforms	5	360	CFU/100mL	20090616.R10A

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	1	17.7	ug/L	20090611.R13E
Antimony	0.5	2.4	ug/L	20090611.R13E
Arsenic	1	4	ug/L	20090611.R13E
Barium	1	31.4	ug/L	20090611.R13E
Beryllium	0.5	<0.5	ug/L	20090611.R13E
Bismuth	1	<1	ug/L	20090611.R13E
Boron	2	95	ug/L	20090611.R13E
Cadmium	0.1	<0.1	ug/L	20090611.R13E
Calcium	500	46300	ug/L	20090611.R13E
Cerium	1	<1	ug/L	20090611.R13E
Cesium	1	<1	ug/L	20090611.R13E
Chromium	1	<1	ug/L	20090611.R13E
Cobalt	0.1	0.22	ug/L	20090611.R13E
Copper	1	1.6	ug/L	20090611.R13E
Europium	1	<1	ug/L	20090611.R13E
Gallium	1	<1	ug/L	20090611.R13E
Iron	20	27	ug/L	20090611.R13E
Lanthanum	1	<1	ug/L	20090611.R13E
Lead	1	<1	ug/L	20090611.R13E
Lithium	5	5.4	ug/L	20090611.R13E
Magnesium	40	7520	ug/L	20090611.R13E
Manganese	1	21.5	ug/L	20090611.R13E
Mercury	0.1	<0.1	ug/L	20090611.R13E

Sample Name: GUI **Date: 06/03/09** **Matrix: Water** **Lab #: 231013**

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Molybdenum	1	5.7	ug/L	20090611.R13E
Nickel	1	4.3	ug/L	20090611.R13E
Niobium	1	<1	ug/L	20090611.R13E
Rubidium	1	2.9	ug/L	20090611.R13E
Scandium	1	3.2	ug/L	20090611.R13E
Selenium	1	<1	ug/L	20090611.R13E
Silver	0.1	<0.1	ug/L	20090611.R13E
Strontium	10	320	ug/L	20090611.R13E
Tellurium	1	<1	ug/L	20090611.R13E
Thallium	0.1	<0.1	ug/L	20090611.R13E
Thorium	1	<1	ug/L	20090611.R13E
Tin	1	<1	ug/L	20090611.R13E
Titanium	1	3.4	ug/L	20090611.R13E
Tungsten	1	<1	ug/L	20090611.R13E
Uranium	1	<1	ug/L	20090611.R13E
Vanadium	1	1.5	ug/L	20090611.R13E
Yttrium	1	<1	ug/L	20090611.R13E
Zinc	1	36.7	ug/L	20090611.R13E
Zirconium	1	<1	ug/L	20090611.R13E

TP FIA Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Phosphorus (as P)	0.002	0.383	mg/L	20090616.R23.2A

TSS				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Suspended Solids	6	12	mg/L	20090615.R27B

Sample Name: GUG **Date: 06/03/09** **Matrix: Water** **Lab #: 231014**

AmmoniaFIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Ammonia (as N)	0.01	0.907	mg/L	20090611.R42.1A

Anions Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Nitrate (as N)	10	<10	mg/L	20090614.R5D

BOD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
BOD (5 day)	15	55	mg/L	20090610.BOD1

CN Total Water FIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Cyanide	0.001	<0.001	mg/L	20090611.R43.1A

COD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Chemical Oxygen Demand	50	380	mg/L	20090610.R4A

AECOM - Trinidad   Work Order: 81656

Sample Name: GUG   Date: 06/03/09   Matrix: Water   Lab #: 231014

FC (MF)

Parameter	MDL	Result	Units	QAQCID
Fecal Coliforms	5	315	CFU/100mL	20090616.R10A

ICPMS Water

Parameter	MDL	Result	Units	QAQCID
Aluminum	1	287	ug/L	20090611.R13E
Antimony	0.5	2.6	ug/L	20090611.R13E
Arsenic	1	92.9	ug/L	20090611.R13E
Barium	1	44.5	ug/L	20090611.R13E
Beryllium	0.5	<0.5	ug/L	20090611.R13E
Bismuth	1	<1	ug/L	20090611.R13E
Boron	20	7830	ug/L	20090611.R13E
Cadmium	0.1	<0.1	ug/L	20090611.R13E
Calcium	500	635000	ug/L	20090611.R13E
Cerium	1	1.1	ug/L	20090611.R13E
Cesium	1	<1	ug/L	20090611.R13E
Chromium	1	3.7	ug/L	20090611.R13E
Cobalt	0.1	2.24	ug/L	20090611.R13E
Copper	10	154	ug/L	20090611.R13E
Europium	1	<1	ug/L	20090611.R13E
Gallium	1	<1	ug/L	20090611.R13E
Iron	200	4870	ug/L	20090611.R13E
Lanthanum	1	<1	ug/L	20090611.R13E
Lead	1	<1	ug/L	20090611.R13E
Lithium	5	199	ug/L	20090611.R13E
Magnesium	40	2030000	ug/L	20090611.R13E
Manganese	1	260	ug/L	20090611.R13E
Mercury	0.1	<0.1	ug/L	20090611.R13E
Molybdenum	1	12.1	ug/L	20090611.R13E
Nickel	1	16	ug/L	20090611.R13E
Niobium	1	<1	ug/L	20090611.R13E
Rubidium	1	113	ug/L	20090611.R13E
Scandium	1	<1	ug/L	20090611.R13E
Selenium	1	416	ug/L	20090611.R13E
Silver	0.1	0.18	ug/L	20090611.R13E
Strontium	10	8550	ug/L	20090611.R13E
Tellurium	1	1.1	ug/L	20090611.R13E
Thallium	0.1	<0.1	ug/L	20090611.R13E
Thorium	1	<1	ug/L	20090611.R13E
Tin	1	<1	ug/L	20090611.R13E
Titanium	1	12	ug/L	20090611.R13E
Tungsten	1	<1	ug/L	20090611.R13E
Uranium	1	2.7	ug/L	20090611.R13E
Vanadium	1	67.2	ug/L	20090611.R13E
Yttrium	1	<1	ug/L	20090611.R13E
Zinc	1	6.3	ug/L	20090611.R13E
Zirconium	1	1.7	ug/L	20090611.R13E

AECOM - Trinidad   Work Order: 81656

Sample Name: GUG   Date: 06/03/09   Matrix: Water   Lab #: 231014

TP FIA Water

Parameter	MDL	Result	Units	QAQCID
Total Phosphorus (as P)	0.02	4.72	mg/L	20090616.R23.2C

TSS

Parameter	MDL	Result	Units	QAQCID
Total Suspended Solids	12	1810	mg/L	20090615.R27B

Sample Name: MAI   Date: 06/03/09   Matrix: Water   Lab #: 231015

AmmoniaFIA

Parameter	MDL	Result	Units	QAQCID
Ammonia (as N)	0.01	0.54	mg/L	20090611.R42.1A

Anions Water

Parameter	MDL	Result	Units	QAQCID
Nitrate (as N)	0.1	0.27	mg/L	20090614.R5B

BOD

Parameter	MDL	Result	Units	QAQCID
BOD (5 day)	0.5	1.3	mg/L	20090610.BOD1

CN Total Water FIA

Parameter	MDL	Result	Units	QAQCID
Total Cyanide	0.001	<0.001	mg/L	20090611.R43.1A

COD

Parameter	MDL	Result	Units	QAQCID
Chemical Oxygen Demand	5	8.8	mg/L	20090610.R4A
Chemical Oxygen Demand (Dup)	5	13	mg/L	20090610.R4A

FC (MF)

Parameter	MDL	Result	Units	QAQCID
Fecal Coliforms	1000	8000	CFU/100mL	20090616.R10A

ICPMS Water

Parameter	MDL	Result	Units	QAQCID
Aluminum	1	156	ug/L	20090611.R13E
Antimony	0.5	0.54	ug/L	20090611.R13E
Arsenic	1	3.7	ug/L	20090611.R13E
Barium	1	39.2	ug/L	20090611.R13E
Beryllium	0.5	<0.5	ug/L	20090611.R13E
Bismuth	1	<1	ug/L	20090611.R13E
Boron	2	198	ug/L	20090611.R13E
Cadmium	0.1	<0.1	ug/L	20090611.R13E
Calcium	500	126000	ug/L	20090611.R13E
Cerium	1	<1	ug/L	20090611.R13E
Cesium	1	<1	ug/L	20090611.R13E
Chromium	1	<1	ug/L	20090611.R13E
Cobalt	0.1	0.3	ug/L	20090611.R13E
Copper	1	26.7	ug/L	20090611.R13E
Europium	1	<1	ug/L	20090611.R13E

Sample Name: MAI **Date: 06/03/09** **Matrix: Water** **Lab #: 231015**

ICPMS Water

Parameter	MDL	Result	Units	QAQCID
Gallium	1	<1	ug/L	20090611.R13E
Iron	20	68	ug/L	20090611.R13E
Lanthanum	1	<1	ug/L	20090611.R13E
Lead	1	<1	ug/L	20090611.R13E
Lithium	5	11	ug/L	20090611.R13E
Magnesium	40	20200	ug/L	20090611.R13E
Manganese	1	8.8	ug/L	20090611.R13E
Mercury	0.1	<0.1	ug/L	20090611.R13E
Molybdenum	1	4.5	ug/L	20090611.R13E
Nickel	1	4.5	ug/L	20090611.R13E
Niobium	1	<1	ug/L	20090611.R13E
Rubidium	1	6	ug/L	20090611.R13E
Scandium	1	3	ug/L	20090611.R13E
Selenium	1	2.9	ug/L	20090611.R13E
Silver	0.1	<0.1	ug/L	20090611.R13E
Strontium	10	1070	ug/L	20090611.R13E
Tellurium	1	<1	ug/L	20090611.R13E
Thallium	0.1	<0.1	ug/L	20090611.R13E
Thorium	1	<1	ug/L	20090611.R13E
Tin	1	<1	ug/L	20090611.R13E
Titanium	1	8.4	ug/L	20090611.R13E
Tungsten	1	<1	ug/L	20090611.R13E
Uranium	1	<1	ug/L	20090611.R13E
Vanadium	1	2.6	ug/L	20090611.R13E
Yttrium	1	<1	ug/L	20090611.R13E
Zinc	1	17.5	ug/L	20090611.R13E
Zirconium	1	<1	ug/L	20090611.R13E

TP FIA Water

Parameter	MDL	Result	Units	QAQCID
Total Phosphorus (as P)	0.002	0.109	mg/L	20090616.R23.2A

TSS

Parameter	MDL	Result	Units	QAQCID
Total Suspended Solids	6	15	mg/L	20090615.R27B

Sample Name: MAG **Date: 06/03/09** **Matrix: Water** **Lab #: 231073**

AmmoniaFIA

Parameter	MDL	Result	Units	QAQCID
Ammonia (as N)	0.1	7.53	mg/L	20090611.R42.1A

Anions Water

Parameter	MDL	Result	Units	QAQCID
Nitrate (as N)	1	<1	mg/L	20090614.R5D

Sample Name: MAG **Date: 06/03/09** **Matrix: Water** **Lab #: 231073**

BOD

Parameter	MDL	Result	Units	QAQCID
BOD (5 day)	15	110	mg/L	20090610.BOD1

CN Total Water FIA

Parameter	MDL	Result	Units	QAQCID
Total Cyanide	0.001	<0.001	mg/L	20090611.R43.1A

COD

Parameter	MDL	Result	Units	QAQCID
Chemical Oxygen Demand	5	65.1	mg/L	20090610.R4A

FC (MF)

Parameter	MDL	Result	Units	QAQCID
Fecal Coliforms	1000	49000	CFU/100mL	20090616.R10A

ICPMS Water

Parameter	MDL	Result	Units	QAQCID
Aluminum	10	1550	ug/L	20090611.R13E
Antimony	0.5	<0.5	ug/L	20090611.R13E
Arsenic	1	27.7	ug/L	20090611.R13E
Barium	1	18.2	ug/L	20090611.R13E
Beryllium	0.5	<0.5	ug/L	20090611.R13E
Bismuth	1	<1	ug/L	20090611.R13E
Boron	20	1360	ug/L	20090611.R13E
Cadmium	0.1	<0.1	ug/L	20090611.R13E
Calcium	500	130000	ug/L	20090611.R13E
Cerium	1	1.3	ug/L	20090611.R13E
Cesium	1	<1	ug/L	20090611.R13E
Chromium	1	4.3	ug/L	20090611.R13E
Cobalt	0.1	1.37	ug/L	20090611.R13E
Copper	1	50	ug/L	20090611.R13E
Europium	1	<1	ug/L	20090611.R13E
Gallium	1	<1	ug/L	20090611.R13E
Iron	200	6200	ug/L	20090611.R13E
Lanthanum	1	<1	ug/L	20090611.R13E
Lead	1	1	ug/L	20090611.R13E
Lithium	5	44	ug/L	20090611.R13E
Magnesium	40	329000	ug/L	20090611.R13E
Manganese	1	207	ug/L	20090611.R13E
Mercury	0.1	<0.1	ug/L	20090611.R13E
Molybdenum	1	2.2	ug/L	20090611.R13E
Nickel	1	10.4	ug/L	20090611.R13E
Niobium	1	<1	ug/L	20090611.R13E
Rubidium	1	23.5	ug/L	20090611.R13E
Scandium	1	6	ug/L	20090611.R13E
Selenium	1	65.1	ug/L	20090611.R13E
Silver	0.1	<0.1	ug/L	20090611.R13E
Strontium	10	1350	ug/L	20090611.R13E
Tellurium	1	<1	ug/L	20090611.R13E

Sample Name: MAG | **Date: 06/03/09** | **Matrix: Water** | **Lab #: 231073**

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Thallium	0.1	<0.1	ug/L	20090611.R13E
Thorium	1	<1	ug/L	20090611.R13E
Tin	1	<1	ug/L	20090611.R13E
Titanium	1	20.8	ug/L	20090611.R13E
Tungsten	1	<1	ug/L	20090611.R13E
Uranium	1	<1	ug/L	20090611.R13E
Vanadium	1	28.7	ug/L	20090611.R13E
Yttrium	1	<1	ug/L	20090611.R13E
Zinc	1	21.1	ug/L	20090611.R13E
Zirconium	1	2.2	ug/L	20090611.R13E

TP FIA Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Phosphorus (as P)	0.002	0.229	mg/L	20090616.R23.2B

TSS				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Suspended Solids	12	1020	mg/L	20090615.R27B

Sample Name: CII | **Date: 06/03/09** | **Matrix: Water** | **Lab #: 231074**

AmmoniaFIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Ammonia (as N)	0.01	0.09	mg/L	20090611.R42.1A

Anions Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Nitrate (as N)	0.1	<0.1	mg/L	20090614.R5B

BOD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
BOD (5 day)	15	170	mg/L	20090610.BOD1

CN Total Water FIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Cyanide	0.001	<0.001	mg/L	20090611.R43.1A

COD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Chemical Oxygen Demand	50	380	mg/L	20090610.R4A

FC (MF)				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Fecal Coliforms	1000	179000	CFU/100mL	20090616.R10A

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	1	287	ug/L	20090611.R13E
Antimony	0.5	<0.5	ug/L	20090611.R13E
Arsenic	1	4.1	ug/L	20090611.R13E

Sample Name: CII | **Date: 06/03/09** | **Matrix: Water** | **Lab #: 231074**

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Barium	1	51.8	ug/L	20090611.R13E
Beryllium	0.5	<0.5	ug/L	20090611.R13E
Bismuth	1	<1	ug/L	20090611.R13E
Boron	2	115	ug/L	20090611.R13E
Cadmium	0.1	<0.1	ug/L	20090611.R13E
Calcium	500	84200	ug/L	20090611.R13E
Cerium	1	<1	ug/L	20090611.R13E
Cesium	1	<1	ug/L	20090611.R13E
Chromium	1	2.4	ug/L	20090611.R13E
Cobalt	0.1	0.61	ug/L	20090611.R13E
Copper	1	10.2	ug/L	20090611.R13E
Europium	1	<1	ug/L	20090611.R13E
Gallium	1	<1	ug/L	20090611.R13E
Iron	200	3660	ug/L	20090611.R13E
Lanthanum	1	<1	ug/L	20090611.R13E
Lead	1	<1	ug/L	20090611.R13E
Lithium	5	6.9	ug/L	20090611.R13E
Magnesium	40	13800	ug/L	20090611.R13E
Manganese	1	403	ug/L	20090611.R13E
Mercury	0.1	<0.1	ug/L	20090611.R13E
Molybdenum	1	1.9	ug/L	20090611.R13E
Nickel	1	3.7	ug/L	20090611.R13E
Niobium	1	<1	ug/L	20090611.R13E
Rubidium	1	2.8	ug/L	20090611.R13E
Scandium	1	4.9	ug/L	20090611.R13E
Selenium	1	<1	ug/L	20090611.R13E
Silver	0.1	<0.1	ug/L	20090611.R13E
Strontium	10	301	ug/L	20090611.R13E
Tellurium	1	<1	ug/L	20090611.R13E
Thallium	0.1	<0.1	ug/L	20090611.R13E
Thorium	1	<1	ug/L	20090611.R13E
Tin	1	<1	ug/L	20090611.R13E
Titanium	1	11.9	ug/L	20090611.R13E
Tungsten	1	<1	ug/L	20090611.R13E
Uranium	1	<1	ug/L	20090611.R13E
Vanadium	1	3.4	ug/L	20090611.R13E
Yttrium	1	<1	ug/L	20090611.R13E
Zinc	1	14.8	ug/L	20090611.R13E
Zirconium	1	1.8	ug/L	20090611.R13E

TP FIA Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Phosphorus (as P)	0.002	0.333	mg/L	20090616.R23.2A

TSS				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Suspended Solids	6	38	mg/L	20090615.R27B

AECOM - Trinidad — Work Order: 81656

Sample Name: CII — **Date: 06/03/09** — **Matrix: Water** — **Lab #: 231074**

TSS				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**

Sample Name: CIG — **Date: 06/03/09** — **Matrix: Water** — **Lab #: 231075**

AmmoniaFIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Ammonia (as N)	0.1	9.01	mg/L	20090611.R42.1A

Anions Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Nitrate (as N)	1	<1	mg/L	20090614.R5D

BOD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
BOD (5 day)	15	43	mg/L	20090610.BOD1

CN Total Water FIA				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Cyanide	0.001	<0.001	mg/L	20090611.R43.1A

COD				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Chemical Oxygen Demand	5	113	mg/L	20090610.R4A

FC (MF)				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Fecal Coliforms	1000	120000	CFU/100mL	20090616.R10A

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Aluminum	1	425	ug/L	20090611.R13E
Antimony	0.5	<0.5	ug/L	20090611.R13E
Arsenic	1	25.7	ug/L	20090611.R13E
Barium	1	72.8	ug/L	20090611.R13E
Beryllium	0.5	<0.5	ug/L	20090611.R13E
Bismuth	1	<1	ug/L	20090611.R13E
Boron	20	1670	ug/L	20090611.R13E
Cadmium	0.1	<0.1	ug/L	20090611.R13E
Calcium	500	136000	ug/L	20090611.R13E
Cerium	1	<1	ug/L	20090611.R13E
Cesium	1	<1	ug/L	20090611.R13E
Chromium	1	2.8	ug/L	20090611.R13E
Cobalt	0.1	1.03	ug/L	20090611.R13E
Copper	1	43.8	ug/L	20090611.R13E
Europium	1	<1	ug/L	20090611.R13E
Gallium	1	1.6	ug/L	20090611.R13E
Iron	200	1600	ug/L	20090611.R13E
Lanthanum	1	<1	ug/L	20090611.R13E
Lead	1	<1	ug/L	20090611.R13E
Lithium	5	48	ug/L	20090611.R13E

AECOM - Trinidad — Work Order: 81656

Sample Name: CIG — **Date: 06/03/09** — **Matrix: Water** — **Lab #: 231075**

ICPMS Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Magnesium	40	303000	ug/L	20090611.R13E
Manganese	1	473	ug/L	20090611.R13E
Mercury	0.1	<0.1	ug/L	20090611.R13E
Molybdenum	1	2.4	ug/L	20090611.R13E
Nickel	1	7.8	ug/L	20090611.R13E
Niobium	1	<1	ug/L	20090611.R13E
Rubidium	1	24.5	ug/L	20090611.R13E
Scandium	1	5.6	ug/L	20090611.R13E
Selenium	1	55.2	ug/L	20090611.R13E
Silver	0.1	0.16	ug/L	20090611.R13E
Strontium	10	1360	ug/L	20090611.R13E
Tellurium	1	<1	ug/L	20090611.R13E
Thallium	0.1	<0.1	ug/L	20090611.R13E
Thorium	1	<1	ug/L	20090611.R13E
Tin	1	<1	ug/L	20090611.R13E
Titanium	1	24.9	ug/L	20090611.R13E
Tungsten	1	<1	ug/L	20090611.R13E
Uranium	1	<1	ug/L	20090611.R13E
Vanadium	1	22.7	ug/L	20090611.R13E
Yttrium	1	<1	ug/L	20090611.R13E
Zinc	1	31.4	ug/L	20090611.R13E
Zirconium	1	3.9	ug/L	20090611.R13E

TP FIA Water				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Phosphorus (as P)	0.02	2.25	mg/L	20090616.R23.2C

TSS				
Parameter	**MDL**	**Result**	**Units**	**QAQCID**
Total Suspended Solids	6	43	mg/L	20090615.R27B

MDL — *Method detection limit or minimum reporting limit.*
% Rec — *Surrogate compounds are added to the sample in some cases and the recovery is reported as a percent recovered.*
QAQCID — *This is a unique reference to the quality control data set used to generate the reported value.*
Data reported for organic analysis in soil samples are corrected for moisture content
Matrix — *If the matrix is a leachate, the sample was extracted according to regulation 558.*
INT — *Interferences*
TNTC — *Too numerous to count*
ND — *Not detected*

Quality Control Data:

AmmoniaFIA

1.0 ppm Control

Parameter	MDL	Units	UCL	Result	LCL	QAQCID
Ammonia (as N)	0.01	mg/L	1.2	1.1	0.8	20090611.R42.1A

Blank

Parameter	MDL	Units	UCL	Result	LCL	QAQCID
Ammonia (as N)	0.01	mg/L	0.03	<0.01	<0.01	20090611.R42.1A

Anions Water

Blank (IC-2)

Parameter	MDL	Units	UCL	Result	LCL	QAQCID
Nitrate (as N)	0.1	mg/L	0.5	<0.1	<0.1	20090614.R5B
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Nitrate (as N)	0.1	mg/L	0.5	<0.1	<0.1	20090614.R5D

Control (IC-2)

Parameter	MDL	Units	UCL	Result	LCL	QAQCID
Nitrate (as N)	0.1	mg/L	55	46.9	40	20090614.R5B
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Nitrate (as N)	0.1	mg/L	55	46.6	40	20090614.R5D

BOD

BOD Blank

Parameter	MDL	Units	UCL	Result	LCL	QAQCID
BOD (5 day)	0.2	mg/L	0.2	<0.2	<0.2	20090610.BOD1

BOD Control

Parameter	MDL	Units	UCL	Result	LCL	QAQCID
BOD (5 day)	100	mg/L	230	180	167.5	20090610.BOD1

CN Total Water FIA

0.05 mg/L Control

Parameter	MDL	Units	UCL	Result	LCL	QAQCID
Total Cyanide	0.002	mg/L	0.06	0.0464	0.04	20090611.R43.1A

Blank

Parameter	MDL	Units	UCL	Result	LCL	QAQCID
Total Cyanide	0.002	mg/L	<0.002	<0.002	<0.002	20090611.R43.1A

COD

100 ppm control

Parameter	MDL	Units	UCL	Result	LCL	QAQCID
Chemical Oxygen Demand	5	mg/L	120	119	80	20090610.R4A

COD

Blank						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Chemical Oxygen Demand	5	mg/L	15	<5	<5	20090610.R4A

ICPMS Water

Blank						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Aluminum	1	ug/L	1	<1	<1	20090611.R13E
Antimony	0.5	ug/L	0.5	<0.5	<0.5	20090611.R13E
Arsenic	1	ug/L	1	<1	<1	20090611.R13E
Barium	0.5	ug/L	0.5	<0.5	<0.5	20090611.R13E
Beryllium	1	ug/L	1	<1	<1	20090611.R13E
Bismuth	1	ug/L	3	<1	<1	20090611.R13E
Boron	1	ug/L	1	<1	<1	20090611.R13E
Cadmium	1	ug/L	1	<1	<1	20090611.R13E
Calcium	50	ug/L	150	<50	<50	20090611.R13E
Cerium	0.1	ug/L	0.1	<0.1	<0.1	20090611.R13E
Cesium	1	ug/L	1	<1	<1	20090611.R13E
Chromium	1	ug/L	1	<1	<1	20090611.R13E
Cobalt	1	ug/L	1	<1	<1	20090611.R13E
Europium	1	ug/L	1	<1	<1	20090611.R13E
Gallium	1	ug/L	1	<1	<1	20090611.R13E
Iron	20	ug/L	20	<20	<20	20090611.R13E
Lanthanum	1	ug/L	1	<1	<1	20090611.R13E
Lead	1	ug/L	1	<1	<1	20090611.R13E
Lithium	5	ug/L	5	<5	<5	20090611.R13E
Magnesium	4	ug/L	4	<4	<4	20090611.R13E
Manganese	1	ug/L	1	<1	<1	20090611.R13E
Mercury	0.1	ug/L	0.1	<0.1	<0.1	20090611.R13E
Molybdenum	1	ug/L	1	<1	<1	20090611.R13E
Nickel	1	ug/L	1	<1	<1	20090611.R13E
Niobium	1	ug/L	1	<1	<1	20090611.R13E
Rubidium	1	ug/L	1	<1	<1	20090611.R13E
Scandium	1	ug/L	1	<1	<1	20090611.R13E
Selenium	1	ug/L	1	<1	<1	20090611.R13E
Silver	0.1	ug/L	0.1	<0.1	<0.1	20090611.R13E
Strontium	1	ug/L	1	<1	<1	20090611.R13E
Tellurium	1	ug/L	1	<1	<1	20090611.R13E
Thallium	1	ug/L	1	<1	<1	20090611.R13E
Thorium	1	ug/L	1	<1	<1	20090611.R13E
Tin	1	ug/L	1	<1	<1	20090611.R13E
Titanium	0.1	ug/L	0.1	<0.1	<0.1	20090611.R13E
Tungsten	1	ug/L	1	<1	<1	20090611.R13E
Uranium	1	ug/L	1	<1	<1	20090611.R13E
Vanadium	1	ug/L	1	<1	<1	20090611.R13E
Yttrium	1	ug/L	1	<1	<1	20090611.R13E
Zinc	1	ug/L	1	<1	<1	20090611.R13E

ICPMS Water

Blank						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Zirconium	1	ug/L	1	<1	<1	20090611.R13E

Positive Control (1011)						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Aluminum	1	ug/L	600	494	400	20090611.R13E
Arsenic	1	ug/L	120	97.3	80	20090611.R13E
Barium	1	ug/L	120	100	80	20090611.R13E
Beryllium	1	ug/L	125	101	75	20090611.R13E
Boron	2	ug/L	110	102	90	20090611.R13E
Cadmium	1	ug/L	120	95.6	80	20090611.R13E
Calcium	50	ug/L	1200	908	800	20090611.R13E
Chromium	1	ug/L	110	97.5	90	20090611.R13E
Cobalt	1	ug/L	120	96.3	80	20090611.R13E
Copper	1	ug/L	120	94.6	80	20090611.R13E
Iron	20	ug/L	600	459	400	20090611.R13E
Lead	1	ug/L	120	97.5	80	20090611.R13E
Magnesium	4	ug/L	1200	992	800	20090611.R13E
Manganese	1	ug/L	120	95.8	80	20090611.R13E
Molybdenum	1	ug/L	120	94.9	80	20090611.R13E
Nickel	1	ug/L	120	97.3	80	20090611.R13E
Selenium	1	ug/L	120	95.7	80	20090611.R13E
Thallium	1	ug/L	120	96.4	80	20090611.R13E
Vanadium	1	ug/L	120	95.4	80	20090611.R13E
Zinc	1	ug/L	120	97.3	80	20090611.R13E

TP FIA Water

Blank						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Total Phosphorus (as P)	0.002	mg/L	0.005	<0.002	<0.002	20090616.R23.2A
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Total Phosphorus (as P)	0.002	mg/L	0.005	<0.002	<0.002	20090616.R23.2B
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Total Phosphorus (as P)	0.002	mg/L	0.005	<0.002	<0.002	20090616.R23.2C

Control (0.05 mg/L)						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Total Phosphorus (as P)	0.002	mg/L	0.06	0.0519	0.04	20090616.R23.2A
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Total Phosphorus (as P)	0.002	mg/L	0.06	0.0519	0.04	20090616.R23.2B
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Total Phosphorus (as P)	0.002	mg/L	0.06	0.0403	0.04	20090616.R23.2C

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160 mg/L Control						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Total Suspended Solids	6	mg/L	192	178	128	20090615.R27B

Blank						
Parameter	**MDL**	**Units**	**UCL**	**Result**	**LCL**	**QAQCID**
Total Suspended Solids	6	mg/L	<6	<6	<6	20090615.R27B

UCL Upper Control Limit
LCL Lower Control Limit

WATER SAMPLE RESULTS TAKEN FROM YSI AUTOMATIC SAMPLER
WEDNESDAY 3RD JUNE 2009

Sample Site: Cipero River (Gulf) (CIG)

Samples not counted in average

Minute interval	Time	Temp. (°C)	Sp. Cond. (mS/cm)	DO Conc.(mg/L)	pH	pHmV (mV)
	7:57:03	27.56	8.576	3.9	8.21	-62.5
1	7:57:33	27.56	8.585	1.4	8.06	-54.5
	7:58:03	27.55	8.588	1.08	8.01	-51.5
2	7:58:33	27.56	8.587	0.9	7.98	-49.8
	7:59:03	27.58	8.584	0.77	7.96	-48.6
3	7:59:33	27.59	8.582	0.64	7.94	-47.7
	8:00:03	27.59	8.582	0.56	7.93	-47
4	8:00:33	27.59	8.583	0.52	7.91	-46.4
	8:01:03	27.60	8.581	0.53	7.91	-46
5	8:01:33	27.60	8.581	0.53	7.9	-45.6
Average		**27.58**	**8.58**	**1.08**	**7.98**	**-49.96**

Sample Site: Cipero River (Inland) (CII)

Minute interval	Time	Temp. (°C)	Sp. Cond. (mS/cm)	DO Conc.(mg/L)	pH	pHmV (mV)
	8:43:29	26.55	0.499	3.23	7.76	-37.7
1	8:43:59	26.57	0.509	2.55	7.61	-29.9
	8:44:29	26.59	0.509	2.29	7.55	-26.3
2	8:44:59	26.59	0.509	2.2	7.51	-24.2
	8:45:29	26.59	0.509	2.19	7.47	-22.6
3	8:45:59	26.6	0.508	2.1	7.46	-21.6
	8:46:29	26.61	0.508	2.11	7.44	-20.8
4	8:46:59	26.61	0.508	2.08	7.43	-20.3
	8:47:29	26.6	0.508	2.05	7.42	-19.7
5	8:47:59	26.61	0.508	2	7.41	-19.2
Average		**26.60**	**0.51**	**2.13**	**7.46**	**-21.84**

Sample Site: Guaracara River (Gulf) (GUG)

Minute interval	Time	Temp. (°C)	Sp. Cond. (mS/cm)	DO Conc.(mg/L)	pH	pHmV (mV)
	7:05:20	31.57	48.32	0.87	8.04	-53.9
1	7:05:50	31.46	48.417	0.66	8.1	-57.1
	7:06:20	31.51	48.399	0.61	8.11	-57.8
2	7:06:50	31.43	48.464	0.56	8.13	-58.7
	7:07:20	31.4	48.5	0.51	8.16	-60.3
3	7:07:50	31.41	48.5	0.47	8.17	-61
	7:08:20	31.43	48.503	0.46	8.18	-61.7
4	7:08:50	31.38	48.564	0.44	8.19	-62.2
	7:09:20	31.4	48.576	0.45	8.2	-62.6
5	7:09:50	31.44	48.563	0.46	8.21	-63
Average		**31.43**	**48.51**	**0.50**	**8.17**	**-60.91**

WATER SAMPLE RESULTS TAKEN FROM YSI AUTOMATIC SAMPLER
WEDNESDAY 3RD JUNE 2009

Sample Site: Guaracara River (Inland) (GUI)

Minute interval	Time	Temp. (°C)	Sp. Cond. (mS/cm)	DO Conc.(mg/L)	pH	pHmV (mV)
1	9:29:38	26.72	0.445	4.49	7.93	-46.9
	9:30:08	26.72	0.445	4.09	7.92	-46.5
2	9:30:38	26.72	0.445	3.93	7.91	-46.2
	9:31:08	26.71	0.445	3.82	7.91	-46
3	9:31:38	26.72	0.445	3.75	7.91	-46
	9:32:08	26.73	0.445	3.73	7.91	-46
4	9:32:38	26.74	0.445	3.69	7.91	-46
	9:33:08	26.75	0.445	3.68	7.91	-46
5	9:33:38	26.74	0.445	3.65	7.91	-46.1
	9:34:08	26.73	0.445	3.61	7.91	-46.1
Average		**26.74**	**0.45**	**3.69**	**7.91**	**-46.03**

Sample Site: Marabella River (Gulf) (MAG)

Minute interval	Time	Temp. (°C)	Sp. Cond. (mS/cm)	DO Conc.(mg/L)	pH	pHmV (mV)
1	6:29:26	25.99	7.739	2.22	7.81	-40.7
	6:29:56	26.01	7.979	1.62	7.89	-44.8
2	6:30:26	26.02	8.076	1.33	7.93	-47.1
	6:30:56	26.02	8.148	1.13	7.96	-48.4
3	6:31:26	26.02	8.192	0.98	7.97	-48.9
	6:31:56	26.02	8.205	0.86	7.97	-49.2
4	6:32:26	26	8.136	0.76	7.98	-49.5
	6:32:56	26	8.147	0.68	8	-51
5	6:33:26	26.01	8.17	0.65	8.01	-51.2
	6:33:56	26.01	8.202	0.61	8.01	-51.2
Average		**26.01**	**8.16**	**0.68**	**8.00**	**-50.73**

Sample Site: Marabella River (Inland) (MAI)

Minute interval	Time	Temp. (°C)	Sp. Cond. (mS/cm)	DO Conc.(mg/L)	pH	pHmV (mV)
1	10:13:16	26.24	0.897	4.94	7.92	-46.3
	10:13:46	26.23	0.897	4.07	7.91	-46.2
2	10:14:16	26.24	0.9	3.58	7.91	-46
	10:14:46	26.21	0.901	3.31	7.91	-45.9
3	10:15:16	26.23	0.906	3.17	7.9	-45.5
	10:15:46	26.24	0.913	3.11	7.9	-45.3
4	10:16:16	26.22	0.915	3.01	7.9	-45.3
	10:16:46	26.23	0.918	3.05	7.9	-45.2
5	10:17:16	26.24	0.919	2.95	7.9	-45.2
	10:17:46	26.24	0.92	2.89	7.9	-45.2
Average		**26.23**	**0.92**	**2.98**	**7.90**	**-45.23**

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This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF Communiqué dated 18 June 2005).

Accreditation No.:	A 3066
Issued on:	June 29, 2009
Accreditation Date:	April 14, 2005
Expiry Date:	June 29, 2012

Chief Executive Officer

ilac-MRA CALA

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ENVIRONMENTAL LTD.

YSI TEST CERTIFICATE # 778

CLIENT:	***AECom***
Instrument:	YSI 556 MPS
Type of Equipment:	Multi-Parameter Water Quality
Date:	June 1 2009
Your Ref:	***Rental*** ***Our Ref:DN#8538/TA/MS/C***

Test Date	*Component*	*Serial #*	*Test*
June 1 2009	556MPS	05H1966 AJ	OK
June 1 2009	Conductivity/Temperature		10 mS/cm
June 1 2009	Dissolved Oxygen		100% Saturation - O.K.
June 1 2009	pH		7,4,10 pH
June 1 2009	Field Cable		OK

1. 3-Point on pH probe at pH7, pH4 and pH10
2. 1-Point on conductivity cell at 10 mS/cm
3. 1-Point on dissolved oxygen at 100% saturation

Verification Checks	*Actual*	*Expected*
pH mV change: 7 to 10	-147.3	-170 $\pm$ 30
pH mV change: 7 to 4	172.1	170 $\pm$ 30

pH, Conductivity/ Temperature and Dissolve Oxygen probes responded well to calibration.

This is to certify that the identified equipment has been tested, calibrated and verified operational as specified by the manufacturer.

Instrument Technician

Verified By

Authorised Manager

Solutions for a healthy environment

Unit #7, Lot 2C Chootoo Road,
El Socorro, San Juan
Tel: 868-638-1640, 638-7673, 675-1094
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Appendix D

Biophysical Baseline Data

D.3 Fauna Studies Report

CONSULTANT'S REPORT

30 November 2009

Graham White

Habitats and Fauna of the San Fernando Wastewater Catchment Area.

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Habitats and Fauna of the San Fernando Wastewater Catchment Area.

1.0 Introduction

The Water and Sewage Authority of Trinidad and Tobago (WASA) is undertaking sewer upgrades in San Fernando and environs. WASA has retained the professional services of AECOM to provide consultancy services for project. This document provides a description of the habitats and fauna of the greater San Fernando area as part of an environmental impact assessment of the overall project.

The catchment area under consideration (the study area) is largely commercial and residential. The natural environment, especially the major watercourses are highly degraded and it is likely that the overall ecological impact of the development should be beneficial.

The emphasis of the ecological impact studies was to identify the most valuable ecological components within the study area. This may include valuable habitats, communities and or species.

Value was attributed to ecosystems or communities based on their abundance and vulnerability in Trinidad and the wider region. Potential valuable components include all natural habitats including mangrove forest and coastal mudflats, natural or artificial freshwater marsh, roosting sites for migrant or coastal birds, feeding sites for migrant shorebirds, seabirds and warblers, and waterways. Value was attributed to species which are rare, threatened, or endangered as identified in the CWA of 1999 or environmentally sensitive as defined under the Environmental Management Act of 2000. Value was also attributed to sites with an aesthetic or educational value related to the natural environment.

The account of likely species richness and composition is limited to the vertebrates. The vertebrates may not be the best indicators of ecosystem health or value; however they are the groups for which habitat requirements and distribution are best known in Trinidad.

2.0 Methodology

2.1 Land Use and Habitats

A draft land use map was prepared based on satellite images from GoogleEarth™, (© 2007), the 1:25000 topographic map (Lands and Surveys Division, Port of Spain, Trinidad. Sheet No. 53) and a map of proposed developments provided by AECOM.

The resolution of the satellite image was such that individual houses and trees could be easily recognised as were waterways and ponds. Based on the satellite image the land use was classified into three main categories and an additional six sub-or intermediate categories.

- **Urban Development** – This category includes high density housing, commercial and industrial areas. The image shows almost continuous roofs and buildings
- **Low vegetation with scrub and/or agriculture**. Such areas are characterised by generally low vegetation with few of scattered trees and no structures. **Abandoned sugarcane** fields could be generally identified by their uniform appearance. Some sugarcane may persist in lands not classified as such. Road verges and wasteland also fall into this basic category.
- **Forested areas**- Including mangrove woodland, Riparian forest, silviculture and secondary forest. **Mangrove woodland** was identified by its location on the coast adjacent to river mouths, and narrow strips of trees bordering watercourses were classified as **Riparian vegetation.** Other areas of tree cover were visited to determine their composition.

An intermediate category of **low density housing and agriculture** was assigned to lands where the houses were further apart and small agriculture plots were visible from the image, assumed to be present or seen during field visits.

An overlay of **Proposed developments** was applied to the map resulting in an eighth land use category. This included developments at several stages of completion from land clearing to completed structures.

Other features relevant to wildlife include mudflats or sandbars associated with river mouths, the San Fernando Wharf and fishing depot and two National Parks, San Fernando Hill and Palmiste Park.

The initial land use map was verified by two observers, G. White and P. Comeau who conducted field visits over five days at 45 locations within the study area and an additional 10 locations in the wider area. Dates and locations are provided in Table 1. During these visits the land use was noted, photographed and if necessary clarified or amended.

For this exercise the term ‘Land Use’ has been used in preference to ‘Habitat’ to emphasise the artificial nature of most of the available habitat. The land use map was used primarily as a tool to select potential sites of interest and gauge the relative abundance of land use classes. The area measurements calculated are sensitive to distinctions between categories, and whether roads are counted within the land use or not. The area of each land use category is thus a rough guide for the purpose of describing the fauna. Further descriptions of the land use types as observed during field visits are described under the results section.

2.2 Fauna

2.2.1 Sources of Information

The land area under consideration comprises approximately 4000 ha. Historically this area would have been covered in lowland forest and mangrove swamp which would have supported most of the vertebrate species reported from Trinidad, including the larger mammals like Ocelot, Red Brocket Deer and Collard Peccary. This original habitat has long been removed and the area is now predominantly urban or agricultural. Apart from one notable exception which is discussed below, the area has not been targeted for studies on fauna. Consequently the current expected vertebrate species composition, is generated from general works on mammals, amphibians or reptiles and represents what is likely to be at the site. More information is available for birds, especially species associated with coastal habitats. Fish are included with the aquatic fauna and are not covered in this report.

Of the more charismatic non-vertebrates, accounts of the butterflies (Barcant 1970 and Cock 1982-2009) and the dragonflies (Michalski 1988) have been published. Neither of these authors did significant collecting in the San Fernando area. However one of the early collectors, Sir Norman Lamont lived and collected at the Palmiste Estate, the remnants of which comprise the Palmiste Park. Lamont and Kaye published accounts of butterflies (Kaye 1921) and moths. Indeed at the time of publication, of the 1166 species of moth recorded for Trinidad, 528 species were collected at Palmiste Estate and another 12 from San Fernando. (Kaye and Lamont 1927; Lamont and Callan 1950). By 1970 when Barcant published his account of the butterflies, this has all changed. He described San Fernando as an urban and agricultural barrier separating the butterfly faunas of Northern and Southern Trinidad.

The primary source for general distribution on amphibians is Murphy (1997; 2008) which includes much of the information presented in earlier publications by Kenny (1969). Boos (1984) provides an assessment of abundance and status of amphibians and reptiles. Recent work on amphibians of Trinidad has been carried out by visiting researchers from Scotland but they have not conducted studies near the San Fernando area.

Sources of information on reptiles include Murphy (1997;2008) for a comprehensive treatment, and Boos 2001 for an account of the Snakes. There are four species of *Anolis* which have become naturalised in Trinidad one of which survives in small populations in San Fernando and Usine St. Madeline in addition to Port of Spain and St. Augustine (Hailey *et al* 2009).

Information on mammals was sourced from Alkins 1979, Boos 2001 and Eisenberg 1989. Treatment of bats is limited to a list of common species usually associated with residential areas or mangrove. (G. Gomes Personal communication) and (Goodwin and Greenhall 1962).

With respect to the birds, ffrench (1991) provides the primary source of information on the birds of Trinidad. Kenefick *et al* 2007 provides updated information on status abundance and identification. Much of the information on migrant shorebirds presented in ffrench (1991) was based on data collected at Point-a-Pierre at the northern edge of the study area. In addition the Point-a-Pierre Wildfowl Trust provides a small habitat for a variety of wetland and forest birds. The small forested areas of the trust are however cut off from the major forested areas of Trinidad (and outside of the study area). The coastal avifauna is present in a continuous zone along the west coast and the avifauna is likely to be similar to that of any small patch of mangrove and mudflats. The avifauna of the west coast of Trinidad is comparatively well known and the area has been recognised as an Important Bird Area (IBA) of regional importance (Caribbean), based on an estimated population in excess of 20,000 waterbirds (White 2008). Additional sources of information used to create a likely species listing include:

1. General literature on the status and distribution of birds in Trinidad (ffrench, 1991, 1993, 1996; ffrench and Manolis, 1984; Hayes, 1996).
2. Studies focusing on Caroni Swamp and other west coast systems
    a. Caroni Swamp (Bacon 1970, ffrench 1977, Cuffy, 1999),
    b. POS sewage ponds (White 2000),
    c. Brickfield mudflats (Chandool 1999; White and Kenefick, 2004),
    d. Laventille Swamp (Gochfeld (2002)
3. Studies focusing on taxanomic groupings
    a. gulls (Hayes *et al* 2004) and
    b. shorebirds (Morrison and Ross 1989) along Trinidad's west coast,
    c. Scarlet Ibis (ffrench and Haverschmidt 1970; Bildstein, 1990),
    d. Lesser Black-backed Gulls (Hayes et al 2002),
    e. palearctic vagrants (Kenefick and Hayes 2007) and
    f. pelagic seabirds (Murphy, 2002).
4. Records of the Trinidad and Tobago Rare Bird Committee (Hayes and White, 2000; White and Hayes, 2002; Kenefick 2005;2007;2008;2009).
5. Unpublished records of G. White and M. Kenefick.

2.2.2 Likely Species Assemblages

Despite the disturbed nature of the study area a wide variety of species may be expected to occur. Birds, especially those that migrate, can turn up anywhere and the comparatively intact area of mangrove in Godineau Swamp to the south may be a source of immigrants to the study area. This is less likely for amphibians and reptiles, nevertheless movement of plants and soil may transport species to residential areas and waterways, may serve as conduits for aquatic or semiaquatic wildlife. Additionally amphibians and reptiles can often survive in small habitats and remain undetected.

A list of terrestrial vertebrate species which are likely to inhabit the study area was prepared. This list includes, or is limited to species recorded from the study area; species generally widespread in Trinidad and species which prefer habitats present in the study area.

Species which are considered rare have not been included unless specifically identified within the study area. Species of amphibians and reptiles, which prefer a forest habitat (with the exception of mangrove) have not been included while those associated with savannahs or grassland are treated as likely.

Mammals are assumed to be generally rare or absent with the exception of a few pests and other species known to survive with habitation. Silky Anteaters or Crab-eating Racoons may conceivably survive in the mangrove. I have deemed the Anteater possible but the Racoon unlikely. The list of bats has been provided by G. Gomes. G. Gomes is a local bat enthusiast with many years experience in trapping and identifying bats.

2.2.3 Field Assessment of Habitats and Fauna

Field visits were conducted over five days at 45 locations within the study area and an additional 10 locations in the wider area. Dates and locations are provided in Table 1. All terrestrial vertebrates observed during site visits were recorded. Special visits were made to sites where semi-natural habitats occurred and local residents or workers (seven) were asked informally about the presence of mammals in the area. Single counts of birds were made at San Fernando Hill, Palmiste Park, Usine St. Madeline, the Mudflats at Bel-Air and the mangrove immediately north of the Guaracara River. In addition any species observed during all site visits were recorded.

There were no areas where mammal footprints or other signs were likely.

Table 1. Dates and Locations for sites visited U.T.M. Zone 20-n.
Original coordinates based on Naparima BWI datum and re-registered manually to Naparima 1955.

07/10/2009	**13/10/2009**	**22/10/2009**
670941, 1130692	668791, 1132762	667685, 1139953
670254, 1130587	668445, 1132965	667783, 1139934
670485, 1130790	668397, 1132942	667916, 1139848
670483, 1131270	667122, 1132162	667975, 1139848
670734, 1132145	666907, 1132351	668235, 1136524
670218, 1132581	666699, 1132684	667275, 1136220
670277, 1132400	664705, 1131470	667236, 1136354
669972, 1129872	665529, 1131224	667246, 1136501
669445, 1131442	666143, 1131330	667405, 1135817
669733, 1132183	666552, 1131656	668398, 1134985
669153, 1133438	666607, 1131106	668521, 1134820
668984, 1133224	666666, 1130660	670148, 1134594
666301, 1134246	667510, 1131059	670528, 1134145
663989, 1132866	668665, 1130357	670594, 1135469
665762, 1133731	**14/10/2009**	
667360, 1135047	668756, 1139721	
666960, 1135095	668772, 1139402	
667034, 1135315	668675, 1138092	
671040, 1136026	668984, 1137983	
08/10/2009	668507, 1137739	
668729, 1136722	668298, 1137924	
667520, 1136983	668239, 1137758	
673138, 1134457	668760, 1137785	
	670068, 1138792	

3.0 Results

3.1 Land Use and Areas of Interest

The major categories of land use within the study area are: presented in Figure 1, and the land area for each category given in Table 2. The sites which are potentially of higher ecological value are deemed to be those which sustain natural or near-natural communities. Such sites include estuarine and associated coastal communities, including mudflats at Bel-Air and a small boatyard just south of Vistabella River, mangrove forest around the Guaracara River, freshwater ponds at Usine St. Madeline, the Cipero River and small areas of forest at San Fernando Hill and Palmiste Park.

Table 2. Land use in San Fernando and environs.

Land Use Category	Area/ Ha	Percent of area
Commercial and Residential	1994.9	49
Low density Buildings	217.3	5
New developments	286.4	7
Abandoned Sugarcane	244.6	6
Scrub and Agriculture	897.1	22
Mangrove Forest	52.9	1
Riparian forest	40.0	1
National parks	51.5	1
Close cropped lawns	122.1	3
Other	197.3	4
Total	**4086 Ha**	

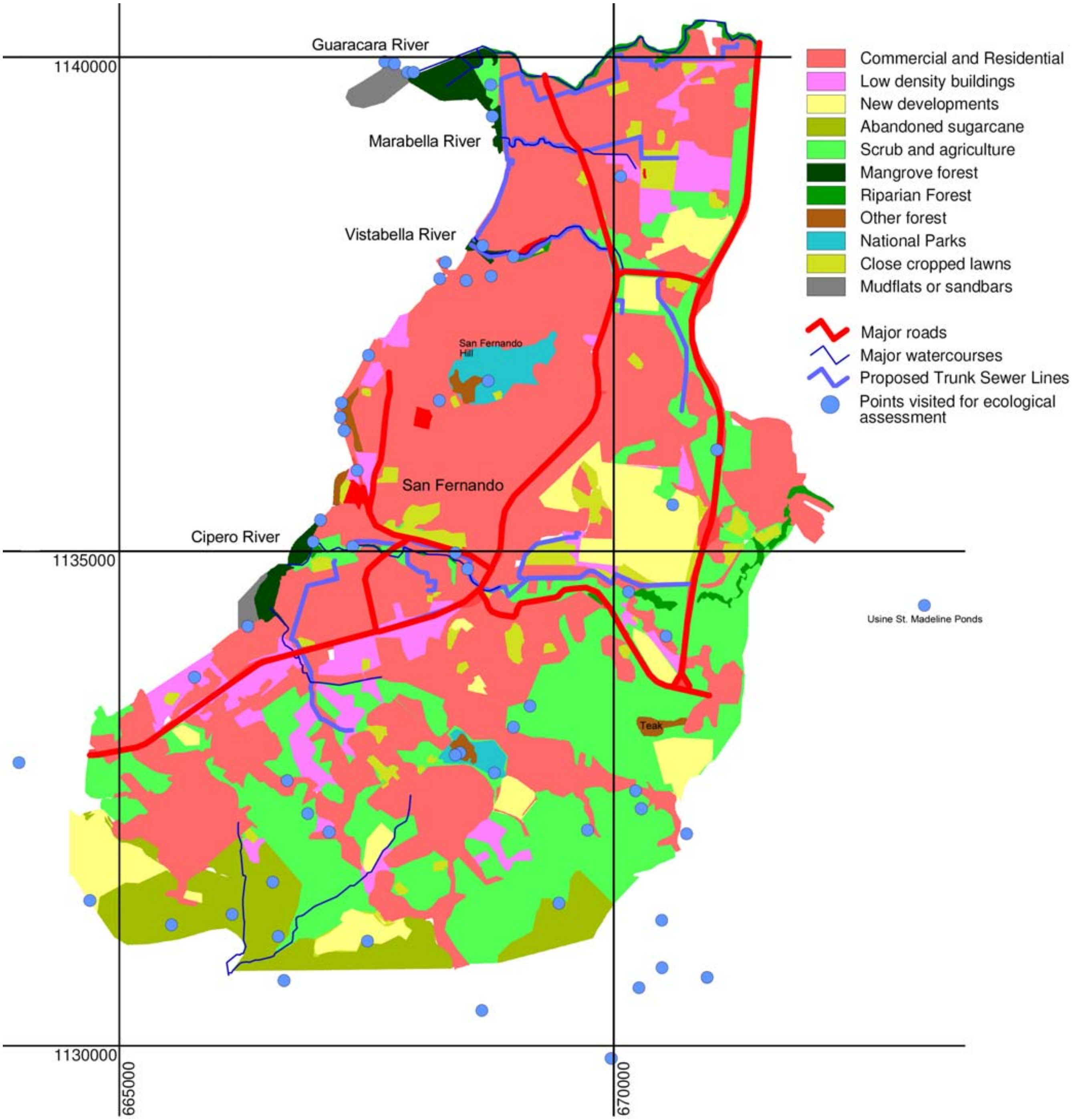

Figure 1. Map of San Fernando and environs showing land use and survey points.

3.2 Likely Species Assemblages

The expected vertebrate fauna of the study area is presented in Tables 3-5 (Amphibians and Reptiles - Table 3, Birds - Table 4 and Mammals - Table 5). In the case of the birds the land use categories in which they are expected has been identified. For the other classes a general list is provided.

The list of possible Amphibians and Reptiles (Table 3) includes 64 species. This list is somewhat speculative given the uncertain abundance and distribution of many of these species in Trinidad.

The list of likely bird species (Table 4) includes 174 of the 444 species recorded from Trinidad. The highest number of species (120) are likely to occur in the coastal environments. 101 species are listed for the Scrub and Agriculture of which 41 species may be found in the urban areas. Of the 174 species 115 are resident in Trinidad and a further 7 regularly breed. Regular seasonal migration form the north or south is exhibited by 51 species. The migrating species are mainly comprised of the seabirds and shorebirds which utilize the coastal environment.

Within the study area there are 29 mammals (Table 5) which one may expect, inclusive of 19 Bats. This is a low proportion of the mammals of Trinidad as is expected for such an area with little natural habitat. The Silky or Two-toed Anteater, *Cyclopes didactylus* has been included as possible since there is a likely population in the Godineau Swamp to the south. The Agouti, *Dasyprocta agouti* is also included as there is a remote possibility that a few still survive in the forest or residential areas around San Fernando Hill.

For all taxa, additional species are possible since rare species have not been included unless they have been recorded from the area.

Table 3 Amphibians and Reptiles which may be expected within San Fernando and environs.
*The category Scrub and Agriculture includes wet grasslands and earth-lined canals.

Family	Order Anura	Habitat & Abundance		Residential	Scrub &* Agriculture	Mangrove
Brachycephalidae	*Eleutherodactylus urichi*	RE	C		X	
Bufonidae	*Rhinella beebei*	S	C	X	X	
	Rhinella marinus	RES	C	X	X	X
Hylidae	*Dendropsophus microcephala misera*	S	FC	X	X	
	Dendropsophus minutes	RES	FC		X	
	Hypsiboas crepitans	ES	C	X	X	
	Hypsiboas geographicus	RE	FC		X	
	Hypsiboas punctata	RES	FC		X	
	Phyllomedusa trinitatis	RES	FC		X	
	Pseudis paradoxa caribensis	S-Aq			X	
	Scinax rubra	S	FC	X	X	
	Sphaenorhynchus lacteus	ES	FC		X	
	Trachycephalus venulosus	ES	FC		X	
Leptodactylidae	*Leptodactylus bolivianus*	S	FC		X	
	Loptodactylus fuscus	S	C	X	X	
	Leptodactylus hylaedactyla	RE			Possible	
	Loptodactylus validus	RES	R	X	X	
Leiuperidae	*Engystomops pustulosus*	S	C	X	X	
Microhylidae	*Elachistocleis ovalis*	S	FC		Possible	
	Order Chelonia					
Geoemyidae	*Rhinoclemmys punctularia punctularia*	RES Aq	C		X	
Kinosternidae	*Kinosternon scorpioides scorpioides*	RES Aq	C		X	
	Order Crocodylia					
Alligatoridae	Caiman crocodilus crocodiles	RES Aq	C		X	X
	Order Squmata: Suborder Sauria					
Amphisbaenidae	*Amphisbaena alba*	RE	UC			
	Amphisbaena fuliginosa fuliginosa	RES	UC		X	
Gekkonidae	*Gonatodes vittatus vittatus*	ES	C	X	X	
	Hemidactylus mabouia	U	C	X	X	
	Hemidactylus palaichthus	ES		X	X	
	Sphaerodactylus molei	E	UC	X	X	
	Thecadactylus rapicauda	RES	UC	X	X	
Gymnophthalmidae	*Bachia heteropa trinitatis*	RE	UC	X	X	
	Gymnophthalmus underwoodi	ES	C			
Iguanidae	*Iguana iguana*	RES	C	X	X	
Polycrotidae	*Anolis aeneus*	I,U	C			
	Anolis trinitatis	I,U	R	X		
	Polychrus marmoratus	E	C	X	X	
Scincisae	*Mabuya nigropunctata*	RE	UC	X	X	

Table 3 Cont. Amphibians and Reptiles which may be expected within San Fernando and environs.
*The category Scrub and Agriculture includes wet grasslands and earth-lined canals.

Family	**Order Squmata: Suborder Sauria**	**Habitat & Abundance**		**Residential**	**Scrub &* Agriculture**	**Mangrove**
Teiidae	*Ameiva ameiva*	RES	C	X	X	
	Kentropyx striatus	ES	UC		X	X
	Tupinambis teguixin	RES	C		X	
	Order Squmata: Suborder Serpentes					
Boidae	*Boa constrictor constrictor*	RES	C		X	
	Corallus ruschbergerii	ES	FC	X	X	X
	Epicrates cenchria maurus	ES	FC		X	
	Eunectes murinus	RES-Aq	FC		X	
Colubridae	*Chironius carinatus*	RE	FC		X	
	Leptophis ahaetulla coeruleodorsus	RE	C	X	X	
	Mastigodryas boddaerti dunni	ES	C		X	
	Oxybelis aeneus	RES	C	X	X	
Dipsadidae	*Attractus trilineatus*	RES	C	X	X	
	Dipsas variegata trinitatis	RE	UC		X	
	Leptodeira annulata ashmeadi	RES	C	X	X	
	Ninia atrata	RES	C		X	
	Sibon nebulata nebulata	RES	C	X	X	
Xenodontinae	*Clelia clelia clelia*	RES	UC			
	Helicops angulatus	RE	FC		X	
	Hydrops triangularis neglectus	RES-Aq	FC		X	X
	Liophis cobella cobella	RES-Aq	C		X	X
	Liophis melanotus nesos	ES	C	X	X	
	Liophis reginae zweifeli	RE	UC	X	X	
	Oxyrhopus petola petola	RES	UC	X	X	
	Pseudoboa neuwiedii	RES	FC	X	X	
	Spilotes pullatus pullatus	RE	C		X	
	Tantilla melanocephala	RE	FC		X	
Elapidae	*Micrurus cercinalis*	RES	C		X	
Loptotyphlopidae	*Leptotyphlops albifrons*	RE	C	X	X	

Taxonomy based on Murphy (2008)

Habitat and distribution based on Murphy (1997) R- Rainforest E- Forest Edge S- Savannah Aq - Aquatic

Abundance based on Boos 1984 C- Common, FC- Fairly Common, UC - Uncommon R - Rare

Table 4 Birds of Trinidad likely to be found within San Fernando and environs and the habitats in which they are likely to be found. The Coastal habitat includes Mangrove, Mudflats and seabird roosts.

Species	Status & Abundance		Residential	Coastal	Scrub and agriculture	Other
Pelicanidae						
Brown Pelican, *Pelicanus occidentalis*	BR	A		X		
Phalacrocoracidae						
Neotropic Cormorant, *Phalacrocorax brasilianus*	MS	C		X		
Anhingidae						
Anhinga, *Anhinga anhinga*	MS	U		X		
Fregatidae						
Magnificent Frigatebird, *Fregata magnificens*	BR	C		X		
Ardeidae						
Boat-billed Heron, *Cochlearius cochlearius*	BR	R		X		
Black-crowned Night-heron, *Nycticorax nycticorax*	BR	C		X	X	
Yellow-crowned Night-heron, *Nyctanassa violacea*	BR	C		X		
Striated Heron, *Butorides striatus*	BR	C		X	X	
Cattle Egret, *Bubulcus ibis*	BR	A		X	X	
Great Blue Heron, *Ardea herodias*	MN	U		X		
Cocoi Heron, *Ardea cocoi*	MS	Sc		X		
Great Egret, *Ardea alba*	BV	C		X		
Tricolored Heron, *Egretta tricolor*	BV	C		X		
Snowy Egret, *Egretta thula*	BV	A		X	X	
Little Blue Heron, *Egretta caerulea*	BV	A		X		
Threskiornithidae						
Scarlet Ibis, *Eudocimus ruber*	BV	L		X		
Cathartidae						
Turkey Vulture, *Cathartes aura*	BR	A			X	
Black Vulture, *Coragyps atratus*	BR	A		X	X	
Phoenicopteridae						
Greater Flamingo, *Phoenicopterus ruber*	MS	R		X		
Accipitridae						
Osprey, *Pandion haliaetus*	MN	C		X		
Pearl Kite, *Gampsonyx swainsonii*	BR	U			X	
Long-winged Harrier, *Circus buffoni*	BR	U			X	
Grey Hawk, *Asturina nitida*	BR	C	X		X	
Common Black-hawk, *Buteogallus anthracinus*	BR	C		X	X	
Rufous Crab-hawk, *Buteogallus aequinoctialis*	BR	R		X		
Savannah Hawk, *Buteogallus meridionalis*	BR	C			X	
Short-tailed Hawk, *Buteo brachyurus*	BR	C			X	
Zone-tailed Hawk, *Buteo albonotatus*	BR	C			X	
Falconidae			X			
Yellow-headed Caracara, *Milvago chimachima*	BR	C	X	X	X	
Merlin, *Falco columbarius*	MN	U	X	X	X	
Aplomado Falcon, *Falco femoralis*	MS	R		X		
Bat Falcon, *Falco rufigularis*	BR	Sc			X	
Peregrine Falcon, *Falco peregrinus*	MN	U	X	X	X	

Table 4 Cont. Birds of Trinidad likely to be found within San Fernando and environs and the habitats in which they are likely to be found.
The Coastal habitat includes Mangrove, Mudflats and seabird roosts.

Species	Status & Abundance		Residential	Coastal	Scrub and agriculture	Other
Aramidae						
Limpkin, *Aramus guarauna*	BR	U			X	
Rallidae						
Clapper Rail, *Rallus longirostris*	BR	L		X		
Grey-necked Wood-rail, *Aramides cajanea*	BR	-			X	
Common Moorhen, *Gallinula chloropus*	BR	C				Marsh
Purple Gallinule, *Porphyrio martinica*	BR	C				Marsh
Charadriidae						
Southern Lapwing, *Vanellus chilensis*	BR	A		X	X	
American Golden-Plover, *Pluvialis dominica*	MN	U				Lawns
Black-bellied Plover, *Pluvialis squatarola*	MN	C		X		
Semipalmated Plover, *Charadrius semipalmatus*	MN	C		X		
Wilson's Plover, *Charadrius wilsonia*	MS	U		X		
Collared Plover, *Charadrius collaris*	BD	C		X		
Recurvirostridae						
Black-necked Stilt, *Himantopus mexicanus*	BD	C		X		
Scolopacidae						
Short-billed Dowitcher, *Limnodromus griseus*	MN	C		X		
Hudsonian Godwit, *Limosa haemastica*	MN	Sc		X		
Marbled Godwit, *Limosa fedoa*	MN	R		X		
Whimbrel, *Numenius phaeopus*	MN	C		X		
Greater Yellowlegs, *Tringa melanoleuca*	MN	C		X		
Lesser Yellowlegs, *Tringa flavipes*	MN	A		X		
Solitary Sandpiper, *Tringa solitaria*	MN	C		X		
Willet, *Catoptrophorus semipalmatus*	MN	C		X		
Spotted Sandpiper, *Actitis macularia*	MN	C		X		
Ruddy Turnstone, *Arenaria interpres*	MN	C		X		
Red Knot, *Calidris canutus*	MN	U		X		
Sanderling, *Calidris alba*	MN	U		X		
Semipalmated Sandpiper, *Calidris pusilla*	MN	A		X		
Western Sandpiper, *Calidris mauri*	MN	A		X		
Least Sandpiper, *Calidris minutilla*	MN	A		X		
White-rumped Sandpiper, *Calidris fuscicollis*	MN	U		X		
Pectoral Sandpiper, *Calidris melanotos*	MN	U				Lawns
Stilt Sandpiper, *Calidris himantopus*	MN	C		X		
Jacanidae						
Wattled Jacana, *Jacana jacana*	BR	A				Marsh
Stercorariidae						
Parasitic Jaegar, *Stercorcarius parasiticus*	O	Sc		X		
Laridae						
Ring-billed Gull, *Larus delawarensis*	MN	R		X		
Lesser Black-backed Gull, *Larus fuscus*	MN	U		X		
Kelp Gull, Larus dominicanus	MN	VR				

Table 4 Cont. Birds of Trinidad likely to be found within San Fernando and environs and the habitats in which they are likely to be found.
The Coastal habitat includes Mangrove, Mudflats and seabird roosts.

Species	Status & Abundance		Residential	Coastal	Scrub and agriculture	Other
Herring Gull, Larus argentatus	V	VR				
Laughing Gull, *Larus atricilla*	BV	A		X		
Franklin's Gull, *Larus pipixcan*	MN	VR				
Sabine's Gull, Xema sabini	W	VR				
Gull-billed Tern, *Sterna nilotica*	MN	U		X		
Sandwich Tern, *Sterna sandvicensis*	MN/S	U		X		
Royal Tern, *Sterna maxima*	MN(B)	C		X		
Common Tern, *Sterna hirundo*	MN	C		X		
Yellow-billed Tern, *Sterna superciliaris*	MS	C		X		
Black Tern, *Chlidonias niger*	MN	Sc		X		
Large-billed Tern, *Phaetusa simplex*	MS	C		X		
Black Skimmer, *Rynchops niger*	MS	C		X		
Columbidae						
Common Ground-dove, *Columbina passerina*	BR	C			X	
Plain-breasted Ground-dove, *Columbina minuta*	BR	U			X	
Ruddy Ground-dove, *Columbina talpacoti*	BR	A	X		X	
Rock Dove, *Columba livia*	Feral	A	X		X	
Eared Dove, *Zenaida auriculata*	BD	C		X	X	
White-tipped Dove, *Leptotila verreauxi*	BR	C	X		X	
Psittacidae						
Green-rumped Parrotlet, *Forpus passerinus*	BR	U	X	X	X	
Yellow-crowned Parrot, *Amazona ochrocephala*	BR	C	X		X	
Orange-winged Parrot, *Amazona amazonica*	BR	A		X	X	
Cuculidae						
Mangrove Cuckoo, *Coccyzus minor*	BR	Sc		X		
Greater Ani, *Crotophaga major*	BR	U		X	X	
Smooth-billed Ani, *Crotophaga ani*	BR	A	X	X	X	
Striped Cuckoo, *Tapera naevia*	BR	C		X	X	
Tytonidae						
Barn Owl, *Tyto alba*	BR	U	X	X	X	
Strigidae						
Tropical Screech-owl, *Megascops choliba*	BR	U	X		X	
Ferruginous Pygmy-owl, *Glaucidium brasilianum*	BR	C	X		X	
Nyctibiidae						
Common Potoo, *Nyctibius griseus*	BR	U		X		
Caprimulgidae						
Lesser Nighthawk, *Chordeiles acutipennis*	MN	C		X	X	
Nacunda Nighthawk, *Podager nacunda*	MS	Sc			X	
Common Pauraque, *Nyctidromus albicollis*	BR	C			X	
White-tailed Nightjar, *Caprilmulgus cayennensis*	BR	C			X	
Apodidae						
Short-tailed Swift, *Chaetura brachyura*	BR	A	X		X	
Fork-tailed Palm-swift, *Tachornis squamata*	BR	C			X	

Table 4 Cont. Birds of Trinidad likely to be found within San Fernando and environs and the habitats in which they are likely to be found.
The Coastal habitat includes Mangrove, Mudflats and seabird roosts.

Species	Status & Abundance		Residential	Coastal	Scrub and agriculture	Other
Trochilidae						
Rufous-breasted Hermit, *Glaucis hirsutus*	BR	C				Forest
Little Hermit, *Phaethornis longuemareus*	BR	C				Forest
Green-throated Mango, *Anthracothorax viridigula*	BR	L		X		
Ruby-topaz Hummingbird, *Chrysolampis mosquitus*	BD	C	X	X	X	
Tufted Coquette, *Lophornis ornate*	BR	U			X	
White-chested Emerald, *Amazilia brevirostris*	BR	C		X	X	
Copper-rumped Hummingbird, *Amazilia tobaci*	BR	A	X	X	X	
Long-billed Starthroat, *Heliomaster longirostris*	BR	Sc		X		
Alcedinidae						
Ringed Kingfisher, *Ceryle torquata*	BR	U		X		
Green Kingfisher, *Chloroceryle Americana*	BR	C		X		
Pygmy Kingfisher, *Chloroceryle aenea*	BR	U		X		
Picidae						
Lineated Woodpecker, *Dryocopus lineatus*	BR	C	X		X	
Furnariidae						
Pale-breasted Spinetail, *Synallaxis albescens*	BR	U			X	
Yellow-chinned Spinetail, *Certhiaxis cinnamomea*	BR	C			X	
Dendrocolaptidae						
Straight-billed Woodcreeper, *Xiphorhynchus picus*	BR	L		X		
Thamnophilidae						
Black-crested Antshrike, *Sakesphorus Canadensis*	BR	C		X		
Barred Antshrike, *Thamnophilus doliatus*	BR	C	X		X	
Tyrannidae						
Yellow-bellied Elaenia, *Elaenia flavogaster*	BR	C	X	X	X	
Southern Beardless Tyrannulet, *Camptostoma obsoletum*	BR	C			X	
Northern scrub Flycatcher, *Sublegatus arenarum*	BR	U		X		
Yellow-breasted Flycatcher, *Tolmonyias flavivrentris*	BR	C		X		
Bran-colored Flycatcher, *Myiophobus fasciatus*	BR	U		X	X	
Pied Water-tyrant, *Fluvicola pica*	BR	C		X	X	
White-headed Marsh-tyrant, *Arundinicola leucocephala*	BR	C		X	X	
Piratic Flycatcher, *Legatus leucophaius*	BD	C			X	
Great Kiskadee, *Pitangus sulphuratus*	BR	A	X	X	X	
Streaked Flycatcher, *Myiodynastes maculates*	BR	C			X	
Boat-billed Flycatcher, *Megarynchus pitangua*	BR	C		X	X	
Tropical Kingbird, *Tyrannus melancholicus*	BR	A	X	X	X	
Fork-tailed Flycatcher, *Tyrannus savanna*	MS	A		X	X	
Grey Kingbird, *Tyrannus dominicensis*	BV	U		X	X	
Brown-crested Flycatcher, *Myiarchus tyrannulus*	BR	U		X		
White-winged Becard, *Pachyramphus polychopterus*	BR	U		X		

Table 4 Cont. Birds of Trinidad likely to be found within San Fernando and environs and the habitats in which they are likely to be found.
The Coastal habitat includes Mangrove, Mudflats and seabird roosts.

Species	Status & Abundance		Residential	Coastal	Scrub and agriculture	Other
Vireonidae						
Rufous-browed Peppershrike, *Cyclarhis gujanensis*	BR	C	X	X	X	
Red-eyed Vireo, *Vireo olivaceus*	BV	C		X	X	
Golden-fronted Greenlet, *Hylophilus aurantiifrons*	BR	C		X	X	
Hirundinidae						
White-winged Swallow, *Tachycineta albiventer*	BR	C	X	X	X	
Grey-breasted Martin, *Progne chalybea*	BR	A	X	X	X	
Blue and White Swallow, *Pygochelidon cyanoleuca*	MS	U		X	X	
Southern Rough-winged Swallow, *Stelgidopteryx ruficollis*	BR	C			X	
Barn Swallow, *Hirundo rustica*	MN	C		X	X	
Bank Swallow, *Riparia riparia*	MN	Sc			X	
Troglodytidae						
House Wren, *Troglodytes aedon*	BR	C	X	X	X	
Rufous-breasted Wren, *Thryothorus rutilus*	BR	C			X	
Sylviidae						
Long-billed Gnat-wren, *Ramphocaenus melanurus*	BR	C		X	X	
Turdidae						
Bare-eyed Robin, *Turdus nudigenis*	BR	C	X	X	X	
Cocoa Thrush, *Turdus fumigatus*	BR	C				Forest
Mimidae						
Tropical Mockingbird, *Mimus gilvus*	BR	C	X	X	X	
Coerebidae						
A Bananaquit, *Coereba flaveola*	BR	A	X	X	X	
Thraupidae						
White-shouldered Tanager, *Tachyphonus luctuosus*	BR	U			X	
White-lined Tanager, *Tachyphonus rufus*	BR	C	X		X	
Silver-beaked Tanager, *Ramphocelus carbo*	BR	C	X		X	
Blue-grey Tanager, *Thraupis episcopus*	BR	C	X	X	X	
Palm Tanager, *Thraupis palmarum*	BR	A	X	X	X	
Turquoise Tanager, *Tangara mexicana*	BR	C			X	
Bicolored Conebill, *Conirostrum bicolor*	BR	C		X		
Emberizidae						
Saffron Finch, *Sicalis flaveola*	BR	U	X		X	
Blue-black Grassquit, *Volatinia jacarina*	BR	A	X		X	
Red-capped Cardinal, *Paroaria gularis*	BR	U		X	X	
Cardinalidae			X			
Greyish Saltator, *Saltator coerulescens*	BR	C	X	X	X	
Dickcissel, *Spiza americana*	MN	C			X	
Parulidae						
Yellow Warbler, *Dendroica petechia*	MN	C	X	X	X	
American Redstart, *Setophaga ruticilla*	MN	C		X	X	

Table 4 Cont. Birds of Trinidad likely to be found within San Fernando and environs and the habitats in which they are likely to be found.
The Coastal habitat includes Mangrove, Mudflats and seabird roosts.

Species	Status & Abundance		Residential	Coastal	Scrub and agriculture	Other
Prothonotary Warbler, *Protonotaria citrea*	MN	Sc		X		
Northern Waterthrush, *Seiurus noveboracensis*	MN	C		X	X	
Masked Yellowthroat, *Geothlypis aequinoctialis*	BR	U			X	
Icteridae						
Crested Oropendola, *Psarocolius decumanus*	BR	A			X	
Yellow Oriole, *Icterus nigrogularis*	BR	C	X	X	X	
Giant Cowbird, *Molothrus oryzivora*	BR	U			X	
Shiny Cowbird, *Molothrus bonariensis*	BR	A	X	X	X	
Carib Grackle, *Quiscalus lugubris*	BR	A	X	X	X	
Red-breasted Blackbird, *Sturnella militaris*	BR	C			X	
Yellow-hooded Blackbird, *Chrysomus icterocephalus*	BR	A		X	X	Marsh
Euphonidae						
Trinidad Euphonia, *Euphonia trinitatis*	BR	U		X	X	
Violaceous Euphonia, *Euphonia violacea*	BR	C			X	
Estrildidae						
Common Waxbill, *Estrilda astrild*	BR	L			X	

Nomenclature (Remsen et al 2007). Status and abundance categories (White et al 2007)

BR *Resident species without significant movement out of Trinidad and Tobago. Breeding is assumed even if no nest has been documented.*

BD *Species that breed locally and migrate or disperse to the mainland (sometimes only partially) in the non-breeding period.*
BV *Resident, regularly breeding species whose numbers are augmented by visitors from continental N & S America*
MN *Non-breeding migrants from continental North America. Predominantly over-wintering.*
MS *Migrants from South America. These species may be avoiding the Austral winter, dispersing from breeding grounds but generally show regular seasonal movements. May occasionally breed.*
O *Oceanic, may be observed from shore.*
W *Generally sedentary or wandering species at the edge of their range. Reported less than onece per decade.*

A *Abundant; widespread and usually in some numbers in suitable habitat.*
C *Common, usually found in suitable habitat.*
U *Uncommon; occasionally seen in suitable habitat in small numbers or singly.*
Sc *Scarce, very few (less than 5) records in a year.*
R *Rare- not recorded annually.*
VR *Very Rare Less than one record per decade.*
L *Locally distributed in restricted habitat; but may be not uncommon there.*

Table 5 Mammals of Trinidad which may be expected within San Fernando and environs.

Order	**Family**	**Sp Alkins**	**Common Name**
Marsupialia	Didelphidae	*Didelphis marsupialis insularis*	Black-eared Opossum
Edentata	Myrmecophagidae	*Cyclopes didactylus didactylus*	Two-toed Anteater
Chiroptera	Emballonuridae	*Rhynchiscus naso*	Jacob's Ladder Bat
	Emballonuridae	*Saccopteryx bilineata perspicillifer*	Greater Trinidadian two-lined Bat
	Emballonuridae	*Saccopteryx leptura*	Lesser two-lined Bat
	Noctilionidae	*Noctilio leporinus leperinus*	Fish-eating Bat
	Mormoopidae	*Chilonycteris rubiginosa fusca*	Greater Mustache Bat
	Mormoopidae	*Pteronotus davyi davyi*	Naked-backed Bat
	Mormoopidae	*Mormoops megalophylla tumidiceps*	Trinidadian Leaf-chinned Bat
	Phyllostomidae	*Micronycteris sp.*	Bat
	Phyllostomidae	*Phyllostomus hastatus hastatus*	Greater Spear-nosed Bat
	Phyllostomidae	*Glossophaga soricina soricina*	Bat
	Phyllostomidae	*Anoura geoffroyi geoffroyi*	Tailless Long-tongued Bat
	Phyllostomidae	*Carollia perspicillata perspicillata*	Short-tailed Fruit Bat
	Phyllostomidae	*Sturnira lilium lilium*	South American Yellow-shouldered Bat
	Phyllostomidae	*Uroderma bilobatum bilobatum*	Yellow-eared or Tent Making Bat
	Phyllostomidae	*Artibeus jamaicensis trinitatis*	Lesser Trinidadian Fruit Bat
	Phyllostomidae	*Artibeus lituratus palmarum*	Greater Trinidadian Fruit Bat
	Vespertilionidae	*Myotis nigricans nigricans*	Little Balck Bat
	Molossidae	*Molossus ater ater*	Large Free-tailed Bat
	Molossidae	*Molossus major major*	Small Free-tailed Bat
Rodentia	Sciuridae	*Sciurus granatensis chapmani*	Trinidadian Squirrel
	Muridae	*Oryzomys concolor speciosus*	Arboreal Rice Rat
	Muridae	*Zygodontomys brevicauda brevicauda*	Trinidadian Cane Rat
	Muridae	*Rattus rattus rattus*	Black Rat
	Muridae	*Rattus norvegicus*	Wharf Rat
	Muridae	*Mus musculus brevirostris*	House mouse
	Dasyproctidae	*Dasyprocta agouti*	Agouti
Carnivora	Viverridae	*Herpestes auropunctatus*	Small Indian Mongoose

* Taxonomy follows Alkins (1979). Likely list of bats conservative with assistance fron Geoffrey Gomes.

3.3 Species Observed During Site visits

With the exception of the birds, comparatively few vertebrate species were observed. Bird species are presented for the specific sites of interest visited, including mudflats at Bel-Air and a small boatyard just south of the Vistabella River, the mangrove forest around the Guaracara River, freshwater ponds at Usine St. Madeline, the Cipero River and small areas of forest at San Fernando Hill and Palmiste Park, and a general list for areas of scrub and agriculture. For other fauna an overall account is presented.

None of the waterways observed during the site visits seemed likely to support a wide range of species although a few birds were seen. Cipero River was concreted for much of its length, (Plates 1 and 2). It appeared to be highly polluted with a putrid odour and little natural vegetation. Despite this a school of Tilapia was observed.

Evidence of amphibians was limited to one chorus of *Leptodactylus validus* and one foam nest of *Engystomops pustulosus*. Reptiles actually observed during the site visits were limited to one Spectacled Caiman, *Caiman crocodilus* a few *Ameiva ameiva* and one *Gonatodes vittatus*. Residents advised of the presence of Iguanas, *Iguana iguana*. There was conflicting opinion on the presence of a Matte, *Tupinambis teguixin*.

The only mammals observed were the Trinidad Squirrel, *Sciurus granatensis.* Residents advised of the occurrence of Black-eared Opossum, *Didelphis marsupialis* and workers at San Fernando Hill thought that there may be a few surviving Agouti, *Dasyprocta agouti*.

As is expected birds constitute most of the vertebrate species observed during the field visits. Overall 84 species were observed, Table 6. The species observed were generally consistent with expectations for the different habitats with greatest numbers from the coastal habitats. Three species observed in Palmiste Park were unexpected, Rufous-breasted Hermit, Little Hermit and Cocoa Thrush. These species are usually associated with a forest environment, and while they are observed on the edges of forest they are seldom seen far from a forest environment. The population of these species in Palmiste Park is presumably a self-sustaining population and if so must be close to the lower limit for a sustainable population.

The small patch of mangrove at the mouth of the Guaracara River housed several species characteristic of mangrove (Plates 3 and 4). These include Common Black Hawk, Straight-billed Woodcreeper, Brown-crested Flycatcher and Bicoloured Conebill. Other recent sightings of Straight-billed Woodcreeper have been confined to Caroni Swamp. This mangrove also supported population of Blue Crabs *Cardisoma guanhumi,* Hairy Crabs *Ucides cordatus* and Fiddler Crabs *Uca* spp. No mangrove Tree Crabs, *Aratus pisonii* were observed.

The mudflats at the mouth of the Cipero River (Viewed from Bel-Air) and at the mouth of the Vistabella River (viewed from a small boatyard at grid reference 668298, 1137924) were both small in extent. They will provide a much longer species list if viewed regularly. The same is true for the San Fernando Wharf, where much higher gull populations would be recorded in March-April.

Plate 1 Cipero River in concrete channel at grid reference 668521, 1134820

Plate 2 Cipero River at grid reference 670148, 1134594

Table 6 Bird species observed within San Fernando and environs in October 2009. Details in text.

Species	Scrub and agriculture	San Fernando Hill	Palmiste Park	Usine St. Madeline	Bellair Mudflats	Guaracara Mangrove	San Fernando Wharf	Boatyard	Cipero River
Pelicanidae									
Brown Pelican, *Pelicanus occidentalis*					36	10	261	20	
Fregatidae									
Magnificent Frigatebird, *Fregata magnificens*					X				
Ardeidae									
Black-crowned Night-heron, *Nycticorax nycticorax*					X				
Striated Heron, *Butorides striatus*				X					
Cattle Egret, *Bubulcus ibis*	X		X	X					
Tricolored Heron, *Egretta tricolor*								X	
Snowy Egret, *Egretta thula*				X	X		X	X	X
Little Blue Heron, *Egretta caerulea*					X				
Cathartidae									
Turkey Vulture, *Cathartes aura*	X								
Black Vulture, *Coragyps atratus*	X	X	X	X		X			
Accipitridae									
Osprey, *Pandion haliaetus*		X			X	20		X	
Common Black-hawk, *Buteogallus anthracinus*						X			
Zone-tailed Hawk, *Buteo albonotatus*	X								
Rallidae									
Common Moorhen, *Gallinula chloropus*				X					
Purple Gallinule, *Porphyrio martinica*			X	X					
Charadriidae									
Southern Lapwing, *Vanellus chilensis*				X					
Black-bellied Plover, *Pluvialis squatarola*					X			X	
Semipalmated Plover, *Charadrius semipalmatus*					X	X		X	
Scolopacidae									
Whimbrel, *Numenius phaeopus*					X			X	
Lesser Yellowlegs, *Tringa flavipes*	X				X				X
Willet, *Catoptrophorus semipalmatus*					X				
Spotted Sandpiper, *Actitis macularia*	X					X		X	X

Table 6 Cont. Bird species observed within San Fernando and environs in October 2009. Details in text

Species	Scrub and agriculture	San Fernando Hill	Palmiste Park	Usine St. Madeline	Bellair Mudflats	Guaracara Mangrove	San Fernando Wharf	Boatyard	Cipero River
Ruddy Turnstone, *Arenaria interpres*					X			X	
Semipalmated Sandpiper, *Calidris pusilla*	X			X	100+	X		X	X
Western Sandpiper, *Calidris mauri*					200+	X		X	
Least Sandpiper, *Calidris minutilla*						X			
White-rumped Sandpiper, *Calidris fuscicollis*						X			
Pectoral Sandpiper, *Calidris melanotos*									X
Jacanidae									
Wattled Jacana, *Jacana jacana*				X					
Laridae									
Laughing Gull, *Larus atricilla*					200	X	16	X	
Gull-billed Tern, *Sterna nilotica*							X		
Common Tern, *Sterna hirundo*					39	X	X		
Large-billed Tern, *Phaetusa simplex*					55		X	X	
Columbidae									
Ruddy Ground-dove, *Columbina talpacoti*	X	X	X	X		X		X	
Rock Dove, *Columba livia*	X	X							
Eared Dove, *Zenaida auriculata*	X	X		X					
Psittacidae									
Green-rumped Parrotlet, *Forpus passerinus*	X	X	X			X			
Cuculidae									
Smooth-billed Ani, *Crotophaga ani*	X								
Striped Cuckoo, *Tapera naevia*	X								
Strigidae									
Ferruginous Pygmy-owl, *Glaucidium brasilianum*			X			X			
Apodidae									
Short-tailed Swift, *Chaetura brachyuran*		X							
Trochilidae									
Rufous-breasted Hermit, *Glaucis hirsutus*			X						
Little Hermit, *Phaethornis longuemareus*			X						
Copper-rumped Hummingbird, *Amazilia tobaci*		X	X			X			
Alcedinidae									
Pygmy Kingfisher, *Chloroceryle aenea*						X			

Table 6 Cont. Bird species observed within San Fernando and environs in October 2009. Details in text.

Species	Scrub and agriculture	San Fernando Hill	Palmiste Park	Usine St. Madeline	Bellair Mudflats	Guaracara Mangrove	San Fernando Wharf	Boatyard	Cipero River
Furnariidae									
Pale-breasted Spinetail, *Synallaxis albescens*						X			
Yellow-chinned Spinetail, *Certhiaxis cinnamomea*				X					
Dendrocolaptidae									
Straight-billed Woodcreeper, *Xiphorhynchus picus*						X			
Thamnophilidae									
Barred Antshrike, *Thamnophilus doliatus*			X			X			
Tyrannidae									
Yellow-bellied Elaenia, *Elaenia flavogaster*	X	X		X					
Southern Beardless Tyrannulet, *Camptostoma obsoletum*	X		X						
Pied Water-tyrant, *Fluvicola pica*				X					X
White-headed Marsh-tyrant, *Arundinicola leucocephala*				X					
Great Kiskadee, *Pitangus sulphuratus*	X	X	X	X		X			
Boat-billed Flycatcher, *Megarynchus pitangua*		X							
Tropical Kingbird, *Tyrannus melancholicus*	X	X		X		X			
Fork-tailed Flycatcher, *Tyrannus savanna*	X								
Brown-crested Flycatcher, *Myiarchus tyrannulus*						X			
Vireonidae									
Rufous-browed Peppershrike, *Cyclarhis gujanensis*			X						
Red-eyed Vireo, *Vireo olivaceus*		X							
Hirundinidae									
White-winged Swallow, *Tachycineta albiventer*					X	X	X		
Grey-breasted Martin, *Progne chalybea*		X	X						
Southern Rough-winged Swallow, *Stelgidopteryx ruficollis*			X			X			
Barn Swallow, *Hirundo rustica*	X								

Table 6 Cont. Bird species observed within San Fernando and environs in October 2009. Details in text

Species	Scrub and agriculture	San Fernando Hill	Palmiste Park	Usine St. Madeline	Bellair Mudflats	Guaracara Mangrove	San Fernando Wharf	Boatyard	Cipero River
Troglodytidae									
House Wren, *Troglodytes aedon*	X	X	X					X	
Sylviidae									
Long-billed Gnat-wren, *Ramphocaenus melanurus*		X	X						
Turdidae									
Bare-eyed Robin, *Turdus nudigenis*	X	X	X	X		X			
Cocoa Thrush, *Turdus fumigatus*			X						
Mimidae									
Tropical Mockingbird, *Mimus gilvus*		X	X	X		X			
Coerebidae									
A Bananaquit, *Coereba flaveola*		X	X			X			
Thraupidae									
White-lined Tanager, *Tachyphonus rufus*		X	X			X			
Blue-grey Tanager, *Thraupis episcopus*	X	X	X	X		X			X
Bicolored Conebill, *Conirostrum bicolor*						X			
Emberizidae									
Saffron Finch, *Sicalis flaveola*		X				X		X	
Blue-black Grassquit, *Volatinia jacarina*		X		X		X			
Cardinalidae									
Greyish Saltator, *Saltator coerulescens*	X	X		X					
Parulidae									
Yellow Warbler, *Dendroica petechia*	X	X	X	X		X			
Northern Waterthrush, *Seiurus noveboracensis*						X			
Icteridae									
Crested Oropendola, *Psarocolius decumanus*	X		X						
Yellow Oriole, *Icterus nigrogularis*	X	X	X			X			
Shiny Cowbird, *Molothrus bonariensis*	X								
Carib Grackle, *Quiscalus lugubris*			X			X			
Yellow-hooded Blackbird, *Chrysomus icterocephalus*			X	X					
Euphonidae									
Trinidad Euphonia, *Euphonia trinitatis*		X							

Plate 3. Mangrove woodland north of the Guaracara River accessed via Pointe-a-Pierre.

Plate 4 Mangrove woodland south of Guaracara River Mouth

Plate 5 Mudflats at the mouth of the Cipero River. Viewed from Bel Air, 666301,1134246.

Plate 6 Mudflats at the mouth of the Vistabella River. Viewed from boatyard at 668298, 1137924.

Very few butterflies were seen during the field visits. This may be in part due to the timing of the field visits. The latter half of the wet season is generally not the best time for collecting butterflies and years with a comparatively wet dry-season are not as good for butterfly collection as years with a harsh dry season (Barcant (1970). Those butterflies which were observed are listed in Table 7.

Table 7 Butterflies observed within San Fernando and environs in October 2009.

Family	**Species***
Satyridae	*Euptychia* sp., Ringlet
Danaidae	*Danaus plexippus*, Monarch
Ithomiidae	*Mechanitis polymnia*, Sweetoil
Heliconidae	*Heliconius* sp. Postman
Heliconidae	*Calaenis iulia*, Flambeau
Heliconidae	*Dione juno*, Scarce Silver-spotted Flambeau
Nymphalidae	*Metamorpha stelenes*, Bamboo Page
Nymphalidae	*Anartia jatrophe*, Biscuit
Nymphalidae	*Anartia amathea*, Coolie
Nymphalidae	*Precis lavinia zonatis,* Donkey's Eye
Brassolidae	*Caligo teucer insulanus*, Cocoa Mort Bleu
Papilionidae	*Papilio homothoas,* Small King Page

* Names follow Barcant (1970) except for *Mechanitis polymnia.*

4.0 Discussion

4.1 Association of Land Use and Fauna

Urban Development accounts for 49% of the land area under consideration and there is a further 7% of land area earmarked for new developments. The habitat ranges from almost entirely steel and concrete to up-scale residential areas. The former supports very little animal life with the likely exception of public health pests. High-value residential areas with gardens with fruiting trees and flowers will support a range of wildlife, especially birds. The vertebrate species which survive under such conditions are a subset of the species listed for the scrub and agriculture, especially at the boundaries of the two habitats. For example, the 41 bird species identified in Table 4 under 'Residential' are likely to maintain self-sustaining populations within such areas, but any of the other species listed under Scrub and Agriculture may occur. The residential areas will usually be more ordered with concrete lined waterways, close cropped grass and well pruned trees with few dead branches and will consequently support fewer species. Amphibians and reptiles, when encountered are often killed in urban areas. A few species, for example parrots, squirrels and iguanas may be considered welcome and protected.

Plate 7. Residential area west of grid reference 670594, 1135469.

Plate 8. Newly constructed residential area east of grid reference 670594, 1135469.

Associated with urban areas are areas of **Lawns and other close-cropped grass** which generally support a very low diversity of animal or plant life. When such fields are flooded however they provide a temporary habitat for a number of migrating shorebirds, especially American Golden Plover, Buff-breasted Sandpiper and Pectoral Sandpiper which prefer freshwater feeding areas.

Approximately 22% of the study area can be described as **Scrub and Agriculture** (Plate 9) and 6% **Abandoned Sugarcane.** Most of the species found in residential areas will also be present in the scrub and agriculture. The scrub and agriculture is more variable with earth lined canals, tangles of vegetation, areas of wet grassland, muddy ponds and occasional dead trees. Due to the greater variability in ecological conditions a wide range of species may occur including most of the species listed in tables 3 and 5 and 101 of the birds listed in Table 4. The Abandoned Sugarcane south of San Fernando included a number of oil installations (Plate 10).

Plate 9 Scrub and Agriculture at grid reference 670528, 1134145.

Plate 10 Abandoned sugarcane with oil installations at grid reference 665529, 1131224.

The study area includes approximately 53 Ha of **Mangrove forest** in three discontinuous locations. The largest areas are around the mouths of the Guaracara and Cipero Rivers, and there is a small highly degraded area at the Vistabella River mouth. These areas house a community characteristic of coastal mangroves as is seen in many areas along Trinidad's west coast especially at Caroni and Godineau Swamps. These communities are not entirely natural as they appear to benefit from the highly enriched runoff from the land at the sewage outlet and the fishing activities at San Fernando Wharf. Despite its small area, the mangrove at the mouth of the Guaracara housed a range of species characteristic of mangrove woodland. The mangrove and associated coastal mudflats constitute the largest number of likely bird species (120) and the largest number of species actually observed (53).

The small areas of **Riparian forest** along some of the watercourses were of very limited diversity and composed mainly of Swamp Immortelle, and Hog Plum (Plate 11). This vegetation may be comparatively easy to re-create if disturbed.

A small area of teak is located at Grid Reference 0670400, 1133300 and there is a small stand of teak within the Palmiste Park. Pure stands of teak are of very limited ecological value.

Plate 11 Riparian vegetation within Abandoned Sugarcane at grid reference 666552, 1131656.

San Fernando Hill is a highly disturbed environment with some attempts at rehabilitation (Plate 12). The original vegetation has long been removed when the site was an active quarry. The site still holds aesthetic value and possible feeding site for migrant passerines. The existing vegetation is composed largely of Lucena on the eastern side. The southern and western slopes retain some more diverse and natural vegetation. The wildlife of the site is very limited and consisted generally of species associated with urban areas. The site supports populations of squirrels, iguanas and possibly Agouti. With respect to birds the site supports a population of Saffron Finches. This species is often caught as a cage bird but survives in areas of well managed lawns and gardens where bird catchers are less likely to frequent.

Plate 12 View towards San Fernando Hill from grid reference 666301, 1134246.

Palmiste Park provides another interesting habitat. Much of the park is short cropped lawns interspersed with shade trees (Plate 13) but the western section includes an area with semi-natural secondary forest. The park is a remnant of the former Palmiste Estate established in 1808, eventually growing to 2328 acres. It was acquired by James Lamont in 1869. Sir Norman Lamont collected moths from about 1913 until his death in 1949 (Cock 2003).

This forest has a varied structure with a closed canopy and a ground layer. The trees support a dense growth of epiphytes, mainly bromeliads but including ferns, cacti, aroids and orchids (Plate

14). There is a small watercourse running through the park (Plate 15) creating tiny wetlands at the eastern and western ends. While the fauna observed was limited, a few species observed were unexpected as they are usually associated with a forested environment. These included Rufous-breasted hermit, Little Hermit and Cocoa Thrush. Also observed was a display lek of the Little Hermit, one colony of Leaf-cutting ants, *Atta cephalotes* and one of Army ants, *Eciton* sp. Other vertebrate species not included on the list of expected species may survive here. While the size is of little consequence to the populations of these species in Trinidad, it does serve as a opportunity for study and education and for the enjoyment of the inhabitants of San Fernando.

Plate 13. Close cropped lawns and shade trees in Palmiste Park.

Plate 14. Shade trees in Palmiste Park festooned with epiphytes.

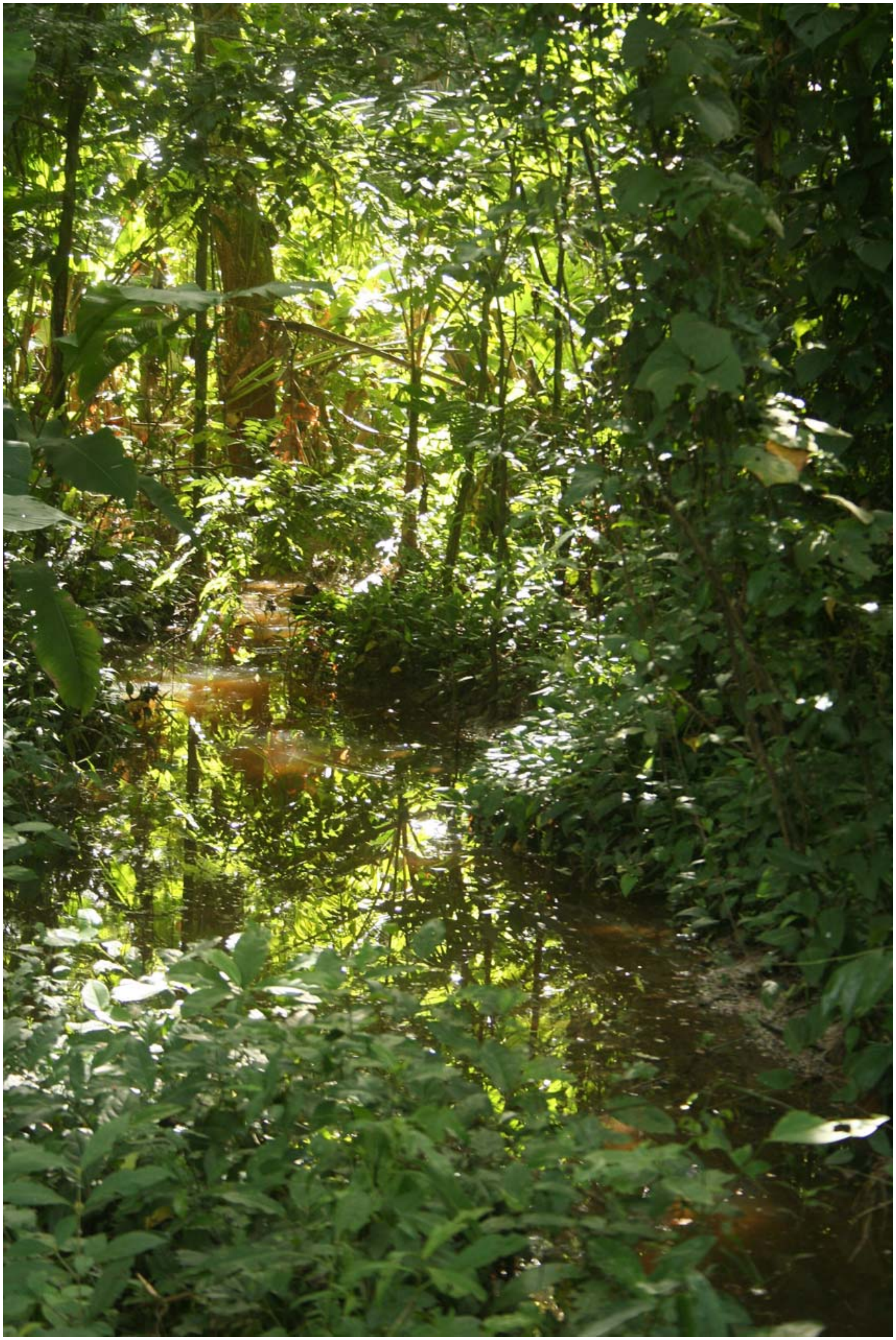

Plate 15 Small watercourse in Palmiste Park.

Usine St. Madeline is outside of the study area. However it houses some significant ponds upstream of the study area which may be significant for re-colonising of Cipero River once the water quality has improved. The area comprises three ponds. One to the east has been drained and is currently being choked by sedges and grasses. The open areas still support a few wetland birds (Table 6) and presumably a variety of amphibians and reptiles. The site serves as a potential site for waterfowl. Waterfowl however are very rare in Trinidad and unlikely to survive without protection of both the individual species and the habitat.

Plate 16 Freshwater Pond at Usine St. Madeline.

4.2 Habitats of Local or Regional Significance

While the cumulative effect on an animal population of small patches of habitat may be very important, none of the habitats observed were sufficiently intact or large enough to support more than a minor portion of the national populations of each animal species present. Two exceptions include the Saffron Finch and *Anolis trinitatis.* The San Fernando Hill and surrounding residential and commercial areas probably support a fair portion of the population of Saffron Finch in Trinidad, perhaps in excess of 10%. The local population of *Anolis trinitatis*, an exotic species which originated in St. Vincent, is limited to small populations in residential areas of San Fernando, Usine St. Madeline, St Augustine and Port pf Spain. Being exotic these populations are of little conservation value. The proposed developments are unlikely to impact either of these species. The number of rats and other vermin in San Fernando is probably a significant portion of the national population of these species.

The coastal zone of the study area, with associated mangrove and mudflats, is the southern extension of an important bird habitat referred to as the 'West coast Mudflats'. The exposed mudflats along Trinidad's west coast from Port of Spain to San Fernando provide a habitat for shorebirds, many of which are non-breeding migrants from North America which overwinter in Trinidad or further south. Shorebirds feed on invertebrates within the mud and roost on exposed mudbanks at high tide. These migrant species are dependant on such feeding and roosting opportunities along their migration route. The proximity of mangrove forest enhances the habitat as several species of Herons, Ibis and Rails roost in the mangrove and venture out onto the mudflats to feed. Species particularly dependant on mangrove include Rufous Crab-hawk, Green-throated Mango, Straight-billed Woodcreeper, Prothonotary Warbler and Bicoloured Conebill. Fishing activities along the coast have resulted in congregations of seabirds. At Port of Spain, Brickfield to Orange Valley and San Fernando large roosts of gulls and terns may occur on mudflats, boats or man made structures. The area is particularly important for Laughing Gulls with the largest overwintering congregation in northern South America (Hayes *et al* 2004).

The West Coast Mudflats of Trinidad have been identified as an Important Bird Area (IBA) for Trinidad and the Caribbean by Birdlife International (White 2008). The regional significance is due to its congregatory waterbirds, which number between 10,000 and 20,000 birds (predominantly Semipalmated and Western Sandpiper).

Protected Habitats

There are several references within the National Environmental Policy document (Anon No date) which are relevant to the current land use and proposed activities. The proposed developments address one of the major environmental issues identified in the document, sewage and wastewater management, by ensuring that all sewage and wastewater are appropriately treated before being discharged and thus reducing pollution to the marine environment.

While the proposed plans are consistent with the policy the emphasis should not be on limiting damage to the river systems but maximizing the environmental benefits which could accrue.

The National Environmental Policy also requires developmental projects to result in no net loss of wetland (including mangrove). The revised policy (Anon No date) includes mangrove with 'keystone species'. The most significant freshwater wetland identified in this report are the ponds at Usine St. Madeline which are well outside of the impact zone. The trunk lines running from the Guaracara River south to the Marabella and Vistabella Rivers may impact the mangrove woodland at the mouths of these rivers. If so this mangrove must be restored to be in compliance with the national environmental policy.

4.3 Species of Local or Regional Significance

Species of local significance include those of economic importance, those that are under a level of threat and receiving some form of protection under the law (or should be) and those which are covered by international treaties.

Species of Commercial Importance

Very few of the species encountered or likely to be present are of commercial benefit. There is some legal hunting of Iguanas and Manicou wherever they occur. There was also evidence of collection of Blue Crabs *Cardisoma guanhumi,* and Hairy Crabs *Ucides cordatus* in the mangrove around Guaracara River A school of Talipia was observed in the Cipero River , despite the very poor quality of the water.

Protected Species

The original Conservation of Wildlife Act (Anon 1963) officially protected all species which are not listed as game or vermin. The revised Conservation of Wildlife Act of 1999 (Anon, 1999) identifies three categories of protected species - *Endangered, Vulnerable* and *Rare.*

No *Endangered* species were encountered during the surveys. Any of the seed-eaters or seed-finches could turn up, but are likely to be escaped or intentionally released cagebirds. The Scarlet Ibis, Yellow-crowned Parrot and Silky Anteater have been listed as Vulnerable under Schedule 4 part B. The Yellow-crowned Parrot *Amazona ocrocephala*, is also listed as *Vulnerable* and is likely to be found in the study area as it is usually associated with urban areas of Trinidad. It has been argued that it may not be an indigenous species (ffrench 1998). Of the species listed as

Rare in the Act (Anon, 1999), only one species Red-capped Cardinal is expected to be present although Rufous-necked Wood-Rail may occur. None of the species observed are listed as Environmentally Sensitive Species, under the Environmental Management Act of 2000. However Scarlet Ibis and 'Seedeaters' have been identified for consideration.

Bird species deemed to be vulnerable in Trinidad according to Temple (2002) include Yellow Crowned Parrot, Boat-billed Heron, Rufous Crab-Hawk, Red-capped Cardinal, Pearl Kite, Mangrove Cuckoo, Anhinga, Zone-tailed Hawk and several seedeaters (not saffron finch). The Rufous Crab Hawk is a rare resident, highly dependant on mangrove woodland. It has been recorded from small patches of Mangrove at Carlie Bay. It has not however been listed as protected by the Conservation of Wildlife Act 1999. Boat-billed Heron is another rare resident which depends on secluded mangrove for breeding and has been observed breeding further south in the Roussillac Swamp.

None of the species observed or expected have been listed in the 2003 IUCN Red List of Threatened Species.

The Peregrine Falcon is listed in Appendix 1 of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). Several of the species observed are listed in Appendix II of the convention including; Scarlet Ibis, Caribbean Flamingo, all birds of prey, parrots and hummingbirds, Spectacled Caiman, large lizards and snakes like the Iguana, Matte, Boa Constrictor and Anaconda. These species are listed under Appendix II of CITES because they can be confused with species genuinely threatened by international trade.

With respect to the Specially Protected Areas and Wildlife (SPAW) Protocol, the Peregrine Falcon is listed in Annex II which, requires signatories to prohibit the disturbance of such species, particularly during periods of biological stress. A number of other species recommended for inclusion include a the Magnificent Frigatebird, Osprey, Merlin, Scarlet Ibis and several of the herons likely to inhabit the mangrove and coastal zone.

4.4 Likely impacts of proposed activities

Much of the impact will be on the aquatic ecology. The birds appear to tolerate and possibly benefit from the very high nutrient content in the water. They often congregate around areas such as the Cipero River mouth and the old Port of Spain sewage facility. These birds feed on high populations of invertebrates supported by the high nutrient load but the exposure to pollutants may impact the birds longevity and reproduction. With a reduction of this nutrient load fewer birds may be apparent. Generally however the impacts should be beneficial to the aquatic communities.

There is likely to be some disturbance to wildlife during construction due to land clearing and noise. As this is a highly industrial area the wildlife should be tolerant of noise and the disturbance should be temporary.

Freshwater habitat is probably the most threatened habitat in Trinidad. Large settling-ponds for sewage and wastewater treatment often provide a valuable, albeit, unnatural habitat for birds which require freshwater habitat. Such a treatment system would be highly beneficial if practical.

The contractors should ensure that none of the mangrove forest is impacted, or if impacted, restored. This is most likely to occur along the trunk lines running south from the Guaracara River south to the Marabella and Vistabella Rivers. Disturbance of aquatic fauna and some disturbance of riparian vegetation may be inevitable. Attempts should be made to re-establish sectors of riparian forest if any is removed.

This project has the potential of greatly improving the quality of the aquatic habitats in the study area. It is likely that with any improvement in water quality the fish species composition should change. It is desirable that the aquatic environment is carefully monitored to record any changes which can be attributed to the improved sewage and wastewater management. This could serve as a model for the restoration of other highly polluted watercourses in Trinidad.

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Appendix D

Biophysical Baseline Data

D.4 Flora Studies Report

San Fernando Wastewater Project: Botanical Component

by

Paul. L. Comeau

1. Introduction

The area designated for this study is on land that has been used in the past for agriculture, mainly sugar cane, cotton, and recently, urban development (Appendix 1). By the 1790s, sugar cane was Trinidad's most important crop (Brereton 1981). Two hundred years later (circa 2010), sugar cane production had been replaced by housing estates (see Figure 1).

If you go back several centuries, the study area would have been covered by three native forest communities (Marshall, 1934; and Beard, 1946):

- Crappo-Guatecare-Cocorite,
- Acurel-Moussara-Carat, which is semi-deciduous, and
- Mora.

Today, the only natural remnants are the mangrove trees along the sea shore and the riparian mixed forest further inland both inside and outside of the project boundaries. Although impressive, plantation trees like Cedar and Saman have been introduced.

2. Methodology

To adequately cover a survey of different habitat types (micro/fragmented), it was necessary to visit as many sites as possible or as time would allow. A global positioning system (GPS) unit was used to document locations. The readings obtained allowed for accuracy in locating ground-level sites based on satellite images. These sites are listed in Section 2.2.3 of Habitats and Fauna of San Fernando Wastewater Catchment Area (White 2009).

3. Field Observations

3.1. Land Use

Land use, as observed during the field visits, included a mixture of small-scale agriculture, landfill, housing, and urban infrastructure that have all had an impact on the original vegetation leaving a diversity of micro-habitats. This is best illustrated by the series of photographs taken during the field visits (Appendix 2).

3.2. Habitats

The study area is a coastal strip of undulating topography. The soils and rainfall are a reflection of tropical climate conditions. Based on these factors the following habitats were recognized:

Table 1 – Observed Habitats in the Project Area

Habitat	Percentage of Project Area	Species Observed	Comments
Urban Development	49	57	104 species originally recorded by Beard when this project area was originally forest.
Low Vegetation with Scrub and Agriculture	22	57	
Abandoned Sugarcane	6	6	Mainly grasses
Mangrove Woodland	1	17	
Riparian Forest	1	7	Tree species
Silviculture or National Parks	1	5	Dominant tree species included teak, saman, cedar, palmist, and mahagany
Secondary Forest	<3	30	Species not recorded
Road Verges and Wasteland	<3	-	Species not recorded
Low Density Housing and Agriculture	5	6	Dominant species
Proposed Housing Developments	7	-	Mostly barren or sparsely vegetated with several common weeds

4. Discussion

4.1. Comparison of Original Flora of Project Area

The original forest (Crappo-fineleaf-carat) around San Fernando Hill has been greatly diminished owing to extensive quarrying following the post war period. A list of the primary forest species recorded for the areas is included in Appendix 3 (Table 1). The number of trees that were recorded by Beard (1946) stood at about one hundred and four species, which suggests that the area supported a richer flora. Owing to the disappearance of the original forest type, it has become difficult to compare the existing vegetation to that of the recent past. Fragments of this forest type are still to be seen in Palmiste Park where secondary forest prevails (Appendix 2; Figures 2, 3, and 4).

4.2. Low Vegetation with Scrub and Agriculture

Agro forestry and/ or urban forestry are the best options for maintaining some semblance of tree life in urban development areas. Food trees and plants have been observed on site visits (See Table 3). Note the huge difference between the original forest and the plantation version (104 vs. 57 trees).

4.3. Mangrove Woodland Habitat

Although the mangrove trees have features in common, they can also be readily distinguished on the basis of their morphological characteristics and their location within the mangrove swamp. Owing to their importance, following is a more detailed profile for mangroves.

Red Mangrove (*Rhizophora mangle*), which is one of the dominant trees in the mangrove swamp at Point-a-Pierre Estate, is distinguished easily by its reddish bark, the numerous long aerial roots that hang down from the upper branches of the tree, and the stilt roots rising above the substrate or sea water. The leaves, which unfurl from stipules, are rounded at the tip and pointed towards the petiole (stalk). The tree produces small whitish, four-petal flowers that are hairy. When the seeds mature, they start to germinate while still attached to the tree, thus producing viviparous seedlings. As the seedling grows, it resembles a pod, dark-green in color that has mistakingly been called a 'radicle'. It is actually an embryo that drops from the plant and floats in the sea. As it absorbs sea water it rights itself in a vertical manner. The tide eventually moves the embryo to shallow water where it anchors itself in the mucky substrate and puts out roots.

Red mangroves grow in pure stands around the lower reaches of the intertidal zone and, therefore, are periodically exposed to storms that produce tidal surges. They are the mangrove trees you would see bordering the seaward margins of the embayment. Their seedlings are better adapted to survive in the harsh nutrient-poor conditions that prevail in the fringing environment.

Black mangrove (*Avicennia germinans*) trees, which have neither long aerial roots or stilt roots, are taller (up to 20 m) than red mangrove (up to 15 m) and grow in more sheltered areas further inland. They have narrow elliptical (pointed at both ends) leathery leaves that are whitish beneath where the salt glands, that regulate the salt concentration, are situated. The black mangrove has whitish tubular flowers with yellow centers and yellow-green oval fruit. The seedlings are nonviviparous and very tolerant of low oxygen levels. Unlike the red mangrove, the black has horizontal roots that send up numerous short vertical shoots called pneumatophores. The function of the pneumatophores is mainly for breathing in an anaerobic environment. They are equipped with lenticels (pores) that have minute openings that permit the entry of air but not water.

Within the tidal region, the further inland, and consequently the shorter the period of time during which the ground is flooded with tidal water, the higher is the salt concentration of the soil. Thus in terms of hypersalinity, the most extreme conditions in the mangrove zone are to be encountered in the upper reaches of the intertidal zone that is inundated by sea water only by the highest tides. The tidal range is at its maximum at new and full moon (spring tide) and at a minimum midway between the two (neap tides). Tides are at their highest when lunar perigee (moon closest to earth) occurs near a spring tide. Amongst the mangrove species, black is the weakest competitor but has the highest salt resistance, so that stunted individuals of this species constitute the landward limit of the mangrove where tidal conditions prevail. In continuously humid areas with heavy rainfall, the situation is more complicated. Under these conditions 'atmospheric flushing' may influence salt concentrations in the substrate.

White mangrove (*Laguncularia racemosa)* trees (up to 18 m tall) have a tendency to grow at slightly higher elevations than either red or black. The white has less tolerance for prolonged inundation by sea water and, like the black, may produce thin small pneumatophores. It also lacks aerial or stilt roots. A white mangrove tree has scaly red-brown bark, oblong (rounded at both ends) leaves with red petioles (not so pronounced in older leaves) having glands near the point of attachment with the leaf, pale green flowers, and reddish, obovoid, fruit that are small (1-2 cm long) and striated. The seedlings have no tolerance for the salinity and periodic flooding of the intertidal zone.

Threats to mangrove – Mangrove seedlings take hold and grow much faster in the shade than in the open. White mangrove seedlings cannot survive the salinity and periodic flooding. Absence of crabs and crab holes may be due to a lack of tidal flushing. Petroleum is the primary pollutant of Caribbean mangrove. It results in tree defoliation and stand death. Hydrocarbons persist in sediments for decades. They are correlated with increasing seedling mutation rates. Chemical, industrial and urban wastes are associated with increased heavy metal content of mangrove seedlings. Stand die-back reduces biodiversity.

Mangrove soils are capable of removing a certain amount of pollutants from wastewater. Mangrove soils are good traps to immobilize phosphorus and heavy metals from wastewater. These soils are not so good for retaining nitrogen from wastewater. Sediment concentrations of ammonia, nitrogen, phosphorus, potassium, and organic carbon were consistently higher in landward locations and decreased gradually towards the sea in mangrove swamps. Mangrove soils are most effective in retaining heavy metals like copper (Cu), but less effective in retaining manganese (Mn) and zinc (Zn). The surface layer (0-1cm) of the mangrove soils has higher concentrations of heavy metals such as Cu, Mn, Zn, and cadmium (Cd). Concentrations decline with soil depth indicating little eluviations. The maximum concentration of heavy metals tended to occur at the landward edge of mangrove swamps (Zheng, 1997). For both total and extractable metals, there were significant seasonal fluctuations. Atmospheric flushing is an influential factor.

In mangrove soils receiving wastewater, a higher percentage of the heavy metals (Mn, Zn, Cd) was found in water-soluble and exchangeable fractions as opposed to residual and precipitated fractions. Copper appears to be more strongly adsorbed in mangrove soils than other heavy metals. Most of the heavy metals are not in a bio-available form. Most heavy metals from wastewater are retained in mangrove soils with little uptake by plants or release into tidal seawater. Mangrove soil has a large capacity to retain heavy metals. Higher heavy metal content was found in mangrove roots than in the aerial parts of the trees. This indicates that the roots act as a barrier for metal translocation thus protecting the sensitive parts of the plant, such as flowers, fruit and seeds. Rhizophora mangle was shown to be a useful biological indicator of heavy metal pollution [nickel (Ni), cobalt (Co), iron (Fe), Mn, Cu, lead (Pb), and Zn]. Nutrients contained in sewage (nitrogen and phosphorus) are beneficial to mangrove plants. Sewage addition did not cause apparent physiological impact on growth.

4.4. Other Habitats

Another important habitat is riparian (along river-banks), where trees such as Silk cotton, Bois canot, Saman, Angelin, Hog plum, and Palmiste can be found. They all stabilize the embankment and enhance the beauty of the surrounding environment. In this respect, nature should prevail over a concrete solution.

The remaining habitats have little economic potential except as real estate that makes them suitable for urban development (housing, commercial, industrial), as well as recreation parks (e.g. San Fernando Hill), Palmiste Park).

Tables 2 and 3 (Appendix 3) show that flora was much more diverse in the past before the the project area was developed. The number of species observed in this study was 57 versus 104 observed by Beard in 1946. Examples from the tables include Hogplum, Saman, Palmiste, Swamp Immortelle, Bois Canot, Silk Cotton, and Sandbox. All of these trees are fast growing and produce soft wood.

5. Conclusion

The ten recognized habitats observed in this study formed a complex mosaic of plant communities either isolated in small patches, contiguous in others, or as distinctive as the mangrove ecosystem. The flora representation ranged from herbaceous grasses and sedges, common shrubby species such as ‘black sage’, tree species including palms, exotic fruit trees, introduced timber species for silviculture (teak, cedar, and mahogany), and remnants of native species such as the Silk Cotton tree near the visitor’s car park at the San Fernando Boat Club.

As far as possible, the Mangrove Woodland, Riparian Forest and giant Silk Cotton tree should be preserved for future generations to enjoy the diversity offered by these natural habitats or native species. The San Fernando Hill and Palmiste Park were stripped of their natural vegetation but demonstrate good examples of restoration and mitigation of degraded landscapes.

6. Definition of Terms

- **Scrub vegetation –** a disturbed plant community dominated by scrubs

- **Primary forest –** one that has a complex infrastructure consisting of three canopy layers. Example of trees that are large enough to break through the upper canopy see table 4

- **Secondary forest –** one that reflects some degree of human disturbance or has received damage from a natural disaster.

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Appendix 1

Map (White 2009)

Appendix 2 (Photos)

Figure 1. New housing on abandoned sugarcane land

Figure 2. Palmiste Park

Figure 3. Palmiste Park secondary forest

Figure 4. Palmiste Park secondary forest

Figure 4. Riparian forest

Figure 5. Abandon sugarcane.

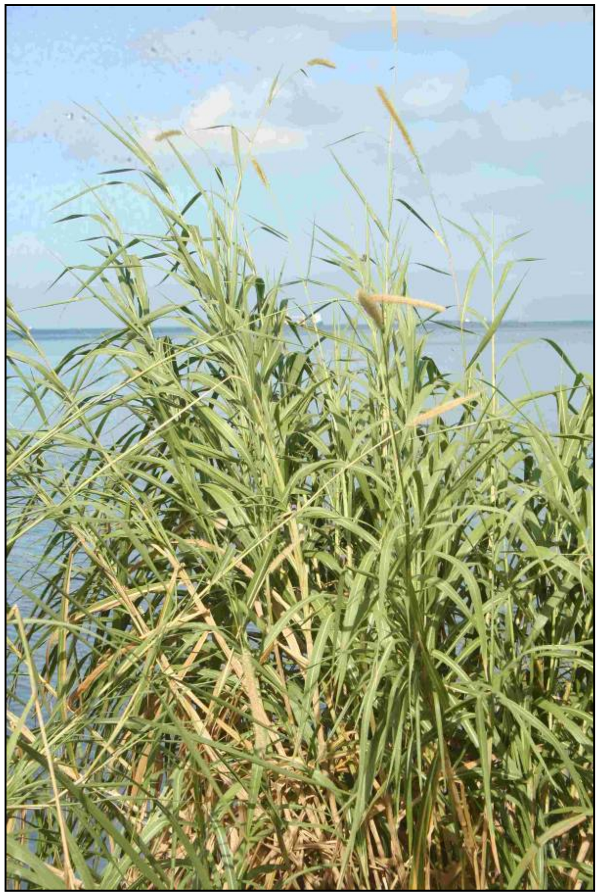

Figure 6. Pennisetum sp.

Figure 7. Black mangrove

Figure 8. Proper drainage

Figure 9. Red mangrove seedlings

Figure 10. Concrete drainage

Figure 12. Short term crops, Dasheen on abandon agricultural land

Figure 13.Teak growing on abandoned sugarcane land

Figure 14. Landfill on former sugarcane land

Appendix 3 (Tables)

Table 2

List of trees found in the original forest within Project Boundaries

Upper canopy trees,	Trees reaching the canopy but not exceeding it	Trees confined to the lower canopy
1.Crappo	21.Bois mulatre	41.Carat
2.Wild chataigne	22.Acurel	42.Cooperhoop
3.Guatecare	23.Redwood	43.Bois pois
4.Waterlocust	24.Monkeybone	44.Manac
5.Mahoe	35.Blackheart	45.White grape
6.Yellow mangue	36.Bois charbon	46.Black grape
7.Hogplum	37.Laurier canelle	47.Cuchape
8.Pois doux	38.Bois canon	48.Carimbo
9.Bloodwood	39.Wild guava	49.Bois tatou
10.Jiggerwood		50.Cocorite
11.Cajuca		
12.Sackysac		
13.Toporite		
14.Balata		
15.Purpleheart		
16.Conore		
17.White Olivier		
18.Angelin		
19.Olivier mangue		
20.Tapana		

Table 3

List of Agro-forestry Species (57) Replacing Original Forest

Common Name	**Botanical Name**	**Status**
Avacado	Persea americana	
Banana	Musa spp.	
Bodi	Vigna unguiculata	
Breadfruit	Artocarpus communis	
Calabash	Crescentia cujete	R
Caraili	Momordica charantia	
Carambola	Averhoa carambola	
Cashew	Anacardium occidentale	R
Cashima	Annona reticulata	
Cassava	Manihot utilissima	
Cerise	Flacourtia indica	R
Chalta	Dillenia indica	R
Chataigne	Artocarpus communis	
Chenet	Melicocca bijuga	R
Cocoa	Theobroma cacao	
Coconut	Cocos nucifera	
Coffee	Coffea robusta	
Corn	Zea mays	
Cush-cush	Dioscorea trifida	R
Dasheen	Colocasia esculenta	
Eddoe	Colocasia esculenta	

Common Name	**Botanical Name**	**Status**
Grapefruit	Citrus paradisi	R
Guava	Psidium guajava	
Hot Pepper	Capsicum annuum	
Indian Almond	Terminalia catappa	R
Kaimit	Chrysophyllum cainito	R
Lemon	Citrus Limon	R
Mammey Apple	Mammea americana	R
Mango	Mangifera indica	
Orange	Citrus sinensis	
Pak Choi	Brassica chinensis	
Paw Paw	Carica papaya	
Peewah	Bactris gasipaes	
Pigeon Pea	Cajanus cajan	
Pineapple	Ananas comosus	
Plantain	Musa spp.	
Plum	Spondias purpurea	R
Pomerac	Eugenia malaccensis	
Pommecythere	Spondias cytherea	R
Portugal	Citrus reticulata	
Primrose	Syzygium jambos	R
Rice	Oryza sativa	
Roucou	Bixa orellana	R
Sapodilla	Manilkara zapota	
Shado Beni	Eryngium foetidum	
Sorrel	Hibiscus sabdariffa	

Common Name	Botanical Name	Status
Sour Cherry	Phyllanthus sp.	R
Sour Tamarind	Tamarindus indica	R
Spanish Thyme	Lippia micrimetria	
Sugar Cane	Saccharum officinarum	
Sweet Pepper	Capsicum annuum	
Tamarind des Indes	Vangueria edulis	R
Tangerine	Citrus reticulata	
Tannia	Xanthosoma sagittifolium	
Thyme	Thymus vulgaris	
Tonka Bean	Dipteryx odorata	R
Yam	Dioscorea spp.	

Legend: R = rare; the remaining plants are common

Appendix D

Biophysical Baseline Data

D.5 Aquatic Fauna Studies Report

REPORT ON AQUATIC FAUNA FOUND WITHIN RIVERS DRAINING THE SAN FERNANDO WASTE WATER CATCHMENT AREA, WEST COAST TRINIDAD

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January 2010

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1. Introduction

Environmental Sciences Limited (ESL) was contracted by AECOM to conduct aquatic faunal surveys within five rivers draining the mid western coast of Trinidad from Pointe- a- Pierre to La Romain. These Rivers included the following: Guaracara River, Marabella River, Vistabella River, Cipero River and the Godineau River. This study is part of a series of environmental baseline surveys being undertaken by the Water and Sewerage Authority of Trinidad and Tobago (WASA) for proposed upgrades within the San Fernando Waste Water Catchment Area.

The following report documents the findings of the study conducted during the months of October and November, 2009 at thirteen (13) sample stations within the boundaries of the immediate study area defined as the boundaries of the San Fernando Waste Water Catchment Area (SFWWCA). The approximate locations of these proposed field stations are provided in the methodology section below.

2. Study Background

ESL was contracted by AECOM (the main consulting firm to the client WASA) to conduct an aquatic faunal survey within the SFWWCA. At present WASA (together with other private contractors) maintain nine (9) Waste Water treatment plants and thirteen (13) lift stations within the SFWWCA. These service a total area of 44 km^2. The SFWWCA has had several new developments constructed recently, with more being proposed. Areas of proposed development include La Romain (EMBD), Golconda (HDC), Retrench (HDC), and Corinth (HDC). Anticipating its future service demands, WASA has undertaken a new Project for locating and establishing new infrastructure to accommodate these increases in housing development. The results of the following aquatic survey will form part of the baseline environmental review process for the Project.

3. Faunal Survey Scope of Works

The Scope of Works for the aquatic faunal survey included the following:

1. A field reconnaissance for the purpose of:
    a. Identification and descriptions of appropriate sample stations
    b. Recommendations for the survey methodology specific to each sample station
    c. Recommendations for the equipment type specific to each survey methodology.
2. A literature review of the species of aquatic freshwater fauna and their distribution patterns throughout the study area.

3. Identification of fish fauna collected during fish surveys conducted during the months of October and November 2009.
4. The preparation of a final report on the aquatic fauna of the SFWWCA.

3.1 Survey Objective

The objective of the faunal surveys was to provide the client with a comprehensive review of the current status of aquatic faunal species within the SFWWCA i.e. to analyze the species abundance and diversity of aquatic fauna within the riverine ecosystems of the project boundaries.

4. Sampling Methods Applied for Survey

4.1 Site Selection

A total of 13 sample sites were selected by ESL for the aquatic faunal survey. The locations of the sites were based on the findings of a reconnaissance visit conducted on 8th October 2009 to determine the extent of the study area and overall accessibility to the rivers being surveyed. Two (2) sampling stations were established along the Marabella and Vistabella Rivers, three (3) along Guaracara River and, four (4) along the Cipero River. Each station represented appropriate segments of the lower, middle and upper courses of the respective river. The locations of these stations are identified in Figure 4-1 and the Station codes (together with the GPS coordinates) are provided in Table 4-1.

Table 4-1: Sampling Station Codes

Sample Station Name	Sample Station Code	GPS Coordinates	
		Easting	Northing
Cipero Upper	(CU)	0672327	1135600
Cipero Middle 1	(CM1)	0668560	1134710
Cipero Middle 2	(CM2)	0671586	1135040
Cipero Lower	(CL)	0666834	1135199
Marabella Upper	(MU)	0670008	1139012
Marabella Lower	(ML)	0668804	1139119
Vistabella Middle	(VM)	0669559	1138262
Vistabella Lower	(VL)	0668506	1138181
Guaracara Upper	(GU)	0671499	1140088
Guaracara Middle	(GM)	0669699	1139736
Guaracara Lower	(GL)	0667941	1139715
Godineau Middle	(GoM)	0661903	1131179
Godineau Lower	(GoL)	0661449	1131676

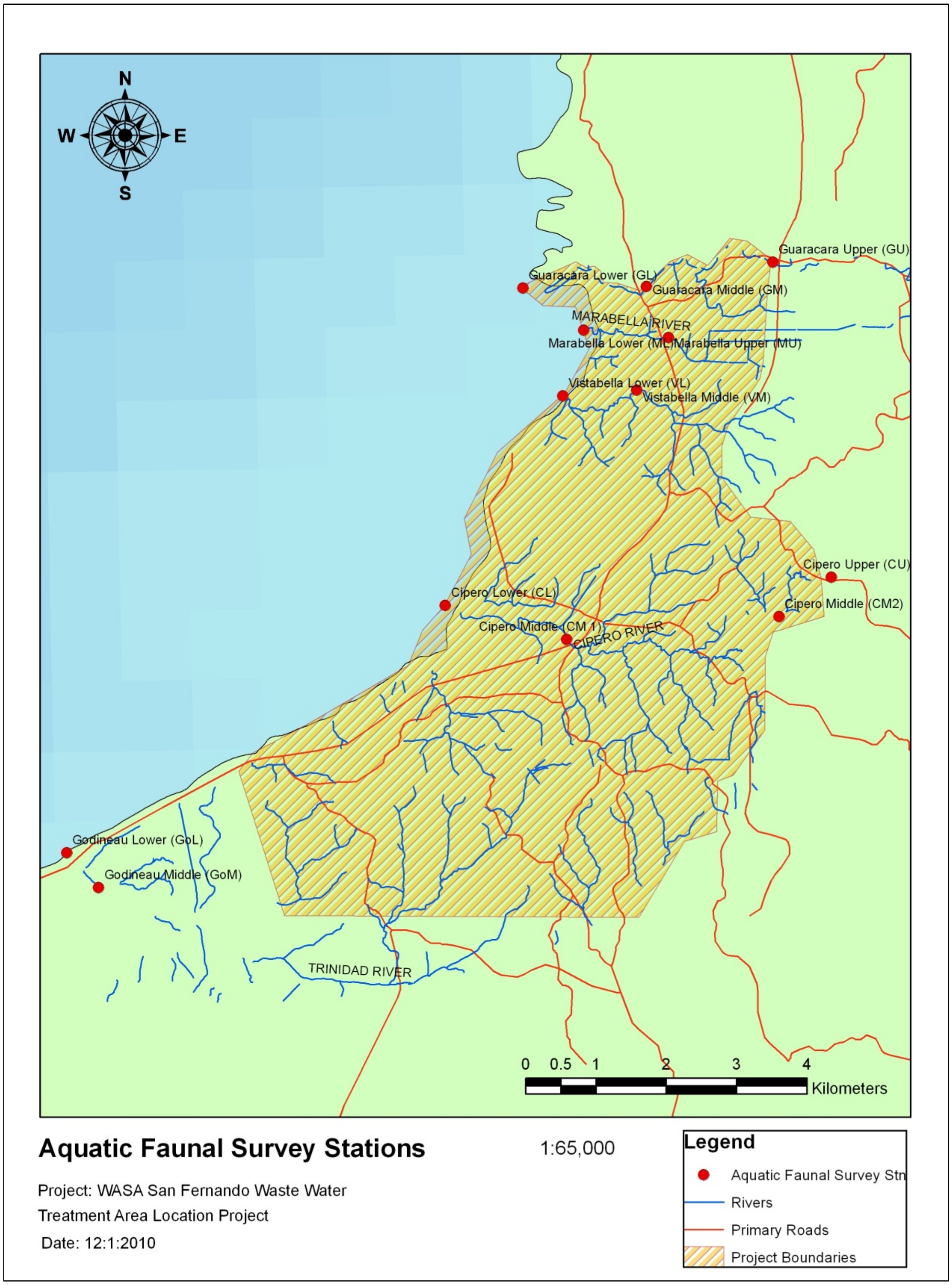

Figure 4-1: **Station Locations within the SFWWCA**

The mouth of each river was inaccessible by land and their lower courses drained estuarine mangrove systems. The presence or absence of mangroves is limited by the hydrological connection of the sea to the rivers at high tide and the tendency of estuarine (brackish water) water to flow into the areas past the riverbanks during high tide. The smaller rivers supported less bank vegetation and very few mangrove trees. They also appeared to terminate abruptly before meeting the coast during base flows. The presence or absence of bank side vegetation has been noted as a critical factor influencing the abundance and diversity of aquatic fauna within rivers, (IMA, 1981). As such, stations were placed at the mouth of each river at the land sea interface. This ensured that representative samples were collected within the estuarine mangrove habitats found at the lower limits of each river's longitudinal profile. Each lower course station was accessed via pirogue.

Additionally, some tributaries of the Godineau River flow within the immediate project area and as such sampling was conducted to evaluate possible effects on aquatic life within this riverine system. This was done at the request of AECOM. The sites selected were accessible via the Southern Main Road at the Southern end of the Mosquito Creek and via the South Trunk Main Road.

Based on previous studies conducted in Trinidad and Tobago, the location of sample stations for the examination of aquatic fauna were selected based on access to the sampling site. Following the traditions set in earlier diversity studies (Phillip 1998, Kenny 1995, Price 1955) each station was established where streams and rivers crossed a road or access trail.

The criteria for selecting station locations not only included accessibility but also required the presence of at least a 10 to 15 m stretch of "debris free" water, short enough to be fished thoroughly yet long enough for all species present to be represented in the catch. Based on surveys conducted by Phillip in 1998 an average sample length of 30 m is prescribed, but this was not feasible for the rivers in question because of their width, the intermittent flow of water in both the upper and middle courses of two rivers and the quantity of debris within the river channel at various sample locations.
Each riverine sample station included more than one of the major riverine habitat types. (e.g. pool, riffle, run, etc).

- *Riffle*- shallow, fast-flowing part of a river with obstructions at the bottom, producing a very rough water surface
- *Run*- stretch of river where the water is relatively shallow, usually slow moving, fairly even depth and with smooth water surface
- *Pool*- water usually deeper and slower in a pool than the surrounding parts of a river
- *Pond*- water deeper than a pool of a river, is slow moving, may have emergent, submergent and surrounding vegetation

- *Vegetation snag*- an area where water within the channel is blocked as a result of macrophytic vegetation growing within the channel.

Table 4-2 below indicates the stations selected and the corresponding dates when sampling activities were carried out.

Table 4-2: Sampling Dates for Aquatic Faunal Surveys within the SFWWCA

Sampling Station	Sampling Code	Sampling Dates	Sampling Times
Cipero Middle	CM1	**27/10/09**	8:45 - 9:30 am
Cipero Middle	CM2	**27/10/09**	9:40 - 10:25 am
Cipero Upper	CU	**27/10/09**	10:35 - 11:05 am
Vistabella Middle	VM	**28/10/09**	11:40 am - 12:10 pm
Marabella Upper	MU	**28/10/09**	12:25 - 12:45 pm
Guaracara Middle	GM	**28/10/09**	1:05 - 1:35 pm
Guaracara Upper	GU	**28/10/09**	1:55 - 2:30 pm
Cipero Lower	CL	**30/10/09 to 31/10/09**	Deploy: 8:50 am Retrieval: 8:30 am
Vistabella Lower	VL	**30/10/09 to 31/10/09**	Deploy: 8:40 am Retrieval: 8:15 am
Marabella Lower	ML	**30/10/09 to 31/10/09**	Deploy: 8:30 am Retrieval: 9:45 am
Guaracara Lower	GL	**30/10/09 to 31/10/09**	Deploy: 8:10 am Retrieval: 10:10 am
Godineau Lower	GoL	**30/10/09 to 31/10/09**	Deploy: 9:20 am Retrieval: 8:50 am
Cipero Middle	CM1	**4/11/09**	9:25 - 10:10 am
Cipero Middle	CM2	**4/11/09**	10:20 - 11:05 am
Cipero Upper	CU	**4/11/09**	11:20 am - 12:00 noon
Guaracara Middle	GM	**4/11/09**	12:25 - 1:10 pm
Guaracara Upper	GU	**4/11/09**	1:25 - 2:00 pm
Godineau Middle	GM	**4/11/09**	8:30 - 9:10 am

4.2 Sample Method

The method and gear type used by ESL staff for fishing was based on several factors these include the depth of the river at the sample station, the width of the river, the quantity of debris within the channel, current speed, turbidity and, gear availability.

The fishing methods employed included:

- Cast Nets
- Fish pots

A cast net 1.9 m in diameter with a 0.01 m^2 mesh size was used in shallow areas with clear water and very little debris. When this net was thrown, centrifugal force acting on the weighted edge of the net allowed it to open into a flat circular shape over the river bed. The general steps in the use of the cast net are as follows:

1. The loop at one end of the cast net was secured with the left hand. The excess rope was coiled and held with the left hand
2. About one foot of the net was held with the left hand allowing the rest of the net to hang
3. The bottom of the net was secured with the right hand, brought up and held with the thumb of the left hand
4. The bottom of the net was secured again spreading the right hand out keeping the left arm to the body
5. The right arm was spun in an upper counter clockwise direction releasing the net in the right and left hands.
6. When retrieving the net, it was slowly pulled onto the bank of the river

Where possible the river channel was blocked to ensure individual fishes did not escape since successive throws were required (for instance, where the river channel was sufficiently narrow and shallow, boulders were used to block upstream and downstream of the sample sites). It should be noted that blocking of the river was not possible at some sampling sites and different techniques were employed to compensate for the different conditions. If the river was too wide and deep to be adequately blocked, throws were conducted up and down the river bank and where possible on both banks. In some instances an additional sampling day was utilised. Approximately 30 minutes of successive throws were conducted at the following locations: CM1, CM2, CU, VM, MU, GU, GM and GoM.

Fish pots were used in areas where the river was too deep or there was too much debris for use of the cast net. The fish pots used were 0.9 m in height by 0.5 m in diameter and the wire mesh size was 0.003 m by 0.003 m. Each fishpot was set for approximately 24-26 hours. Fishes entered the pots through an entry funnel located at the centre of the front face of the trap. The funnel tapered from a large opening on the outside of the pot to a narrow aperture on the inside of the pot. Fishes entering the pots swam freely through the large opening but found it difficult to escape through the narrow end of the funnel once inside of the baited pot. This method was use at the mouth of all (5) five rivers. Specimen collected at each site were frozen then subsequently identified by the Ecologist.

It should be noted that fish pots were utilized at GU and GM however, heavy rains resulted in the loss of set pots and alternatively nets were used at these sites. Visual observations were carried out at all sites during the reconnaissance site visits and field sampling. The fact that no specimens were captured at five of the stations could be the result of several factors and not only a consequence of the sampling technique used. Possible factors leading to the empty data sets obtained are presented in Section 7.

Table 4-2: Images of the Sample Gear used for the Aquatic Survey

	
A) Fish Pot with specimens	**B) Cast net**

4.3 Data Analysis

Each specimen collected was measured to the nearest centimetre.

- Fishes – Total length
- Shrimps- Body length, i.e.: from tip of rostrum to the edge of the telson

The samples were then identified using Food and Agriculture Organisation (FAO) referenced fisheries identification sheets and other local literature. Juvenile fish and shrimp were defined as those in length of less than 25% of commonly occurring (or maximum where stated) length or width as recorded in the FAO fisheries identification sheets and other relevant literature (IMA, 1982). The diversity index was measured following Odum (1971) using the following equation.

$$\mathbf{d=S/N}$$

d= diversity, S= no. of species, N=no. of individuals.

4.4 Limitations of the Study

Survey limitations included the use of multiple types of sample gear and the presence of debris or unconsolidated sediment on streambeds. Debris within the river channel impeded fishers from moving swiftly enough to catch specimen within the blocked segments of river and it also prohibited the throwing of cast nets at certain locations. Cast net fishing and setting of fish pots were the two techniques used for the capture of fish species. The variation in sampling methods introduced a systematic error into the data set since the sample size and species capture probability varies with each technique. Additionally fish pots were used to sample the faunal populations at the mouth of rivers. These pots rested on the floor of the riverbed and selected specifically for demersal or benthopelagic species of fish which feed on benthos. This lowered the probability of the set pots capturing pelagic species which feed within the water column above the sea bed.

5. Historical Overview of Riverine Faunal Species in Trinidad and the Immediate Study Area

The fish fauna of Trinidad are unique compared with that of the other islands in the insular Caribbean, most of which have no “true” freshwater fishes. The freshwater fish species of Trinidad comprise mainly a stable “relict” population of species that are South American in origin and date to the time when Trinidad was connected to the mainland (Kenny 1995). The fish fauna of Trinidad and Tobago is quite diverse. In 1998 Phillip estimated the total species richness for freshwater fishes on the island to be between 37 and 40. At the time these figures represented 7.4% of the vertebrate fauna on the island.

The “health” of aquatic systems has long been the concern of the users of these ecosystems and the wider society. The loss of functions that are provided by these systems through degradation tends to have far reaching consequences to their present and potential use. A wide variety of anthropogenic influences have interacted over time to pose a serious threat to the integrity of the fish populations on the island. Problems such as the introduction of exotic fish species and long term habitat alteration have affected species diversity. Frequent colonisations and extinctions can be expected on the island as a result of its location and proximity to the South American mainland (Kenny 1995). There is a constant pressure on the existing fauna on the island of being replaced or out-competed by these colonizers. This danger is further exacerbated by human introduction of exotic species. Phillip 1998 stated that since the 1950’s, there has been fifteen (15) introductions and twelve (12) local extinctions, with an estimated one (1) new species every year. Phillip estimated that forty-seven percent (47%) of the new introductions and forty-three percent (43%) of the extinctions during this period were of human-introduced exotics.

Over fishing can also serve to decrease populations to levels below what is considered to be a minimum viable population. Below this population level, the effects of inbreeding depression can serve to severely hinder the health of the population and can lead to their localized extinction (Phillip 1998). Apart from being a valuable food source, wild fish populations on the island have been a valuable source of stock for a well-developed aquarium trade that is centered on local species.

The possible impact of pollution on species diversity is particularly acute in reference to freshwater fish on the island. Industrial activities have been the source of much degradation of aquatic systems particularly during the Dry Season that spans the period of January to May. The reason behind this lies in the temporal variation of rainfall experienced throughout the year. As a consequence, during the Dry Season, less dilution of industrial and domestic effluents is experienced and their effects on ecosystems are far more consequential. The problem of pollution and habitat degradation on the island serve to make riverine habitats more conducive to the lifestyle of habitat generalists or 'r-selected' species. It is estimated that 70% of the fish in Trinidad and Tobago are classified as "rare" on the island while 80% of these rarities possess a restricted geographic distribution or narrow habitat specificity (Phillip, 1998). Thus, impact upon even a small area can result in loss of significant ichthyofaunal diversity on the island.

Estuarine mangrove systems were found at the mouth of all the rivers within the SFWWCA. Historical records estimate the size of the estuarine mangrove at the mouth of the Guaracara River to be 110 ha, that which occurs near the mouth of the Marabella River 65 ha and, the Godineau tidal marsh and estuarine mangrove swamp 3,171 ha (Juman and James-Alexander 2006; IMA 2000). Using Google Earth 2008 images [1] the estimated sizes of the wetland systems currently existing at the mouth of the rivers studied were; Guaracara River approximately 25 ha, Marabella River approximately 9 ha, Vistabella River approximately 2.4 ha, Cipero River approximately 12 ha and the Godineau Swamp >3000 ha. These rough estimates require validation through extensive ground truthing exercises (the scope of which, falls outside of that required for the aquatic faunal species survey within the SFWWCA). It should however be noted that the estimated size of the Godineau Swamp has remained fairly consistent from the historical records of 2000 to present. This observation is likely the result of the wetland being proclaimed a reserve in 1939. The Godineau swamp currently accounts for approximately 34% of the west coast wetlands in Trinidad (Kenny, 2008).

The larger rivers within the study area have been well surveyed over the years and are known to support a great diversity of aquatic fauna. Table 5-1 below provides a catalogue of aquatic faunal species identified with the study area during more recent historical surveys.

[1] Data SIO,NOAA Us Navy.NGA GEBCO © 2009 LeadDog Consulting;
Image© 2010 GeoEye;
Image© Terrametrics

Table 5-1: Historical Records of Aquatic Species found within SFWWCA

FAMILY	SPECIES	COMMON NAME	epas 2005	IMA 2003	Kenny 1995
		Fishes			
ACHIRIDAE	*Trinectes sp*	Flat Fish	X		
ANABLEPIDAE	*Anableps anableps*	Four-eyed Fish	X		
ARIIDAE	*Ariopsis bonillai (Hexanematichthys spp.)*	Catfish	X	X	
	Arius sp.	Catfish	X		
	Cathorops spixii	Catfish	X		
	Rhamdia. quelen	Barbe	X		X
	Pseudauchenipterus nodosus	Cocosoda Catfish		X	
BATRACHOIDIDAE	*Batrachoides surinamensis*	Crapaud Fish	X	X	
CALLICHTHYIDAE	*Callichthys callichthys*	Chato			X
	Corydoras aeneus	Pui-Pui			X
	Hoplosternum littorale	Cascadu		X	X
CARANGIDAE	*Caranx hippos*	Cavalli		X	
	Chloroscombrus chrysurus	Plateau	X		
	Oligoplites palometa	Zapate	X		
CENTROPOMIDAE	*Centropomus undecimalis*	Brochet	X	X	
CICHLIDAE	*Aequidens pulcher*	Green Coscorob		X	X
	Cichlasoma taenia	Coscorob			X
	Crenicichia alta	Millet			X
	Oreochromis mossambicus	Tilapia			X
CHARACIDAE	*Astyanax bimaculats*	Sardine Doree		X	X
	Corynopoma riisei	Swordtail Sardine			X
	Hemibrycon			X	
	Hemigrammus unilineatus	Feather Sardine			X
	Megalamphodus axelrodi	Riddlei			X
	Roeboides dayi	Glass Sardine		X	
CLUPEIDAE	*Harengula jaguna*	Hardback Herring	X		
	Odontognathus compressus	Sardine	X		
CYPRINODONTIDAE	*Rivulus hartii*	Jumping guabine			X
EPINEPHELINAE	*Epinephelus itajara*	Jewfish		X	
ELEOTRIDAE	*Dormitator maculatus*				X
	Eleptris pisonis	Guabine			X
EPHIPPIDAE	*Chaetodipterus faber*	Paoua	X		
ENGRAULIDAE	*Anchovia sp.*	Jashua	X		
	A. trinitatis	Sardine	X		
	Cetengraulis edentulus	Sardine	X		
ERYTHRINIDAE	*Hoplias malabaricus*	Guabine		X	X
GERREIDAE	*Diapterus rhombeus*	Blinch	X	X	
GYMNOTIDAE	*Gymnotus carapo*	Cutlass knife			X
HAEMULIDAE	*Genyatremus luteus*	Trawat		X	
LORICARIIDAE	*Hypostomus robinii*	Teta		X	X
LUTIJANIDAE	*Lutjanus cyanopterus*	Grey Snapper		X	
MEGALOPIDAE	*Megalops atlanticus*	Tarpon		X	
MUGILIDAE	*Mugil curema*	Mullet	X	X	
	Mugil cephalus			X	
NANDIDAE	*Polycentrus schomburgkii*	King Coscarob		X	X
POECILLIIDAE	*Poecilia reticulata*	Guppy 7 Colours		X	X
	Poecilia picta	Millions			X
	Poecilia vivipara	Millions			X
POMADASYIDAE	*Haemulon bonariense*	Grunt		X	
RIVULIDAE	*Rivulus hartii*	Jumping Guabine			X
SCIAENIDAE	*Cynoscion acoupa*	Acoupa Weakfish		X	
	Larimus breviceps	Weiwei	X		
	Macrodon ancyclodon	King Weakfish		X	
	Micropogon furnieri	Racando (Cro cro)	X		
	Ophioscion punctatissimus	Spotted Croaker		X	
	Stellifer			X	
SOLEIDAE	*Achirus sp.*	Flounder		X	
SYMBRANCHIDAE	*Symbranchus marmoratus*	Zange			X
		Shrimp			
PENAEIDAE	*Penaeus notialis*	Red Shrimp	X		
	Penaeus schmitti	White Shrimp (Cork)	X		
	Xiphopenaeus kroyeri	Seabob	X		
		Crabs			
OCYPODIDAE	*Uca sp.*	Fiddler Crab	X		
PORTUNIDAE	*Callinectes danae*	Blue (Marine) Crab	X		
	Callinectes sapidus	Blue (Marine) Crab	X		

At this point it should also be noted that as recently as the early 1950's the endangered West Indian Manatee (*Trichechus manatus*) was observed in water courses of the Godineau Swamp (Kenny 2008).

6. Survey Results for the SFWWCA

As previously described four (4) of the five (5) rivers surveyed (Guaracara, Vistabella, Marabella and Cipero) drain the SFWWCA which amounts to an area of approximately 44 km^2. The study area is well developed and includes a mix of residential, commercial and industrial (light and heavy) activities. The rivers within the SFWWCA were well maintained and the upper courses of those passing through established housing developments have had their beds concreted. The larger rivers, namely the Guaracara and Cipero have been recently dredged and their channels made both deeper and wider.

The distribution of fauna within a river channel is influenced by a variety of factors. These include precipitation and seasonality in river discharge, river verge vegetation, pollution and proximity to tidally influenced areas (IMA, 1981). Each of the aforementioned factors was grossly assessed for all sample stations and this data is presented in Tables 6-1 and 6-2 below.

Descriptions of each site including; the river depth, location (with reference to the longitudinal profile of the river) and river verge vegetation are presented in Table 6-1.

In the absence of quantitative physiochemical data, the surface water quality at each riverine location (with the exception of those at the mouth of the rivers) was classified using a checklist of qualitative[2] indicators of pollution. The visible indicators of pollution selected were turbidity, water colour, the presence of solid waste/debris, oil and grease, foaming and, odour. Based on these indicators the quality of water at each sample station was classified according to the following scheme:

- **Pristine:** Streams considered pristine were not influenced by significant human activity. There was no noticeable oil sheen, odour, colour nor turbidity in their channel and foaming from detergents or petroleum based substances was absent or dissipated quickly.

- **Mildly Contaminated:** The level of contaminants in such streams did not exceed the streams assimilative capacity. There was generally no oil sheen, odour or colour in their channel and the water was not turbid. Light foam may have been present but dissipated quickly.

[2] Qualitative indicators are generally aesthetic, physical or biological and can be evaluated by field observations

- **Moderately Contaminated:** The level of contaminants in such streams exceeded the assimilative capacity of the stream. Oil sheens were present in the channel and the water had a "murky" to faintly coloured appearance. A mild odour and foam was noted in certain segments of the river.

- **Heavily Polluted:** The level of contaminants in such streams exceeded the assimilative capacity of the stream. An oil slick or stained riverbanks was obvious and the water in the channel had a readily observed "milky" appearance. Foaming was quite prevalent and very strong odours emanated from these channels.

The results of this classification scheme are presented in Table 6-2. As identified in the table none of the river segments examined within the SFWWCA can be considered pristine. The majority of sample stations fell into the category of mildly or moderately contaminated the exception being the Guaracara River which was heavily contaminated.

The method of visually assessing the water quality of a stream using qualitative or gross indicators has been applied successfully in other local studies (epas Consultants Limited (2005) and Ecoengineering Consultants Limited (2005)). The approach has also been used by the Soil Conservation Services (SCS) of the United States Department of Agriculture as guide for teaching fundamental concepts in surface water monitoring and as a tool for conducting basic water quality assessments (SCS, 1996).

Table 6-1: Description of the Riverine Sample Locations within the SFWWCA.

Site Number	River/Freshwater ecosystem	Location
Cipero Upper (CU) 0672327 E 1135600 N	The habitats observed along this stretch of the Cipero River's upper course included a riffle, run and pool.	The station was located off the Golconda access road. Areas along the river bank had been cleared of vegetation for subsistence agriculture however the majority of the bank-side flora consisted of Wild cane (*Gynerium sagittatum*), and Razor grass (*Scleria* sp.). Recent earthworks had been carried out on the channel. This was evidenced by the presence of visible gabion baskets on the eastern river bank. The river bed was littered with boulders and concrete piles. The concrete masses appeared to be part of a dilapidated bridge which serviced a nearby taska trail.
Cipero Middle (CM2) 0671586 E 1135040 N	This Station encompassed a stretch of the Cipero River in its' middle course. The habitats surveyed included a pool and run.	The station was located along the Cipero main road. The width of the river was approximately 3 m and it appeared to be greater than 1 meter in depth. The riverbed consisted of sediment/mud and was recently cleaned or dredged. The riparian vegetation consisted primarily of Razor grass (*Scleria* sp.), with one or two Coconut (*Cocos nucifera*) and Hog plum (*Spondias mombin*) trees.
Cipero Middle (CM1) 0668560 E 1134710 N	The channel was approximately 2.5 m wide and 0.3 m deep, with slow flowing run and pool segments	This site is located off the St. Madeleine Main Road near a small housing settlement. The bank vegetation consisted primarily of Razor grass (*Scleria* sp.).
Cipero Lower (CL) 0666834E 1135199N	Mouth of the River. Estuarine environment. River depth greater than 2m	Riparian vegetation consisted of mangrove and other littoral trees.
Vistabella Middle (VM) 0669559 E 1138262 N	This station located along the middle course of the Vistabella River and encompassed a riffle, a pool and a run.	Located off Majak Street the riverbed of this sample location was paved with concrete. The channel was approximately 1.5 m wide and the water appeared to be less than 0.05m deep. The bank vegetation included Wild cane (*Gynerium sagittatum*), Razor grass (*Scleria* sp.) and Bamboo (*Bambusa* sp). Macrophytes were observed within the river channel. The upscale residences were noted along the river banks.

Site Number	River/Freshwater ecosystem	Location
Vistabella Lower (VL) 0668506 E 1138181 N	Mouth of the River. Estuarine environment. River depth greater than 2m	Riparian vegetation consisted of sparse mangroves and other littoral trees. Areas along the coast have been cleared for 'squatting' or illegal housing.
Marabella Upper (MU) 0670008 E 1139012 N	The station was located in the upper course of the Marabella River. The habitats observed at the site included a pool, run and vegetation snag.	Located off Kenneth Street in the Gopaul Lands area, the channel of this sample location was paved with concrete. The river segment contained numerous macrophytes and on the banks of the river Razor grass (*Scleria* sp.) was prevalent. The primary activity occurring in the riparian zone of this river appeared to be residential housing.
Marabella Lower (ML) 0668804 E 1139119 N	Mouth of the River. Estuarine environment. River depth greater than 2m	Riparian vegetation consisted of mangrove trees.
Guaracara Upper (GU) 0671499 E 1140088 N	This station was located along the upper course of the Guaracara River and encompassed a pool and a run.	The river channel was greater than 5 m wide and 3 m deep. The vegetation on the banks of the river was quite dense in this location and encompassed species such as Button Mangrove (*Conocarpus erectus*), Coconut (*Cocos nucifera*) Hog Plum *(Spondias mombin),* Swamp palm (*Bactris* sp.) and Razor grass (*Scleria sp*.). On the northern riparian zone of this river is the Petrotrin Oil Refinery Complex. The channel of the river had large debris in the form of branches.

Site Number	River/Freshwater ecosystem	Location
Guaracara Middle (GM) 0669699 E 1139736 N	This station was located along the middle course of the Guaracara River and encompassed a pool and a run	Located off Battoo Avenue, this river channel was greater than 5 m wide and 3 m deep. The vegetation on the banks of the river consisted of Indian Almond *(Terminalia cattapa)*, Button Mangrove (*Conocarpus erectus*), Hog Plum *(Spondias mombin)*, Black Sage *(Cordia curassavica)*, Swamp palm (*Bactris sp*.) and Razor grass (*Scleria* sp.). On the northern riparian zone of this river is the Petrotrin Oil Refinery Complex. The channel of the river had large debris in the form of branches.
Guaracara Lower (GL) 0667941 E 1139715 N	Mouth of the River. Estuarine environment. River depth greater than 2m	Riparian vegetation consisted of mangroves and other littoral trees.
Godineau Middle (GoM) 0661903 E 1131179 N	This station was located in the middle course of the Godineau River.	Off the South Trunk Main Road. The channel was approximately 9m wide and 5m deep. The bank side vegetation consisted primarily of red mangroves (*Rhizophora mangle*).
Godineau Lower (GoL) 0661449 E 1131676 N	Mouth of the River. Estuarine environment. River depth greater than 2m	Riparian vegetation consisted of mangroves and other littoral trees.

Plate 1 Cipero Upper (CU)

Plate 2 Cipero Middle (CM2)

Plate 3 Cipero Middle (CM1)

Plate 4 Cipero Lower (CL)

Plate 5 Vistabella Middle (VM)

Plate 6 Vistabella Lower (VL)

Plate 7 Marabella Upper (MU)

Plate 8 Marabella Lower (ML)

Plate 9 Guaracara Upper (GU)

Plate 10 Guaracara Middle GM

Plate 11 Guaracara Lower (GL)

Plate 12 Godineau Middle (GoM)

Plate 13 Godineau Lower (GoL)

Table 6-2: Gross Water Quality Indicators Observed at each Sampling Station

Parameter	Observation							
	Station CM1	Station CM2	Station CU	Station VM	Station MU	Station GM	Station GU	Station GoM
Solid Waste	Debris (garbage)	Numerous pieces of Garbage	Numerous pieces of Garbage	None	Isolated pieces of garbage	None	Isolated pieces of garbage	None
Oil and Grease	None	None	None	None	None	Slight Deposits stream bed visible	Eye witness account of oil sheen on water	None
Foaming	Foaming	None	None	Slight	Present	None	None	None
Colour	Clear brown	Milky Brown/ Grey	Milky Brown	Clear Brown	Milky Grey	Milky Grey/ Black	Milky Brown	Milky brown
Odour	Rotting Smell,	Rotting Smell	None	None	Rotting Smell	Hydrocarbon smell	Hydrocarbon smell	None
Classification	Moderately Contaminated	Moderately Contaminated	Moderately Contaminated	Mildly Contaminated	Moderately Contaminated	Anoxic	Heavily Polluted	Mildly Contaminated

Given the small sample size and low sample effort applied for this rapid habitat assessment it was not possible to conduct comparative studies for individual rivers. Thus, the faunal diversity observed was discussed in general terms for the entire study area.

Within the catchment areas surveyed a total of sixty-six (66) specimens were collected during the sampling period. These specimens belonged to ten (10) species representing ten (10) different families. The assemblage of organisms collected by ESL consisted of finfish and shrimp. A list of all the species caught within the rivers surveyed and brief biological notes are provided in Table 6-3 below.

The locations where no fish were caught were not included in the calculations for diversity. The species diversity for the SFWWCA was calculated using the equation outlined in Section 4.3. The number of species found within the entire sample area was divided by the number of specimen collected. This method has been referenced by Odum (1971)[3] and used by the Institute of Marine Affairs in fisheries studies previously conducted within the Point Lisas Industrial Port Area (1982)[4]. The calculation was thought to be a better indicator of diversity for the study area since no specimens were collected at five of the thirteen sample sites and only one species was observed at two of the sample sites.

The overall diversity index calculated for the finfish observed was 0.151. Ramsundar (2005) cited the species richness and species diversity (Shannon-Weiner Index) for the Godineau Swamp to be over 2-11 and 0.162-0.967, respectively, in the dry season and 2-7 and 0.036-0.903, respectively, in the wet season (Ramsundar, 2005). Using this as a guide the species richness and fish diversity observed within the SFWWCA appears to be lower than that reported for the Godineau Swamp. The number of species caught per site within the SFWWCA ranged from 0-4 species per station and the Shannon-Weiner Diversity Index values ranged from 0 - 1.289 per station (Table 6-4). The large disparity in the Shannon-Weiner Index values for the SFWWCA was a result of the small number of species collected as well as the small sample population observed at the various sample sites.

[3] Odum, E.P. 1971. Fundamentals of Ecology. Third Edition. W.B. Saunders Company. 574pg.

[4] IMA 1982. Point Lisas Environmental Protection Project, Fisheries. Volume II. Joint Study of PLIPDECO and the IMA

Table 6-3: Description of Species Captured per Sample Station

FAMILY	SPECIES	COMMON NAME	BIOLOGY	GL	ML	MU	VL	VM	CL	GoL	GoM
ACHIRIDAE	*Achirus lineatus*	Lined Sole/ Flounder	This Sole fish occurs mainly in the littoral zone, down to 20 m depth, and on all sandy-muddy bottoms of estuaries, rivers and coastal streams where it hides itself leaving just its eyes out. This is not a particularly valuable commercial species. Adults may achieve a maximum length of 23 cm.								X
ANABLEPIDAE	*Anableps anableps*	Four-eyed Fish	This fish is mainly found in freshwater, sometimes in brackish parts of lagoons and mangrove coastlines. The maximum length this species may achieve is 30cm. It is not a commercially valuable species.								X
ARIIDAE	*Arius* sp.	Catfish	Incidence of this species is confined chiefly to turbid waters in estuaries and the lower parts of rivers. Its delicate flesh is highly valued. though not commercially important in Trinidad, The maximum length achieved by this species is 97.5 cm the most common length observed however is 50 cm	X	X		X		X		X
CENTROPOMIDAE	*Centropomus undecimalis*	Brochet	This species inhabits coastal waters, estuaries and lagoons, penetrating into freshwater. The congregate at mouths of passes and rivers during the spawning season, and move seasonally into freshwater. Adults of this species grow to a maximum length of 140 cm; however the most common length observed is 50cm. This species is a valued game fish and an excellent food fish of commercial importance.								X
CICHLIDAE	*Oreochromis mossambicus*	Tilapia	This species thrives in standing waters and inhabits reservoirs, rivers, drains, swamps and tidal creeks. They are commonly found over mud bottoms, often in well-vegetated estuaries and coastal lakes. The fish is usually absent from permanently open estuaries and open sea and from fast-flowing waters. They are also able to survive extreme reductions of temporary water-bodies. This species can achieve a maximum length of 39 cm. An artisanal fishery for this species exists in the Caroni Swamp (Phillip and Ramnarine 2001).The species is also cultured locally for both food and the aquarium trade. This species is regarded as near threatened globally (IUCN, 2006).					X			
GERREIDAE	*Diapterus rhombeus*	Blinch	This fish is common in mangrove-lined lagoons; also found over shallow mud and sand grounds in marine areas; Juveniles common in hyper saline lagoons and in brackish water. The maximum length achieved by this species is 40 cm, however adults of 30 cm are more commonly found. The species probably feeds on small benthic invertebrates. Marketed fresh but not highly esteemed.	X	X						
MUGILIDAE	*Mugil* sp.	Mullet	These fish inhabit sandy coasts and littoral pools but also occurs in muddy bottoms of brackish lagoons and estuaries. They may at times penetrate rivers. Juveniles are common in coastal waters and are known to find their way to estuaries and coastal lagoons. Mullet can grow to 90cm in length however the most common length observed is 50 cm. It is a commercially important food fish in Trinidad					X			
PENAEIDAE	*Xiphopenaeus kroyeri*	Honey Shrimp	Fairly small species of shrimp lives in coastal water, remaining inshore in fairly sheltered areas and within estuaries. Important commercial species for the trawling industry within the Gulf of Paria. The total length adults rage between 7 and 14 cm. species.							X	
POECILIIDAE	*Poecilia reticulata*	Guppy	This species is found in various habitats, ranging from highly turbid water in ponds, canals and ditches at low elevations to pristine mountain streams at high elevations. It inhabits slow-flowing or still water near the margin of pools among vegetation. The maximum length achieved by this species is 3.5 cm			X		X			
SCIAENIDAE	*Micropogon furnieri*	Racando	Found over muddy and sandy bottoms in coastal waters and in estuaries where the nursery and feeding grounds are located. Maximum length 60cm most common length observed for adults is 45 cm. Important food fish in the Gulf of Paria Juvenile and Adults feed on benthic organisms.	X						X	

- Note: No samples were collected at Stations CU, CM1, CM2, GU and GM. As a result these locations are not cited in the table above.
- Details on the biology of each species were referenced form Fish Base (www.fishbase.org) an online resource. The information cited has been derived from more than 3,500 references such as the *FAO Species Catalogues* (e.g., Nielsen et al. 1999), the Indo-Pacific Fishes Series (e.g., Randall, 2000), other taxonomic revisions, e.g., (Pietsch and Grobecker 1987) as well as faunal checklists such as Daget et al. (1984, 1990), Shao et al. (1992). Kottelat et al. (1993), Smith and Heemstra (1995), Myers (1999) and Smith-Vaniz et al. (1999).

Table 6-4: The Shannon-Weiner Diversity Index Values Calculated for sample stations within the SFWWCA

Site	Shannon-Weiner Index
Cipero Upper	0
Cipero Middle 1	0
Cipero Middle 2	0
Cipero Lower	0
Marabella Upper	0
Marabella Lower	0.410
Vistabella Middle	0.703
Vistabella Lower	0
Guaracara Upper	0
Guaracara Middle	0
Guaracara Lower	0.562
Godineau Middle	1.289
Godineau Lower	0.687

The predominant species observed in upstream riverine locations (MU and VM) was the Guppy (*Poecilia reticulata*). These fish are tolerant of polluted, turbid waters with low levels of dissolved oxygen. The two other species collected in the middle course of the Vistabella River were Black Tilapia (*Oreochromis mossambicus*) and Mullet (*Mugil* sp.) (See Appendix 1). Both these species are generally found in brackish to freshwater environments with "sluggish" slow moving waters. Their presence suggests that the station along the middle course of the Vistabella River can be subjected to tidal influences.

Within the lower courses of the rivers surveyed, Catfish (*Arius* sp.) appeared to be the most predominant species. However, this species is benthopelagic and as such their prevalence in the sample population may have been as a result of the gear type (fish pots) used for fishing and not a true reflection of the aquatic community structure.

Among the finfish captured Tilapia, Mullet, Catfish, Racando (*Micropogon furnieri*), Blinch (*Diapterus rhombeus*) and Brochet (*Centropomus undecimalis*) are good food fish (See Appendix 1). They are also game fish and are usually caught on light tackle. Racando, Brochet, Tilapia and Mullet were the most commercially important species of fish noted. Honey shrimp (*Xiphopenaeus kroyeri*) was also caught within the study area. This species is commercially important to both the artisanal and semi-industrial shrimp trawling fisheries in the Gulf of Paria (Kuruvilla, 2000).

Four-eyed Fish (*Anableps* sp.) were observed in the intertidal zone, at the mouths of the major rivers surveyed. *Anableps* sp. are an intertidal specialist found in fresh, brackish or even pelagic waters, eating insects, other invertebrates and diatoms above and below the water line or on the substrate. Although not commercially important, their presence indicates that they may be a key secondary consumer in the littoral zone, as well as prey for fish and bird predators within estuarine environments (See Appendix 1).

It should be noted that none of the species encountered are currently considered rare or endangered globally (IUCN Red List, 2006). However, the status of *Oreochromis mossambicus* has been listed as near threatened as a result of hybridization with the rapidly spreading *Oreochromis niloticus*. At present *Oreochromis niloticus* species is preferred by anglers for aquaculture (IUCN Red List, Ref. 57073).

7. Data Interpretation

Based on the fishing exercises conducted by ESL, there appears to be a greater number of aquatic species within the lower courses of the rivers draining the SFWWCA. Many studies have shown that fish species diversity increases in a downstream direction (Hughes and Gammon 1987). However, since no data was obtained at five (5) of the seven (7) upstream locations surveyed (despite vigorous sampling effort); this limited a clear evaluation of this hypothesis. The small sample population collected was attributed to several factors including; the polluted nature of sample stations, dredging and the intermittent stream flows experienced in the upper courses of smaller rivers. Most of the stations examined were perturbed and had been recently dredged for flood control. Such physical and chemical alterations to a river channel can result in losses of faunal biodiversity (Revenga and Mock 2000, Phillip 1998; Moyle and Leidy 1992).

Another factor which may have contributed to the small sample numbers observed was intrinsic limitations in the sample design. Referencing work previously carried out by Hugueny and Paugy (1995) in African rivers, Phillip (1998) inferred that it is possible for species richness to fluctuate along the length of rivers in Trinidad. As such samples taken at points too close together or at an insufficient number of points may fail to show overall longitudinal trends or encompass all the species existing within a water course.

Despite the survey limitations described above the fish assemblages captured at the mouth of the rivers show a strong marine influence and can be classed as estuarine in nature. The estuarine conditions within the dynamic environment at the mouth of rivers created a unique habitat in which marine, estuarine and freshwater species co-existed. Based on the result of past surveys, the estuaries within the study area support a diversity of ichthyofaunal species. Many of these species depend on organic matter transported downstream by the rivers as a food source. The majority of fishes captured were obligatory estuarine species, living solely within such areas or they required an estuarine habitat for the completion of their life cycle. Day *et al* (1989) identified 6 main ways in which fish utilize estuaries such as those observed during the course of this survey (after Mc Hugh, 1967):

1. Freshwater species that occasionally enter brackish water.
2. Truly estuarine species that spend their entire lives in estuaries (e.g. *Anableps anableps and Arius* sp.*)*.
3. Estuarine-marine species that use estuaries as a nursery ground, but spawn and spend much of their adult lives at sea, returning seasonally to estuaries (e.g. *Xiphopenaeus kroyeri; Mugil* sp; *Centropomus undecimalis* and *Diapterus rhombeus*).
4. Marine species that pay regular seasonal visits to estuaries, usually as adults looking for food (e.g. *Micropogon furnieri).*
5. Anadromous (sea dwellers that migrate to freshwater to spawn). catadromous (freshwater species that migrate to seawater to breed) species in transit.
6. Occasional visitors, which appear irregularly or accidentally

The mangroves located at the mouth of the rivers serve several ecological functions. Mangroves are actively involved in primary production and provide a habitat for many populations of invertebrates and fishes. The out welling of organic matter from mangrove forests creates a highly nutritious, turbid system that promotes offshore production (Wolanski *et al*., 1980). Mangrove systems export both energy and nutrients to neighbouring coastal ecosystems by providing a continuous source of food for invertebrates, juvenile fish and other aquatic species, (Kricher, 1997). The physical structure of the prop root system of the red mangroves (*Rhizophora mangle)* at the mouth of the rivers acted as a tidal buffer and protective maze or nursery which sheltered small fish and provide a substrate for populations of oysters.

A nursery area is a place where larval, juvenile or young stages of aquatic life concentrate for feeding or refuge. By this definition, it is implied that a habitat having a nursery function value may possess these characteristics: be a location of intense biological activity, e.g. feeding, refuge or shelter to the larval, juvenile and sub-adult stages of organisms; provide shelter and a refuge habitat with a broad cross-section of microhabitats; facilitate, accommodate and preserve the growth and development of the organism and its niche within the habitat. In addition, food should be available and accessible in either the dissolved or particulate state in order to sustain the physiological needs of the organism. Dennis (1992) also suggests that a nursery should have low mortality from predation or starvation.

Reproductively, aquatic fauna can be classified (Day *et al*., 1989) as:

- Saltwater spawners – larvae migrate to the estuary

- Estuarine spawners – larvae spend most of the time in the estuary
- Freshwater spawners – larvae and juveniles drift into the estuary

Saltwater spawners spawn in nearshore coastal waters and eggs or larvae drift into the estuary via currents. Juveniles spend a few weeks to a few years in an estuary before migrating offshore to adult feeding grounds, e.g. Mullet, *Mugil* sp. Other saltwater estuarine-dependent species include the Penaeid shrimp worldwide, Blue crab, *Callinectes* sp., Croakers, Weakfish, and some Flounders (Day *et al*., 1989).

Estuarine spawners include Sea Catfishes (Ariidae) previously of freshwater origin, now completely adapted to reproduce and spawn in estuarine conditions, especially in *Rhizophora* (mangrove) and *Thalassia* (seagrass) habitats (Day *et al*., 1989).

With the exception of Catfish (*Arius* sp.) and *Anableps* sp. the majority of individuals captured at the mouth of the rivers in the SFWWCA was classed as juveniles (classification was based on referenced maximum species length See Appendix 2) and were primarily sought as bait or fish food. The estuaries and the estuarine mangrove systems within the study area seem to act as a nursery for valuable finfish of the Gulf of Paria. Surveys conducted by epas in 2005 also indicated that the area is used as spawning ground for finfish, shrimp and crabs as well as a nursery for juveniles.

8. Concluding Notes

The rivers within the SFWWCA appear to support a fair diversity of aquatic fauna particularly in their lower courses at the land sea interface. Unlike historical studies which suggest that the larger rivers within the SFWWCA support a great diversity of aquatic fauna, the sample population collected by ESL was quite small. The small sample size and low diversity of species was attributed to several factors including; the polluted nature of sample stations, dredging and the intermittent stream flows experienced in the upper courses of smaller rivers. Most of the stations examined were perturbed and had been recently dredged for flood control. Such physical and chemical alterations to a river channel generally result in losses of faunal biodiversity. Intrinsic limitations in the sample design may have also contributed to the small sample population observed. It is possible that the sample stations were placed too close together or a greater number of sample points along each river was required to detect overall longitudinal trends in fish species distribution.

It was however noted that the estuarine environment at the mouth of the rivers surveyed provided a unique habitat for both marine and estuarine species of aquatic fauna. These areas act as a nursery for juveniles, a protected spawning ground and a sheltered feeding environment for numerous marine species of finfish, shrimp and crabs some of which are important to both the artisanal and semi-industrial fishing industry of the Gulf of Paria.

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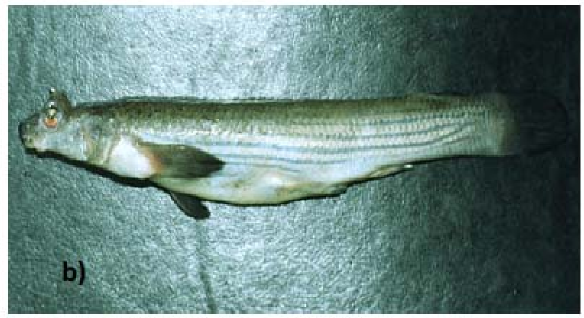
Appendix 1

Centropomus undecimalis collected in the middle course of the Godineau River

Reference images of *Centropomus undecimalis* (www.FIshbase.org)

Anableps anableps collected in the middle course of the Godineau River



Reference images of *Anableps anableps* (www.FIshbase.org)

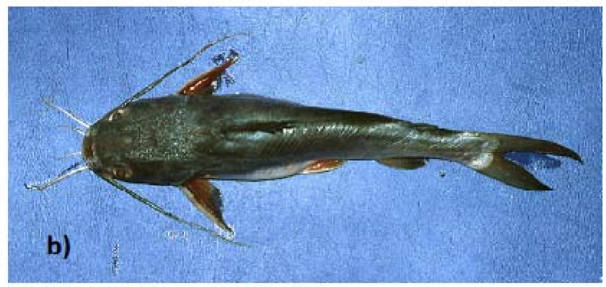
Mugil sp. collected in the middle course of the Vistabella River

Reference images of Mugil sp. (www.FIshbase.org)

Oreochromis mossambicus collected from the middle course of the Vistabella River

Reference images of *Oreochromis mossambicus* (www.Fishbase.org)

Arius sp. collected at the mouth of the Cipero River

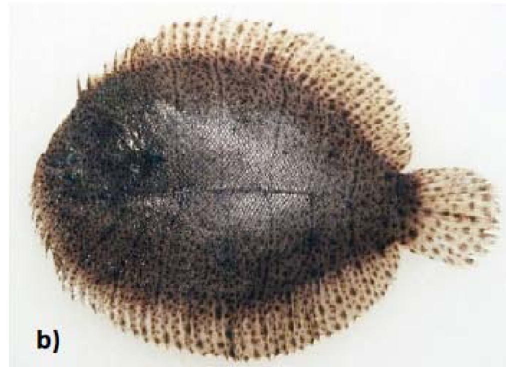


Reference image of Arius sp (www.Fishbase.org)

Micropogon furnieri collected at the mouth of the Godineau River

Reference images of *Micropogon furnieri* (www.Fishbase.org)

Achirus lineatus collected in the middle course of the Godineau River



Refernce image of *Achirus lineatus* (www.FIshbase.org)

Diapterus rhombeus collected at the mouth of the Guaracara River

Reference image of *Diapterus rhombeus* (www.FIshbase.org)

Appendix 2

Appendix 2-1 Table of Raw Species Data Collected for the SFWWCA Project

Station	Family	Species	Common Name	Length (cm)	Probable Life Phase	Percentage of maximum reported length
Marabella Upper	Poeciliidae	*Poecilia reticulata*	Guppy	1	Adult	28.57
				1.4	Adult	40
				0.8	Juvenile	22.88
				0.9	Adult	25.71
				1	Adult	28.57
				1	Adult	28.57
				1.2	Adult	34.29
Vistabella Middle	Cichlidae	*Oreochromis mossambicus*	Tilapia	9	Juvenile	23.08
				9.5	juvenile	24.36
				10.5	Adult	26.92
				9.5	Juvenile	24.36
				9.5	Juvenile	24.36
				10.5	Adult	26.92
				6	Juvenile	15.38
				10	Juvenile	25.64
				13	Adult	33.33
				15	Adult	38.46
				15	Adult	38.46
				12.5	Adult	32.05
	Mugilidae	*Mugil* sp.	Mullet	12.5	Juvenile	13.88
				11.5	Juvenile	12.77
				12	Juvenile	13.33
	Poeciliidae	*Poecilia reticulata*	Guppy	0.5	Juvenile	14.29

Station	Family	Species	Common Name	Length (cm)	Probable Life Phase	Percentage of maximum reported length
Godineau Lower	Sciaenidae	*Micropogon furnieri*	Racando/ Cro Cro	10.5	Juvenile	23.33
				8.5	Juvenile	18.88
				7	Juvenile	15.55
				7.5	Juvenile	16.66
				6	Juvenile	13.33
	Penaeidae	*Xiphopenaeus kroyeri*	Shrimp Seabob	4	Adult	57.14
				4.5	Adult	64.29
				4.5	Adult	64.29
				5	Adult	71.43
Cipero Lower	Ariidae	*Arius* sp.	Catfish	30	Adult	60.00
				20	Adult	40.00
				33	Adult	66.00
				30	Adult	60.00
				23	Adult	46.00
				37	Adult	74.00
				6	Juvenile	12.00
				14	Adult	28.00
Guaracara Lower	Gerreidae	*Diapterus rhombeus*	Blinch	6	Juvenile	20.00
				8.5	Adult	28.33
				7	Juvenile	23.33
	Sciaenidae	*Micropogon furnieri*	Racando/ Cro Cro	10	Juvenile	22.22
Vistabella Lower	Ariidae	*Arius* sp.	Catfish	36	Adult	72.00
				18	Adult	36.00

Station	Family	Species	Common Name	Length (cm)	Probable Life Phase	Percentage of maximum reported length
				21	Adult	42.00
Marabella Lower	Ariidae	*Arius* sp.	Catfish	23	Adult	46.00
	Gerreidae	*Diapterus rhombeus*	Blinch	7.5	Juvenile	25.00
				7.5	Juvenile	25.00
				6.5	Juvenile	21.66
				6.5	Juvenile	21.66
				6.5	Juvenile	21.66
				7.5	Juvenile	25.00
Godineau Middle	Centropomidae	*Centropomus undecimalis*	Brochet	13.5	Adult	27.00
				8.5	Juvenile	17.00
				11	Juvenile	22.00
	Achiridae	*Achirus lineatus*	Drab Sole Fish/Flounder	5.5	Juvenile	14.86
	Ariidae	*Arius* sp.	Catfish	6	Juvenile	12.00
				6.5	Juvenile	13.00
				6	Juvenile	12.00
				8.5	Juvenile	17.00
	Anablepidae	*Anableps anableps*	Four-eyed Fish	13	Adult	43.33
				20	Adult	66.66
				26	Adult	86.66
				17	Adult	56.66

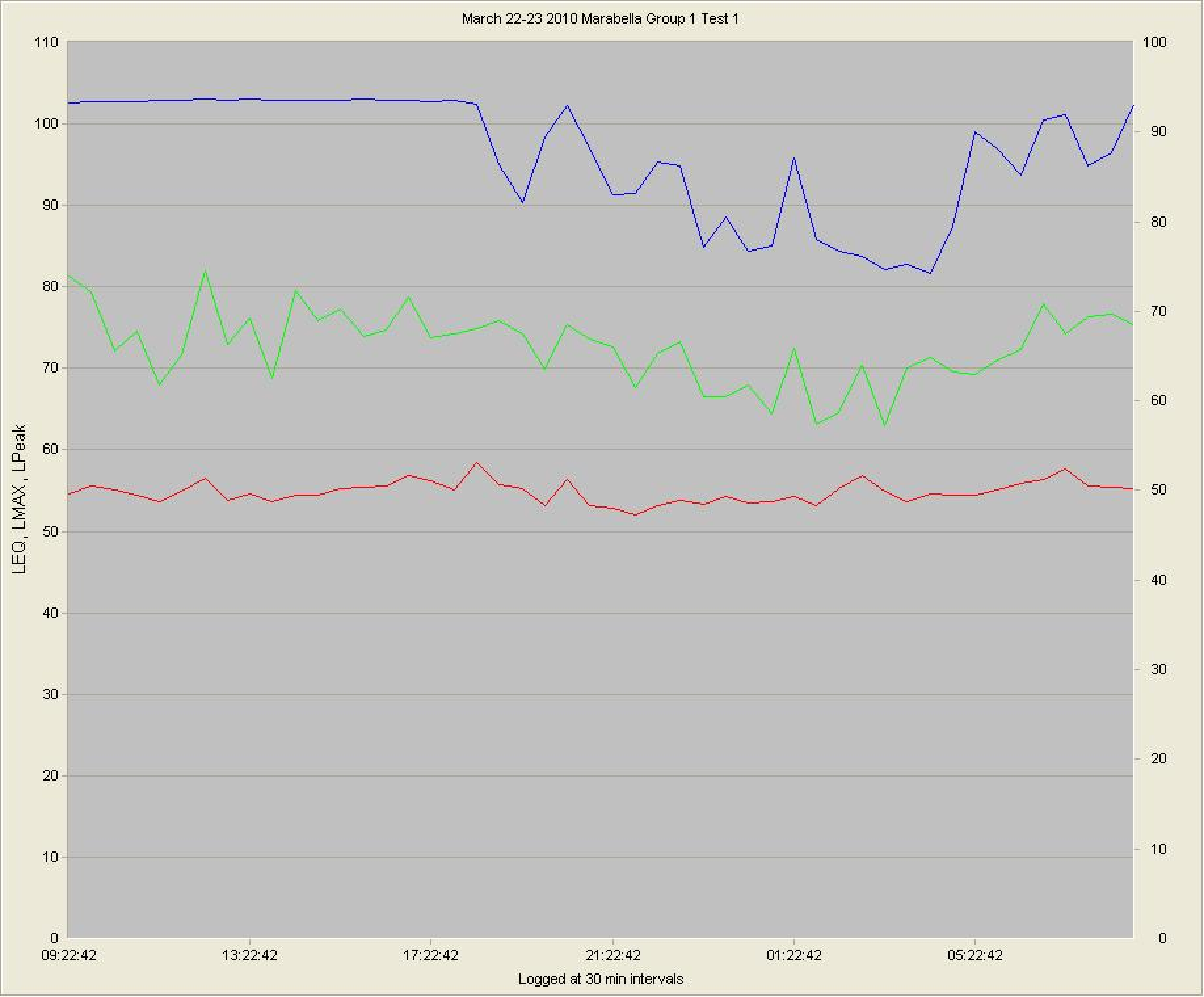
Appendix D

Biophysical Baseline Data

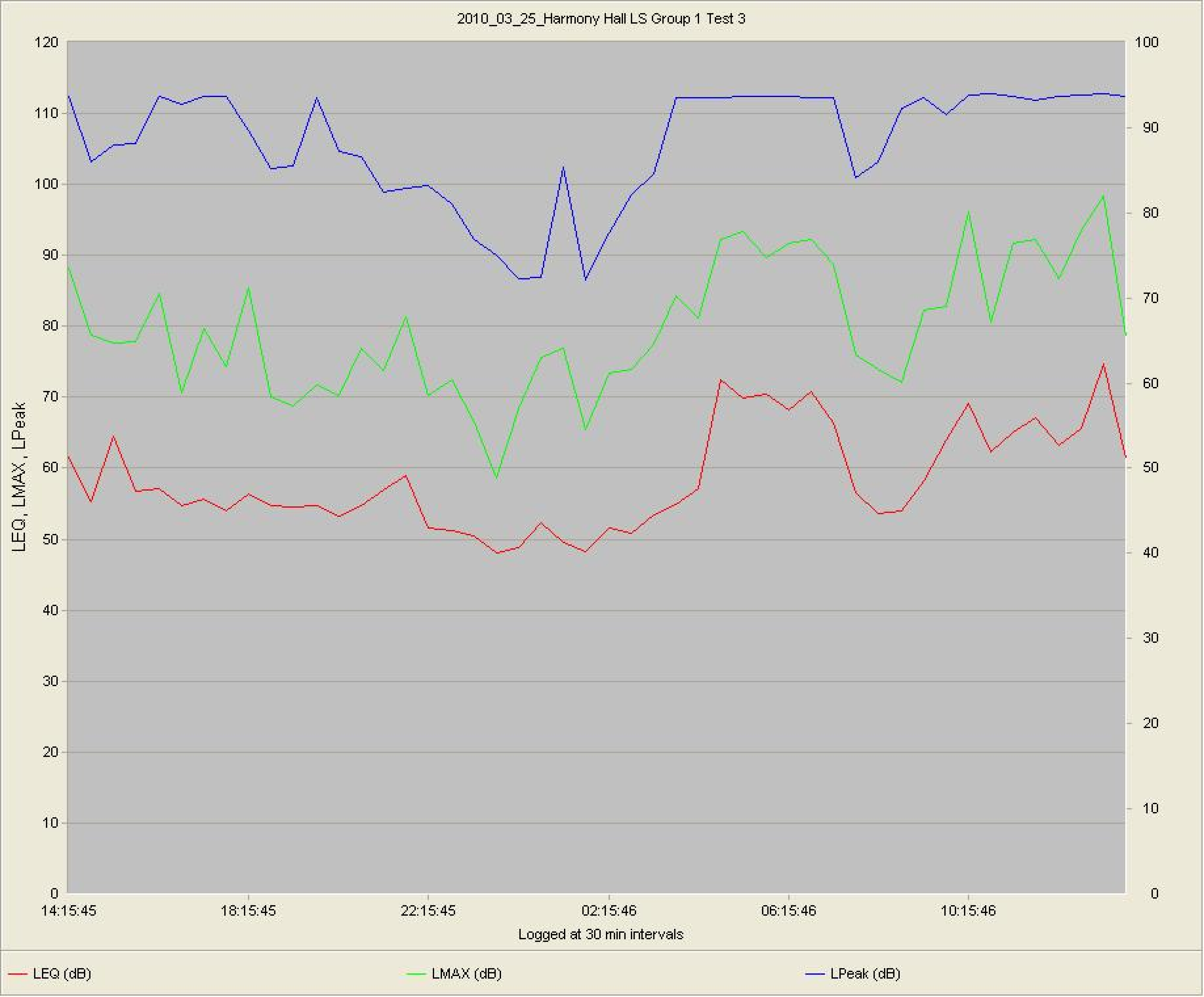
D.6 Noise Baseline Sampling Data

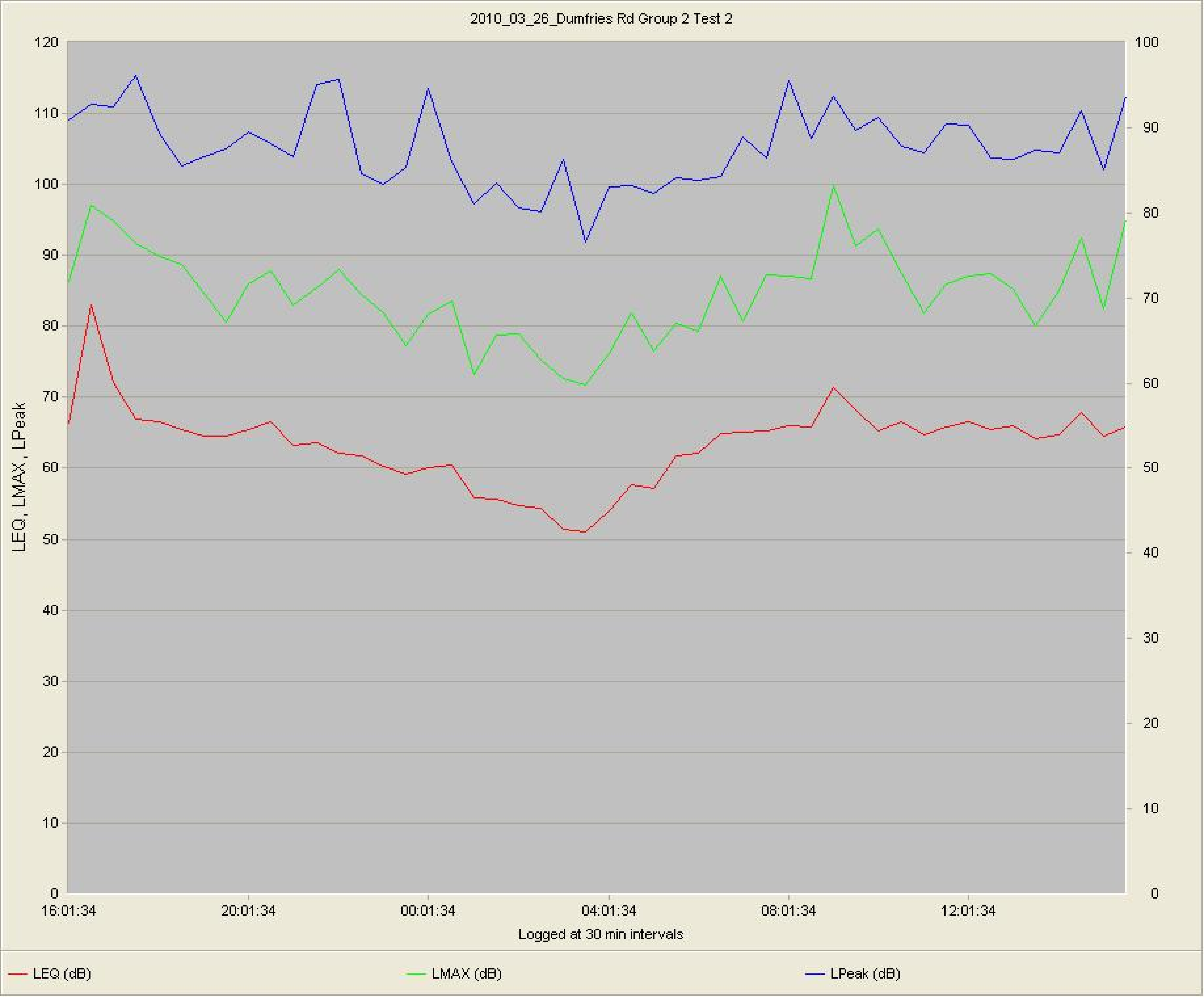
Appendix D.6 – Noise Baseline Results (2010)

Location	Lpeak (dB)	
	8am-8pm	8pm-8am
Marabella	103	102
Harmony Hall	113	113
Dumfries Road	115	115
Pleasantville	123	111
EMA Noise Pollution Rules General Area	**120**	**115**
San Fernando WWTP	119	117
EMA Noise Pollution Rules Industrial Area	**130**	**130**

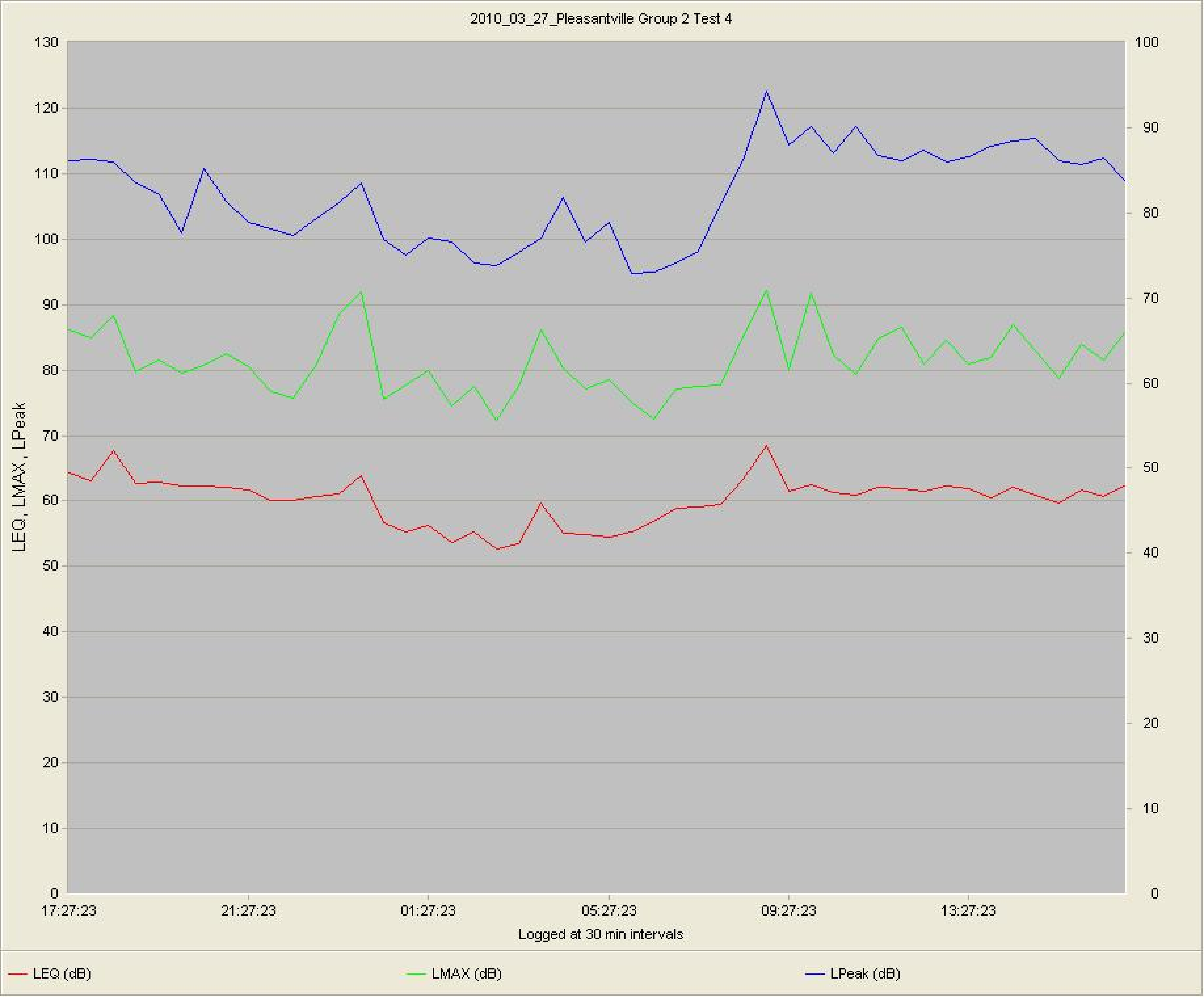


March 22-23 2010 Marabella Group 1 Test 1
LEQ, LMAX, LPeak
110
100
90
80
70
60
50
40
30
20
10
0
100
90
80
70
60
50
40
30
20
10
0
09:22:42
13:22:42
17:22:42
21:22:42
01:22:42
05:22:42
Logged at 30 min intervals


2010_03_25_Harmony Hall LS Group 1 Test 3
LEQ, LMAX, LPeak
120
110
100
90
80
70
60
50
40
30
20
10
0
100
90
80
70
60
50
40
30
20
10
0
14:15:45
18:15:45
22:15:45
02:15:46
06:15:46
10:15:46
Logged at 30 min intervals
LEQ (dB)
LMAX (dB)
LPeak (dB)



2010_03_26_Dumfries Rd Group 2 Test 2
LEQ, LMAX, LPeak
120
110
100
90
80
70
60
50
40
30
20
10
0
100
90
80
70
60
50
40
30
20
10
0
16:01:34
20:01:34
00:01:34
04:01:34
08:01:34
12:01:34
Logged at 30 min intervals
LEQ (dB)
LMAX (dB)
LPeak (dB)



2010_03_27_Pleasantville Group 2 Test 4
LEQ, LMAX, LPeak
130
120
110
100
90
80
70
60
50
40
30
20
10
0
100
90
80
70
60
50
40
30
20
10
0
17:27:23
21:27:23
01:27:23
05:27:23
09:27:23
13:27:23
Logged at 30 min intervals
LEQ (dB)
LMAX (dB)
LPeak (dB)


2010_03_24_SFVWTP Group 1 Test 2
LEQ, LMAX, LPeak
120
110
100
90
80
70
60
50
40
30
20
10
0
100
90
80
70
60
50
40
30
20
10
0
11:23:07
15:23:07
19:23:07
23:23:07
03:23:07
07:23:07
Logged at 30 min intervals
LEQ (dB)
LMAX (dB)
LPeak (dB)

Appendix D

Biophysical Baseline Data

D.7 Air Quality Baseline Data

Test 002

Marabella Residential Area

Instrument		Data Properties	
Model	Dust Trak	Start Date	03/22/2010
Meter S/N	23567	Start Time	09:03:55
		Stop Date	03/23/2010
		Stop Time	09:34:55
		Total Time	1:00:31:00
		Logging Interval	60 seconds

Test Data

Data Point	Date	Time	Aerosol mg/m^3
1	03/22/2010	09:04:55	0.020
2	03/22/2010	09:05:55	0.020
3	03/22/2010	09:06:55	0.020
4	03/22/2010	09:07:55	0.021
5	03/22/2010	09:08:55	0.021
6	03/22/2010	09:09:55	0.022
7	03/22/2010	09:10:55	0.020
8	03/22/2010	09:11:55	0.020
9	03/22/2010	09:12:55	0.019
10	03/22/2010	09:13:55	0.021
11	03/22/2010	09:14:55	0.022
12	03/22/2010	09:15:55	0.020
13	03/22/2010	09:16:55	0.021
14	03/22/2010	09:17:55	0.019
15	03/22/2010	09:18:55	0.021
16	03/22/2010	09:19:55	0.021
17	03/22/2010	09:20:55	0.021
18	03/22/2010	09:21:55	0.023
19	03/22/2010	09:22:55	0.022
20	03/22/2010	09:23:55	0.023
21	03/22/2010	09:24:55	0.024
22	03/22/2010	09:25:55	0.024
23	03/22/2010	09:26:55	0.025
24	03/22/2010	09:27:55	0.023
25	03/22/2010	09:28:55	0.021
26	03/22/2010	09:29:55	0.022
27	03/22/2010	09:30:55	0.024
28	03/22/2010	09:31:55	0.024
29	03/22/2010	09:32:55	0.024
30	03/22/2010	09:33:55	0.022
31	03/22/2010	09:34:55	0.023
32	03/22/2010	09:35:55	0.023
33	03/22/2010	09:36:55	0.024
34	03/22/2010	09:37:55	0.025

Test Data

Data Point	Date	Time	Aerosol mg/m^3
35	03/22/2010	09:38:55	0.025
36	03/22/2010	09:39:55	0.023
37	03/22/2010	09:40:55	0.021
38	03/22/2010	09:41:55	0.021
39	03/22/2010	09:42:55	0.020
40	03/22/2010	09:43:55	0.022
41	03/22/2010	09:44:55	0.020
42	03/22/2010	09:45:55	0.019
43	03/22/2010	09:46:55	0.022
44	03/22/2010	09:47:55	0.018
45	03/22/2010	09:48:55	0.018
46	03/22/2010	09:49:55	0.018
47	03/22/2010	09:50:55	0.018
48	03/22/2010	09:51:55	0.018
49	03/22/2010	09:52:55	0.016
50	03/22/2010	09:53:55	0.018
51	03/22/2010	09:54:55	0.018
52	03/22/2010	09:55:55	0.018
53	03/22/2010	09:56:55	0.020
54	03/22/2010	09:57:55	0.023
55	03/22/2010	09:58:55	0.021
56	03/22/2010	09:59:55	0.020
57	03/22/2010	10:00:55	0.020
58	03/22/2010	10:01:55	0.021
59	03/22/2010	10:02:55	0.021
60	03/22/2010	10:03:55	0.021
61	03/22/2010	10:04:55	0.021
62	03/22/2010	10:05:55	0.022
63	03/22/2010	10:06:55	0.023
64	03/22/2010	10:07:55	0.019
65	03/22/2010	10:08:55	0.019
66	03/22/2010	10:09:55	0.021
67	03/22/2010	10:10:55	0.024
68	03/22/2010	10:11:55	0.023
69	03/22/2010	10:12:55	0.025
70	03/22/2010	10:13:55	0.026
71	03/22/2010	10:14:55	0.024
72	03/22/2010	10:15:55	0.023
73	03/22/2010	10:16:55	0.023
74	03/22/2010	10:17:55	0.024
75	03/22/2010	10:18:55	0.023
76	03/22/2010	10:19:55	0.024
77	03/22/2010	10:20:55	0.024
78	03/22/2010	10:21:55	0.026
79	03/22/2010	10:22:55	0.023
80	03/22/2010	10:23:55	0.023

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
81	03/22/2010	10:24:55	0.023
82	03/22/2010	10:25:55	0.025
83	03/22/2010	10:26:55	0.025
84	03/22/2010	10:27:55	0.024
85	03/22/2010	10:28:55	0.020
86	03/22/2010	10:29:55	0.022
87	03/22/2010	10:30:55	0.021
88	03/22/2010	10:31:55	0.021
89	03/22/2010	10:32:55	0.023
90	03/22/2010	10:33:55	0.022
91	03/22/2010	10:34:55	0.021
92	03/22/2010	10:35:55	0.023
93	03/22/2010	10:36:55	0.026
94	03/22/2010	10:37:55	0.024
95	03/22/2010	10:38:55	0.021
96	03/22/2010	10:39:55	0.021
97	03/22/2010	10:40:55	0.022
98	03/22/2010	10:41:55	0.022
99	03/22/2010	10:42:55	0.022
100	03/22/2010	10:43:55	0.025
101	03/22/2010	10:44:55	0.023
102	03/22/2010	10:45:55	0.021
103	03/22/2010	10:46:55	0.022
104	03/22/2010	10:47:55	0.024
105	03/22/2010	10:48:55	0.023
106	03/22/2010	10:49:55	0.023
107	03/22/2010	10:50:55	0.024
108	03/22/2010	10:51:55	0.023
109	03/22/2010	10:52:55	0.024
110	03/22/2010	10:53:55	0.026
111	03/22/2010	10:54:55	0.026
112	03/22/2010	10:55:55	0.023
113	03/22/2010	10:56:55	0.024
114	03/22/2010	10:57:55	0.023
115	03/22/2010	10:58:55	0.022
116	03/22/2010	10:59:55	0.025
117	03/22/2010	11:00:55	0.026
118	03/22/2010	11:01:55	0.027
119	03/22/2010	11:02:55	0.028
120	03/22/2010	11:03:55	0.026
121	03/22/2010	11:04:55	0.029
122	03/22/2010	11:05:55	0.028
123	03/22/2010	11:06:55	0.027
124	03/22/2010	11:07:55	0.025
125	03/22/2010	11:08:55	0.027
126	03/22/2010	11:09:55	0.025

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
127	03/22/2010	11:10:55	0.023
128	03/22/2010	11:11:55	0.023
129	03/22/2010	11:12:55	0.022
130	03/22/2010	11:13:55	0.023
131	03/22/2010	11:14:55	0.023
132	03/22/2010	11:15:55	0.023
133	03/22/2010	11:16:55	0.028
134	03/22/2010	11:17:55	0.027
135	03/22/2010	11:18:55	0.027
136	03/22/2010	11:19:55	0.027
137	03/22/2010	11:20:55	0.027
138	03/22/2010	11:21:55	0.026
139	03/22/2010	11:22:55	0.028
140	03/22/2010	11:23:55	0.028
141	03/22/2010	11:24:55	0.027
142	03/22/2010	11:25:55	0.025
143	03/22/2010	11:26:55	0.024
144	03/22/2010	11:27:55	0.027
145	03/22/2010	11:28:55	0.030
146	03/22/2010	11:29:55	0.028
147	03/22/2010	11:30:55	0.028
148	03/22/2010	11:31:55	0.031
149	03/22/2010	11:32:55	0.033
150	03/22/2010	11:33:55	0.036
151	03/22/2010	11:34:55	0.034
152	03/22/2010	11:35:55	0.033
153	03/22/2010	11:36:55	0.032
154	03/22/2010	11:37:55	0.033
155	03/22/2010	11:38:55	0.033
156	03/22/2010	11:39:55	0.031
157	03/22/2010	11:40:55	0.035
158	03/22/2010	11:41:55	0.036
159	03/22/2010	11:42:55	0.043
160	03/22/2010	11:43:55	0.041
161	03/22/2010	11:44:55	0.042
162	03/22/2010	11:45:55	0.040
163	03/22/2010	11:46:55	0.037
164	03/22/2010	11:47:55	0.035
165	03/22/2010	11:48:55	0.038
166	03/22/2010	11:49:55	0.038
167	03/22/2010	11:50:55	0.037
168	03/22/2010	11:51:55	0.038
169	03/22/2010	11:52:55	0.041
170	03/22/2010	11:53:55	0.037
171	03/22/2010	11:54:55	0.034
172	03/22/2010	11:55:55	0.033

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
173	03/22/2010	11:56:55	0.033
174	03/22/2010	11:57:55	0.033
175	03/22/2010	11:58:55	0.028
176	03/22/2010	11:59:55	0.030
177	03/22/2010	12:00:55	0.030
178	03/22/2010	12:01:55	0.032
179	03/22/2010	12:02:55	0.032
180	03/22/2010	12:03:55	0.034
181	03/22/2010	12:04:55	0.033
182	03/22/2010	12:05:55	0.033
183	03/22/2010	12:06:55	0.033
184	03/22/2010	12:07:55	0.036
185	03/22/2010	12:08:55	0.040
186	03/22/2010	12:09:55	0.037
187	03/22/2010	12:10:55	0.035
188	03/22/2010	12:11:55	0.044
189	03/22/2010	12:12:55	0.043
190	03/22/2010	12:13:55	0.042
191	03/22/2010	12:14:55	0.042
192	03/22/2010	12:15:55	0.034
193	03/22/2010	12:16:55	0.028
194	03/22/2010	12:17:55	0.027
195	03/22/2010	12:18:55	0.023
196	03/22/2010	12:19:55	0.024
197	03/22/2010	12:20:55	0.028
198	03/22/2010	12:21:55	0.031
199	03/22/2010	12:22:55	0.032
200	03/22/2010	12:23:55	0.032
201	03/22/2010	12:24:55	0.039
202	03/22/2010	12:25:55	0.047
203	03/22/2010	12:26:55	0.048
204	03/22/2010	12:27:55	0.060
205	03/22/2010	12:28:55	0.066
206	03/22/2010	12:29:55	0.066
207	03/22/2010	12:30:55	0.057
208	03/22/2010	12:31:55	0.055
209	03/22/2010	12:32:55	0.058
210	03/22/2010	12:33:55	0.057
211	03/22/2010	12:34:55	0.058
212	03/22/2010	12:35:55	0.053
213	03/22/2010	12:36:55	0.059
214	03/22/2010	12:37:55	0.055
215	03/22/2010	12:38:55	0.052
216	03/22/2010	12:39:55	0.050
217	03/22/2010	12:40:55	0.048
218	03/22/2010	12:41:55	0.050

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
219	03/22/2010	12:42:55	0.046
220	03/22/2010	12:43:55	0.043
221	03/22/2010	12:44:55	0.037
222	03/22/2010	12:45:55	0.036
223	03/22/2010	12:46:55	0.033
224	03/22/2010	12:47:55	0.031
225	03/22/2010	12:48:55	0.037
226	03/22/2010	12:49:55	0.046
227	03/22/2010	12:50:55	0.044
228	03/22/2010	12:51:55	0.045
229	03/22/2010	12:52:55	0.045
230	03/22/2010	12:53:55	0.047
231	03/22/2010	12:54:55	0.046
232	03/22/2010	12:55:55	0.047
233	03/22/2010	12:56:55	0.047
234	03/22/2010	12:57:55	0.045
235	03/22/2010	12:58:55	0.043
236	03/22/2010	12:59:55	0.037
237	03/22/2010	13:00:55	0.036
238	03/22/2010	13:01:55	0.202
239	03/22/2010	13:02:55	0.058
240	03/22/2010	13:03:55	0.057
241	03/22/2010	13:04:55	0.059
242	03/22/2010	13:05:55	0.056
243	03/22/2010	13:06:55	0.058
244	03/22/2010	13:07:55	0.055
245	03/22/2010	13:08:55	0.055
246	03/22/2010	13:09:55	0.058
247	03/22/2010	13:10:55	0.055
248	03/22/2010	13:11:55	0.053
249	03/22/2010	13:12:55	0.052
250	03/22/2010	13:13:55	0.052
251	03/22/2010	13:14:55	0.052
252	03/22/2010	13:15:55	0.056
253	03/22/2010	13:16:55	0.056
254	03/22/2010	13:17:55	0.058
255	03/22/2010	13:18:55	0.056
256	03/22/2010	13:19:55	0.054
257	03/22/2010	13:20:55	0.051
258	03/22/2010	13:21:55	0.051
259	03/22/2010	13:22:55	0.051
260	03/22/2010	13:23:55	0.055
261	03/22/2010	13:24:55	0.058
262	03/22/2010	13:25:55	0.058
263	03/22/2010	13:26:55	0.061
264	03/22/2010	13:27:55	0.060

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
265	03/22/2010	13:28:55	0.060
266	03/22/2010	13:29:55	0.057
267	03/22/2010	13:30:55	0.058
268	03/22/2010	13:31:55	0.060
269	03/22/2010	13:32:55	0.065
270	03/22/2010	13:33:55	0.065
271	03/22/2010	13:34:55	0.074
272	03/22/2010	13:35:55	0.075
273	03/22/2010	13:36:55	0.075
274	03/22/2010	13:37:55	0.076
275	03/22/2010	13:38:55	0.076
276	03/22/2010	13:39:55	0.071
277	03/22/2010	13:40:55	0.065
278	03/22/2010	13:41:55	0.064
279	03/22/2010	13:42:55	0.066
280	03/22/2010	13:43:55	0.065
281	03/22/2010	13:44:55	0.065
282	03/22/2010	13:45:55	0.060
283	03/22/2010	13:46:55	0.060
284	03/22/2010	13:47:55	0.060
285	03/22/2010	13:48:55	0.059
286	03/22/2010	13:49:55	0.063
287	03/22/2010	13:50:55	0.061
288	03/22/2010	13:51:55	0.065
289	03/22/2010	13:52:55	0.066
290	03/22/2010	13:53:55	0.069
291	03/22/2010	13:54:55	0.064
292	03/22/2010	13:55:55	0.064
293	03/22/2010	13:56:55	0.063
294	03/22/2010	13:57:55	0.062
295	03/22/2010	13:58:55	0.062
296	03/22/2010	13:59:55	0.060
297	03/22/2010	14:00:55	0.058
298	03/22/2010	14:01:55	0.059
299	03/22/2010	14:02:55	0.056
300	03/22/2010	14:03:55	0.049
301	03/22/2010	14:04:55	0.047
302	03/22/2010	14:05:55	0.046
303	03/22/2010	14:06:55	0.051
304	03/22/2010	14:07:55	0.064
305	03/22/2010	14:08:55	0.077
306	03/22/2010	14:09:55	0.080
307	03/22/2010	14:10:55	0.079
308	03/22/2010	14:11:55	0.078
309	03/22/2010	14:12:55	0.071
310	03/22/2010	14:13:55	0.068

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
311	03/22/2010	14:14:55	0.066
312	03/22/2010	14:15:55	0.064
313	03/22/2010	14:16:55	0.066
314	03/22/2010	14:17:55	0.067
315	03/22/2010	14:18:55	0.070
316	03/22/2010	14:19:55	0.073
317	03/22/2010	14:20:55	0.073
318	03/22/2010	14:21:55	0.077
319	03/22/2010	14:22:55	0.088
320	03/22/2010	14:23:55	0.098
321	03/22/2010	14:24:55	0.098
322	03/22/2010	14:25:55	0.097
323	03/22/2010	14:26:55	0.098
324	03/22/2010	14:27:55	0.093
325	03/22/2010	14:28:55	0.093
326	03/22/2010	14:29:55	0.093
327	03/22/2010	14:30:55	0.100
328	03/22/2010	14:31:55	0.101
329	03/22/2010	14:32:55	0.101
330	03/22/2010	14:33:55	0.104
331	03/22/2010	14:34:55	0.104
332	03/22/2010	14:35:55	0.103
333	03/22/2010	14:36:55	0.103
334	03/22/2010	14:37:55	0.095
335	03/22/2010	14:38:55	0.100
336	03/22/2010	14:39:55	0.101
337	03/22/2010	14:40:55	0.102
338	03/22/2010	14:41:55	0.110
339	03/22/2010	14:42:55	0.112
340	03/22/2010	14:43:55	0.108
341	03/22/2010	14:44:55	0.105
342	03/22/2010	14:45:55	0.107
343	03/22/2010	14:46:55	0.106
344	03/22/2010	14:47:55	0.107
345	03/22/2010	14:48:55	0.096
346	03/22/2010	14:49:55	0.090
347	03/22/2010	14:50:55	0.090
348	03/22/2010	14:51:55	0.092
349	03/22/2010	14:52:55	0.093
350	03/22/2010	14:53:55	0.093
351	03/22/2010	14:54:55	0.094
352	03/22/2010	14:55:55	0.093
353	03/22/2010	14:56:55	0.091
354	03/22/2010	14:57:55	0.074
355	03/22/2010	14:58:55	0.072
356	03/22/2010	14:59:55	0.083

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
357	03/22/2010	15:00:55	0.089
358	03/22/2010	15:01:55	0.091
359	03/22/2010	15:02:55	0.094
360	03/22/2010	15:03:55	0.096
361	03/22/2010	15:04:55	0.096
362	03/22/2010	15:05:55	0.094
363	03/22/2010	15:06:55	0.093
364	03/22/2010	15:07:55	0.084
365	03/22/2010	15:08:55	0.077
366	03/22/2010	15:09:55	0.078
367	03/22/2010	15:10:55	0.080
368	03/22/2010	15:11:55	0.087
369	03/22/2010	15:12:55	0.101
370	03/22/2010	15:13:55	0.096
371	03/22/2010	15:14:55	0.095
372	03/22/2010	15:15:55	0.091
373	03/22/2010	15:16:55	0.107
374	03/22/2010	15:17:55	0.115
375	03/22/2010	15:18:55	0.122
376	03/22/2010	15:19:55	0.119
377	03/22/2010	15:20:55	0.111
378	03/22/2010	15:21:55	0.100
379	03/22/2010	15:22:55	0.098
380	03/22/2010	15:23:55	0.094
381	03/22/2010	15:24:55	0.094
382	03/22/2010	15:25:55	0.094
383	03/22/2010	15:26:55	0.094
384	03/22/2010	15:27:55	0.094
385	03/22/2010	15:28:55	0.094
386	03/22/2010	15:29:55	0.107
387	03/22/2010	15:30:55	0.110
388	03/22/2010	15:31:55	0.102
389	03/22/2010	15:32:55	0.100
390	03/22/2010	15:33:55	0.103
391	03/22/2010	15:34:55	0.102
392	03/22/2010	15:35:55	0.100
393	03/22/2010	15:36:55	0.102
394	03/22/2010	15:37:55	0.104
395	03/22/2010	15:38:55	0.100
396	03/22/2010	15:39:55	0.090
397	03/22/2010	15:40:55	0.089
398	03/22/2010	15:41:55	0.085
399	03/22/2010	15:42:55	0.086
400	03/22/2010	15:43:55	0.088
401	03/22/2010	15:44:55	0.088
402	03/22/2010	15:45:55	0.092

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
403	03/22/2010	15:46:55	0.098
404	03/22/2010	15:47:55	0.110
405	03/22/2010	15:48:55	0.113
406	03/22/2010	15:49:55	0.123
407	03/22/2010	15:50:55	0.128
408	03/22/2010	15:51:55	0.124
409	03/22/2010	15:52:55	0.111
410	03/22/2010	15:53:55	0.113
411	03/22/2010	15:54:55	0.110
412	03/22/2010	15:55:55	0.108
413	03/22/2010	15:56:55	0.103
414	03/22/2010	15:57:55	0.099
415	03/22/2010	15:58:55	0.097
416	03/22/2010	15:59:55	0.106
417	03/22/2010	16:00:55	0.105
418	03/22/2010	16:01:55	0.101
419	03/22/2010	16:02:55	0.093
420	03/22/2010	16:03:55	0.090
421	03/22/2010	16:04:55	0.090
422	03/22/2010	16:05:55	0.087
423	03/22/2010	16:06:55	0.085
424	03/22/2010	16:07:55	0.095
425	03/22/2010	16:08:55	0.103
426	03/22/2010	16:09:55	0.106
427	03/22/2010	16:10:55	0.108
428	03/22/2010	16:11:55	0.094
429	03/22/2010	16:12:55	0.090
430	03/22/2010	16:13:55	0.083
431	03/22/2010	16:14:55	0.085
432	03/22/2010	16:15:55	0.083
433	03/22/2010	16:16:55	0.080
434	03/22/2010	16:17:55	0.086
435	03/22/2010	16:18:55	0.085
436	03/22/2010	16:19:55	0.085
437	03/22/2010	16:20:55	0.084
438	03/22/2010	16:21:55	0.081
439	03/22/2010	16:22:55	0.080
440	03/22/2010	16:23:55	0.079
441	03/22/2010	16:24:55	0.080
442	03/22/2010	16:25:55	0.096
443	03/22/2010	16:26:55	0.113
444	03/22/2010	16:27:55	0.099
445	03/22/2010	16:28:55	0.083
446	03/22/2010	16:29:55	0.078
447	03/22/2010	16:30:55	0.071
448	03/22/2010	16:31:55	0.071

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
449	03/22/2010	16:32:55	0.068
450	03/22/2010	16:33:55	0.070
451	03/22/2010	16:34:55	0.079
452	03/22/2010	16:35:55	0.087
453	03/22/2010	16:36:55	0.090
454	03/22/2010	16:37:55	0.084
455	03/22/2010	16:38:55	0.084
456	03/22/2010	16:39:55	0.081
457	03/22/2010	16:40:55	0.084
458	03/22/2010	16:41:55	0.099
459	03/22/2010	16:42:55	0.106
460	03/22/2010	16:43:55	0.100
461	03/22/2010	16:44:55	0.095
462	03/22/2010	16:45:55	0.094
463	03/22/2010	16:46:55	0.097
464	03/22/2010	16:47:55	0.086
465	03/22/2010	16:48:55	0.081
466	03/22/2010	16:49:55	0.077
467	03/22/2010	16:50:55	0.075
468	03/22/2010	16:51:55	0.079
469	03/22/2010	16:52:55	0.085
470	03/22/2010	16:53:55	0.089
471	03/22/2010	16:54:55	0.090
472	03/22/2010	16:55:55	0.082
473	03/22/2010	16:56:55	0.077
474	03/22/2010	16:57:55	0.078
475	03/22/2010	16:58:55	0.081
476	03/22/2010	16:59:55	0.084
477	03/22/2010	17:00:55	0.083
478	03/22/2010	17:01:55	0.081
479	03/22/2010	17:02:55	0.081
480	03/22/2010	17:03:55	0.081
481	03/22/2010	17:04:55	0.074
482	03/22/2010	17:05:55	0.071
483	03/22/2010	17:06:55	0.068
484	03/22/2010	17:07:55	0.068
485	03/22/2010	17:08:55	0.066
486	03/22/2010	17:09:55	0.069
487	03/22/2010	17:10:55	0.072
488	03/22/2010	17:11:55	0.082
489	03/22/2010	17:12:55	0.082
490	03/22/2010	17:13:55	0.080
491	03/22/2010	17:14:55	0.081
492	03/22/2010	17:15:55	0.080
493	03/22/2010	17:16:55	0.079
494	03/22/2010	17:17:55	0.079

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
495	03/22/2010	17:18:55	0.078
496	03/22/2010	17:19:55	0.079
497	03/22/2010	17:20:55	0.082
498	03/22/2010	17:21:55	0.085
499	03/22/2010	17:22:55	0.091
500	03/22/2010	17:23:55	0.091
501	03/22/2010	17:24:55	0.088
502	03/22/2010	17:25:55	0.092
503	03/22/2010	17:26:55	0.096
504	03/22/2010	17:27:55	0.099
505	03/22/2010	17:28:55	0.101
506	03/22/2010	17:29:55	0.098
507	03/22/2010	17:30:55	0.089
508	03/22/2010	17:31:55	0.086
509	03/22/2010	17:32:55	0.083
510	03/22/2010	17:33:55	0.079
511	03/22/2010	17:34:55	0.079
512	03/22/2010	17:35:55	0.084
513	03/22/2010	17:36:55	0.082
514	03/22/2010	17:37:55	0.077
515	03/22/2010	17:38:55	0.077
516	03/22/2010	17:39:55	0.072
517	03/22/2010	17:40:55	0.070
518	03/22/2010	17:41:55	0.072
519	03/22/2010	17:42:55	0.071
520	03/22/2010	17:43:55	0.070
521	03/22/2010	17:44:55	0.067
522	03/22/2010	17:45:55	0.068
523	03/22/2010	17:46:55	0.068
524	03/22/2010	17:47:55	0.069
525	03/22/2010	17:48:55	0.072
526	03/22/2010	17:49:55	0.073
527	03/22/2010	17:50:55	0.082
528	03/22/2010	17:51:55	0.071
529	03/22/2010	17:52:55	0.075
530	03/22/2010	17:53:55	0.077
531	03/22/2010	17:54:55	0.074
532	03/22/2010	17:55:55	0.072
533	03/22/2010	17:56:55	0.078
534	03/22/2010	17:57:55	0.091
535	03/22/2010	17:58:55	0.095
536	03/22/2010	17:59:55	0.085
537	03/22/2010	18:00:55	0.076
538	03/22/2010	18:01:55	0.074
539	03/22/2010	18:02:55	0.073
540	03/22/2010	18:03:55	0.075

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
541	03/22/2010	18:04:55	0.079
542	03/22/2010	18:05:55	0.082
543	03/22/2010	18:06:55	0.086
544	03/22/2010	18:07:55	0.084
545	03/22/2010	18:08:55	0.084
546	03/22/2010	18:09:55	0.082
547	03/22/2010	18:10:55	0.083
548	03/22/2010	18:11:55	0.081
549	03/22/2010	18:12:55	0.081
550	03/22/2010	18:13:55	0.080
551	03/22/2010	18:14:55	0.080
552	03/22/2010	18:15:55	0.079
553	03/22/2010	18:16:55	0.075
554	03/22/2010	18:17:55	0.075
555	03/22/2010	18:18:55	0.071
556	03/22/2010	18:19:55	0.071
557	03/22/2010	18:20:55	0.075
558	03/22/2010	18:21:55	0.077
559	03/22/2010	18:22:55	0.076
560	03/22/2010	18:23:55	0.077
561	03/22/2010	18:24:55	0.078
562	03/22/2010	18:25:55	0.081
563	03/22/2010	18:26:55	0.082
564	03/22/2010	18:27:55	0.081
565	03/22/2010	18:28:55	0.082
566	03/22/2010	18:29:55	0.082
567	03/22/2010	18:30:55	0.080
568	03/22/2010	18:31:55	0.079
569	03/22/2010	18:32:55	0.079
570	03/22/2010	18:33:55	0.078
571	03/22/2010	18:34:55	0.081
572	03/22/2010	18:35:55	0.083
573	03/22/2010	18:36:55	0.083
574	03/22/2010	18:37:55	0.086
575	03/22/2010	18:38:55	0.086
576	03/22/2010	18:39:55	0.087
577	03/22/2010	18:40:55	0.089
578	03/22/2010	18:41:55	0.089
579	03/22/2010	18:42:55	0.091
580	03/22/2010	18:43:55	0.093
581	03/22/2010	18:44:55	0.094
582	03/22/2010	18:45:55	0.095
583	03/22/2010	18:46:55	0.097
584	03/22/2010	18:47:55	0.099
585	03/22/2010	18:48:55	0.101
586	03/22/2010	18:49:55	0.103

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
587	03/22/2010	18:50:55	0.103
588	03/22/2010	18:51:55	0.101
589	03/22/2010	18:52:55	0.102
590	03/22/2010	18:53:55	0.100
591	03/22/2010	18:54:55	0.099
592	03/22/2010	18:55:55	0.100
593	03/22/2010	18:56:55	0.101
594	03/22/2010	18:57:55	0.102
595	03/22/2010	18:58:55	0.100
596	03/22/2010	18:59:55	0.103
597	03/22/2010	19:00:55	0.107
598	03/22/2010	19:01:55	0.110
599	03/22/2010	19:02:55	0.110
600	03/22/2010	19:03:55	0.109
601	03/22/2010	19:04:55	0.111
602	03/22/2010	19:05:55	0.115
603	03/22/2010	19:06:55	0.116
604	03/22/2010	19:07:55	0.117
605	03/22/2010	19:08:55	0.121
606	03/22/2010	19:09:55	0.124
607	03/22/2010	19:10:55	0.125
608	03/22/2010	19:11:55	0.125
609	03/22/2010	19:12:55	0.125
610	03/22/2010	19:13:55	0.127
611	03/22/2010	19:14:55	0.126
612	03/22/2010	19:15:55	0.129
613	03/22/2010	19:16:55	0.132
614	03/22/2010	19:17:55	0.134
615	03/22/2010	19:18:55	0.137
616	03/22/2010	19:19:55	0.135
617	03/22/2010	19:20:55	0.136
618	03/22/2010	19:21:55	0.140
619	03/22/2010	19:22:55	0.136
620	03/22/2010	19:23:55	0.140
621	03/22/2010	19:24:55	0.142
622	03/22/2010	19:25:55	0.141
623	03/22/2010	19:26:55	0.144
624	03/22/2010	19:27:55	0.143
625	03/22/2010	19:28:55	0.143
626	03/22/2010	19:29:55	0.146
627	03/22/2010	19:30:55	0.143
628	03/22/2010	19:31:55	0.145
629	03/22/2010	19:32:55	0.143
630	03/22/2010	19:33:55	0.143
631	03/22/2010	19:34:55	0.143
632	03/22/2010	19:35:55	0.143

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
633	03/22/2010	19:36:55	0.147
634	03/22/2010	19:37:55	0.146
635	03/22/2010	19:38:55	0.148
636	03/22/2010	19:39:55	0.148
637	03/22/2010	19:40:55	0.146
638	03/22/2010	19:41:55	0.145
639	03/22/2010	19:42:55	0.143
640	03/22/2010	19:43:55	0.146
641	03/22/2010	19:44:55	0.147
642	03/22/2010	19:45:55	0.148
643	03/22/2010	19:46:55	0.146
644	03/22/2010	19:47:55	0.144
645	03/22/2010	19:48:55	0.146
646	03/22/2010	19:49:55	0.146
647	03/22/2010	19:50:55	0.159
648	03/22/2010	19:51:55	0.151
649	03/22/2010	19:52:55	0.152
650	03/22/2010	19:53:55	0.146
651	03/22/2010	19:54:55	0.147
652	03/22/2010	19:55:55	0.143
653	03/22/2010	19:56:55	0.143
654	03/22/2010	19:57:55	0.143
655	03/22/2010	19:58:55	0.149
656	03/22/2010	19:59:55	0.149
657	03/22/2010	20:00:55	0.151
658	03/22/2010	20:01:55	0.150
659	03/22/2010	20:02:55	0.152
660	03/22/2010	20:03:55	0.154
661	03/22/2010	20:04:55	0.152
662	03/22/2010	20:05:55	0.154
663	03/22/2010	20:06:55	0.153
664	03/22/2010	20:07:55	0.152
665	03/22/2010	20:08:55	0.152
666	03/22/2010	20:09:55	0.149
667	03/22/2010	20:10:55	0.150
668	03/22/2010	20:11:55	0.146
669	03/22/2010	20:12:55	0.151
670	03/22/2010	20:13:55	0.151
671	03/22/2010	20:14:55	0.151
672	03/22/2010	20:15:55	0.149
673	03/22/2010	20:16:55	0.144
674	03/22/2010	20:17:55	0.145
675	03/22/2010	20:18:55	0.146
676	03/22/2010	20:19:55	0.144
677	03/22/2010	20:20:55	0.145
678	03/22/2010	20:21:55	0.146

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
679	03/22/2010	20:22:55	0.143
680	03/22/2010	20:23:55	0.144
681	03/22/2010	20:24:55	0.143
682	03/22/2010	20:25:55	0.140
683	03/22/2010	20:26:55	0.138
684	03/22/2010	20:27:55	0.134
685	03/22/2010	20:28:55	0.135
686	03/22/2010	20:29:55	0.137
687	03/22/2010	20:30:55	0.132
688	03/22/2010	20:31:55	0.136
689	03/22/2010	20:32:55	0.138
690	03/22/2010	20:33:55	0.139
691	03/22/2010	20:34:55	0.141
692	03/22/2010	20:35:55	0.143
693	03/22/2010	20:36:55	0.147
694	03/22/2010	20:37:55	0.149
695	03/22/2010	20:38:55	0.146
696	03/22/2010	20:39:55	0.152
697	03/22/2010	20:40:55	0.149
698	03/22/2010	20:41:55	0.148
699	03/22/2010	20:42:55	0.151
700	03/22/2010	20:43:55	0.149
701	03/22/2010	20:44:55	0.150
702	03/22/2010	20:45:55	0.152
703	03/22/2010	20:46:55	0.155
704	03/22/2010	20:47:55	0.155
705	03/22/2010	20:48:55	0.157
706	03/22/2010	20:49:55	0.161
707	03/22/2010	20:50:55	0.160
708	03/22/2010	20:51:55	0.160
709	03/22/2010	20:52:55	0.165
710	03/22/2010	20:53:55	0.163
711	03/22/2010	20:54:55	0.165
712	03/22/2010	20:55:55	0.168
713	03/22/2010	20:56:55	0.168
714	03/22/2010	20:57:55	0.169
715	03/22/2010	20:58:55	0.168
716	03/22/2010	20:59:55	0.171
717	03/22/2010	21:00:55	0.170
718	03/22/2010	21:01:55	0.166
719	03/22/2010	21:02:55	0.168
720	03/22/2010	21:03:55	0.162
721	03/22/2010	21:04:55	0.166
722	03/22/2010	21:05:55	0.166
723	03/22/2010	21:06:55	0.166
724	03/22/2010	21:07:55	0.163

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
725	03/22/2010	21:08:55	0.163
726	03/22/2010	21:09:55	0.163
727	03/22/2010	21:10:55	0.162
728	03/22/2010	21:11:55	0.163
729	03/22/2010	21:12:55	0.161
730	03/22/2010	21:13:55	0.160
731	03/22/2010	21:14:55	0.159
732	03/22/2010	21:15:55	0.159
733	03/22/2010	21:16:55	0.160
734	03/22/2010	21:17:55	0.162
735	03/22/2010	21:18:55	0.162
736	03/22/2010	21:19:55	0.164
737	03/22/2010	21:20:55	0.170
738	03/22/2010	21:21:55	0.165
739	03/22/2010	21:22:55	0.167
740	03/22/2010	21:23:55	0.167
741	03/22/2010	21:24:55	0.172
742	03/22/2010	21:25:55	0.171
743	03/22/2010	21:26:55	0.170
744	03/22/2010	21:27:55	0.168
745	03/22/2010	21:28:55	0.177
746	03/22/2010	21:29:55	0.180
747	03/22/2010	21:30:55	0.188
748	03/22/2010	21:31:55	0.190
749	03/22/2010	21:32:55	0.189
750	03/22/2010	21:33:55	0.185
751	03/22/2010	21:34:55	0.182
752	03/22/2010	21:35:55	0.179
753	03/22/2010	21:36:55	0.180
754	03/22/2010	21:37:55	0.177
755	03/22/2010	21:38:55	0.177
756	03/22/2010	21:39:55	0.179
757	03/22/2010	21:40:55	0.180
758	03/22/2010	21:41:55	0.184
759	03/22/2010	21:42:55	0.191
760	03/22/2010	21:43:55	0.211
761	03/22/2010	21:44:55	0.233
762	03/22/2010	21:45:55	0.292
763	03/22/2010	21:46:55	0.270
764	03/22/2010	21:47:55	0.351
765	03/22/2010	21:48:55	0.267
766	03/22/2010	21:49:55	0.204
767	03/22/2010	21:50:55	0.190
768	03/22/2010	21:51:55	0.186
769	03/22/2010	21:52:55	0.180
770	03/22/2010	21:53:55	0.179

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
771	03/22/2010	21:54:55	0.177
772	03/22/2010	21:55:55	0.177
773	03/22/2010	21:56:55	0.177
774	03/22/2010	21:57:55	0.178
775	03/22/2010	21:58:55	0.180
776	03/22/2010	21:59:55	0.180
777	03/22/2010	22:00:55	0.182
778	03/22/2010	22:01:55	0.180
779	03/22/2010	22:02:55	0.181
780	03/22/2010	22:03:55	0.186
781	03/22/2010	22:04:55	0.188
782	03/22/2010	22:05:55	0.192
783	03/22/2010	22:06:55	0.196
784	03/22/2010	22:07:55	0.198
785	03/22/2010	22:08:55	0.208
786	03/22/2010	22:09:55	0.226
787	03/22/2010	22:10:55	0.220
788	03/22/2010	22:11:55	0.228
789	03/22/2010	22:12:55	0.248
790	03/22/2010	22:13:55	0.261
791	03/22/2010	22:14:55	0.298
792	03/22/2010	22:15:55	0.310
793	03/22/2010	22:16:55	0.312
794	03/22/2010	22:17:55	0.327
795	03/22/2010	22:18:55	0.319
796	03/22/2010	22:19:55	0.328
797	03/22/2010	22:20:55	0.332
798	03/22/2010	22:21:55	0.333
799	03/22/2010	22:22:55	0.342
800	03/22/2010	22:23:55	0.349
801	03/22/2010	22:24:55	0.371
802	03/22/2010	22:25:55	0.376
803	03/22/2010	22:26:55	0.386
804	03/22/2010	22:27:55	0.399
805	03/22/2010	22:28:55	0.420
806	03/22/2010	22:29:55	0.433
807	03/22/2010	22:30:55	0.451
808	03/22/2010	22:31:55	0.470
809	03/22/2010	22:32:55	0.476
810	03/22/2010	22:33:55	0.514
811	03/22/2010	22:34:55	0.535
812	03/22/2010	22:35:55	0.548
813	03/22/2010	22:36:55	0.551
814	03/22/2010	22:37:55	0.560
815	03/22/2010	22:38:55	0.565
816	03/22/2010	22:39:55	0.569

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
817	03/22/2010	22:40:55	0.569
818	03/22/2010	22:41:55	0.578
819	03/22/2010	22:42:55	0.574
820	03/22/2010	22:43:55	0.573
821	03/22/2010	22:44:55	0.580
822	03/22/2010	22:45:55	0.587
823	03/22/2010	22:46:55	0.583
824	03/22/2010	22:47:55	0.583
825	03/22/2010	22:48:55	0.589
826	03/22/2010	22:49:55	0.608
827	03/22/2010	22:50:55	0.607
828	03/22/2010	22:51:55	0.624
829	03/22/2010	22:52:55	0.610
830	03/22/2010	22:53:55	0.614
831	03/22/2010	22:54:55	0.608
832	03/22/2010	22:55:55	0.603
833	03/22/2010	22:56:55	0.602
834	03/22/2010	22:57:55	0.596
835	03/22/2010	22:58:55	0.606
836	03/22/2010	22:59:55	0.604
837	03/22/2010	23:00:55	0.593
838	03/22/2010	23:01:55	0.595
839	03/22/2010	23:02:55	0.584
840	03/22/2010	23:03:55	0.575
841	03/22/2010	23:04:55	0.566
842	03/22/2010	23:05:55	0.550
843	03/22/2010	23:06:55	0.530
844	03/22/2010	23:07:55	0.531
845	03/22/2010	23:08:55	0.529
846	03/22/2010	23:09:55	0.526
847	03/22/2010	23:10:55	0.526
848	03/22/2010	23:11:55	0.529
849	03/22/2010	23:12:55	0.530
850	03/22/2010	23:13:55	0.516
851	03/22/2010	23:14:55	0.513
852	03/22/2010	23:15:55	0.514
853	03/22/2010	23:16:55	0.508
854	03/22/2010	23:17:55	0.509
855	03/22/2010	23:18:55	0.509
856	03/22/2010	23:19:55	0.503
857	03/22/2010	23:20:55	0.497
858	03/22/2010	23:21:55	0.501
859	03/22/2010	23:22:55	0.500
860	03/22/2010	23:23:55	0.505
861	03/22/2010	23:24:55	0.496
862	03/22/2010	23:25:55	0.495

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
863	03/22/2010	23:26:55	0.504
864	03/22/2010	23:27:55	0.498
865	03/22/2010	23:28:55	0.500
866	03/22/2010	23:29:55	0.507
867	03/22/2010	23:30:55	0.510
868	03/22/2010	23:31:55	0.501
869	03/22/2010	23:32:55	0.510
870	03/22/2010	23:33:55	0.503
871	03/22/2010	23:34:55	0.504
872	03/22/2010	23:35:55	0.505
873	03/22/2010	23:36:55	0.507
874	03/22/2010	23:37:55	0.500
875	03/22/2010	23:38:55	0.499
876	03/22/2010	23:39:55	0.516
877	03/22/2010	23:40:55	0.496
878	03/22/2010	23:41:55	0.494
879	03/22/2010	23:42:55	0.500
880	03/22/2010	23:43:55	0.497
881	03/22/2010	23:44:55	0.493
882	03/22/2010	23:45:55	0.493
883	03/22/2010	23:46:55	0.485
884	03/22/2010	23:47:55	0.491
885	03/22/2010	23:48:55	0.489
886	03/22/2010	23:49:55	0.493
887	03/22/2010	23:50:55	0.493
888	03/22/2010	23:51:55	0.488
889	03/22/2010	23:52:55	0.496
890	03/22/2010	23:53:55	0.495
891	03/22/2010	23:54:55	0.503
892	03/22/2010	23:55:55	0.499
893	03/22/2010	23:56:55	0.508
894	03/22/2010	23:57:55	0.509
895	03/22/2010	23:58:55	0.509
896	03/22/2010	23:59:55	0.505
897	03/23/2010	00:00:55	0.506
898	03/23/2010	00:01:55	0.504
899	03/23/2010	00:02:55	0.499
900	03/23/2010	00:03:55	0.498
901	03/23/2010	00:04:55	0.496
902	03/23/2010	00:05:55	0.497
903	03/23/2010	00:06:55	0.493
904	03/23/2010	00:07:55	0.497
905	03/23/2010	00:08:55	0.491
906	03/23/2010	00:09:55	0.488
907	03/23/2010	00:10:55	0.489
908	03/23/2010	00:11:55	0.489

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
909	03/23/2010	00:12:55	0.489
910	03/23/2010	00:13:55	0.481
911	03/23/2010	00:14:55	0.478
912	03/23/2010	00:15:55	0.482
913	03/23/2010	00:16:55	0.469
914	03/23/2010	00:17:55	0.471
915	03/23/2010	00:18:55	0.473
916	03/23/2010	00:19:55	0.476
917	03/23/2010	00:20:55	0.472
918	03/23/2010	00:21:55	0.469
919	03/23/2010	00:22:55	0.466
920	03/23/2010	00:23:55	0.457
921	03/23/2010	00:24:55	0.461
922	03/23/2010	00:25:55	0.452
923	03/23/2010	00:26:55	0.454
924	03/23/2010	00:27:55	0.453
925	03/23/2010	00:28:55	0.453
926	03/23/2010	00:29:55	0.444
927	03/23/2010	00:30:55	0.442
928	03/23/2010	00:31:55	0.443
929	03/23/2010	00:32:55	0.440
930	03/23/2010	00:33:55	0.435
931	03/23/2010	00:34:55	0.430
932	03/23/2010	00:35:55	0.429
933	03/23/2010	00:36:55	0.423
934	03/23/2010	00:37:55	0.419
935	03/23/2010	00:38:55	0.425
936	03/23/2010	00:39:55	0.421
937	03/23/2010	00:40:55	0.413
938	03/23/2010	00:41:55	0.414
939	03/23/2010	00:42:55	0.413
940	03/23/2010	00:43:55	0.406
941	03/23/2010	00:44:55	0.407
942	03/23/2010	00:45:55	0.404
943	03/23/2010	00:46:55	0.402
944	03/23/2010	00:47:55	0.398
945	03/23/2010	00:48:55	0.393
946	03/23/2010	00:49:55	0.387
947	03/23/2010	00:50:55	0.380
948	03/23/2010	00:51:55	0.377
949	03/23/2010	00:52:55	0.377
950	03/23/2010	00:53:55	0.375
951	03/23/2010	00:54:55	0.373
952	03/23/2010	00:55:55	0.373
953	03/23/2010	00:56:55	0.375
954	03/23/2010	00:57:55	0.368

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
955	03/23/2010	00:58:55	0.365
956	03/23/2010	00:59:55	0.355
957	03/23/2010	01:00:55	0.353
958	03/23/2010	01:01:55	0.346
959	03/23/2010	01:02:55	0.343
960	03/23/2010	01:03:55	0.337
961	03/23/2010	01:04:55	0.336
962	03/23/2010	01:05:55	0.334
963	03/23/2010	01:06:55	0.332
964	03/23/2010	01:07:55	0.327
965	03/23/2010	01:08:55	0.328
966	03/23/2010	01:09:55	0.331
967	03/23/2010	01:10:55	0.328
968	03/23/2010	01:11:55	0.325
969	03/23/2010	01:12:55	0.323
970	03/23/2010	01:13:55	0.322
971	03/23/2010	01:14:55	0.319
972	03/23/2010	01:15:55	0.319
973	03/23/2010	01:16:55	0.330
974	03/23/2010	01:17:55	0.341
975	03/23/2010	01:18:55	0.342
976	03/23/2010	01:19:55	0.343
977	03/23/2010	01:20:55	0.344
978	03/23/2010	01:21:55	0.348
979	03/23/2010	01:22:55	0.340
980	03/23/2010	01:23:55	0.338
981	03/23/2010	01:24:55	0.334
982	03/23/2010	01:25:55	0.331
983	03/23/2010	01:26:55	0.329
984	03/23/2010	01:27:55	0.331
985	03/23/2010	01:28:55	0.330
986	03/23/2010	01:29:55	0.334
987	03/23/2010	01:30:55	0.332
988	03/23/2010	01:31:55	0.335
989	03/23/2010	01:32:55	0.331
990	03/23/2010	01:33:55	0.329
991	03/23/2010	01:34:55	0.334
992	03/23/2010	01:35:55	0.330
993	03/23/2010	01:36:55	0.329
994	03/23/2010	01:37:55	0.337
995	03/23/2010	01:38:55	0.342
996	03/23/2010	01:39:55	0.346
997	03/23/2010	01:40:55	0.343
998	03/23/2010	01:41:55	0.343
999	03/23/2010	01:42:55	0.352
1000	03/23/2010	01:43:55	0.351

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1001	03/23/2010	01:44:55	0.353
1002	03/23/2010	01:45:55	0.357
1003	03/23/2010	01:46:55	0.357
1004	03/23/2010	01:47:55	0.361
1005	03/23/2010	01:48:55	0.373
1006	03/23/2010	01:49:55	0.388
1007	03/23/2010	01:50:55	0.396
1008	03/23/2010	01:51:55	0.394
1009	03/23/2010	01:52:55	0.396
1010	03/23/2010	01:53:55	0.405
1011	03/23/2010	01:54:55	0.401
1012	03/23/2010	01:55:55	0.404
1013	03/23/2010	01:56:55	0.411
1014	03/23/2010	01:57:55	0.408
1015	03/23/2010	01:58:55	0.408
1016	03/23/2010	01:59:55	0.407
1017	03/23/2010	02:00:55	0.403
1018	03/23/2010	02:01:55	0.401
1019	03/23/2010	02:02:55	0.404
1020	03/23/2010	02:03:55	0.400
1021	03/23/2010	02:04:55	0.397
1022	03/23/2010	02:05:55	0.397
1023	03/23/2010	02:06:55	0.399
1024	03/23/2010	02:07:55	0.392
1025	03/23/2010	02:08:55	0.382
1026	03/23/2010	02:09:55	0.377
1027	03/23/2010	02:10:55	0.374
1028	03/23/2010	02:11:55	0.376
1029	03/23/2010	02:12:55	0.377
1030	03/23/2010	02:13:55	0.372
1031	03/23/2010	02:14:55	0.373
1032	03/23/2010	02:15:55	0.376
1033	03/23/2010	02:16:55	0.377
1034	03/23/2010	02:17:55	0.377
1035	03/23/2010	02:18:55	0.376
1036	03/23/2010	02:19:55	0.377
1037	03/23/2010	02:20:55	0.383
1038	03/23/2010	02:21:55	0.377
1039	03/23/2010	02:22:55	0.374
1040	03/23/2010	02:23:55	0.372
1041	03/23/2010	02:24:55	0.373
1042	03/23/2010	02:25:55	0.372
1043	03/23/2010	02:26:55	0.376
1044	03/23/2010	02:27:55	0.363
1045	03/23/2010	02:28:55	0.356
1046	03/23/2010	02:29:55	0.352

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1047	03/23/2010	02:30:55	0.348
1048	03/23/2010	02:31:55	0.347
1049	03/23/2010	02:32:55	0.345
1050	03/23/2010	02:33:55	0.341
1051	03/23/2010	02:34:55	0.338
1052	03/23/2010	02:35:55	0.336
1053	03/23/2010	02:36:55	0.335
1054	03/23/2010	02:37:55	0.331
1055	03/23/2010	02:38:55	0.330
1056	03/23/2010	02:39:55	0.329
1057	03/23/2010	02:40:55	0.324
1058	03/23/2010	02:41:55	0.318
1059	03/23/2010	02:42:55	0.312
1060	03/23/2010	02:43:55	0.306
1061	03/23/2010	02:44:55	0.298
1062	03/23/2010	02:45:55	0.289
1063	03/23/2010	02:46:55	0.287
1064	03/23/2010	02:47:55	0.284
1065	03/23/2010	02:48:55	0.279
1066	03/23/2010	02:49:55	0.275
1067	03/23/2010	02:50:55	0.263
1068	03/23/2010	02:51:55	0.259
1069	03/23/2010	02:52:55	0.255
1070	03/23/2010	02:53:55	0.256
1071	03/23/2010	02:54:55	0.256
1072	03/23/2010	02:55:55	0.259
1073	03/23/2010	02:56:55	0.254
1074	03/23/2010	02:57:55	0.249
1075	03/23/2010	02:58:55	0.249
1076	03/23/2010	02:59:55	0.248
1077	03/23/2010	03:00:55	0.238
1078	03/23/2010	03:01:55	0.237
1079	03/23/2010	03:02:55	0.232
1080	03/23/2010	03:03:55	0.234
1081	03/23/2010	03:04:55	0.232
1082	03/23/2010	03:05:55	0.233
1083	03/23/2010	03:06:55	0.229
1084	03/23/2010	03:07:55	0.229
1085	03/23/2010	03:08:55	0.228
1086	03/23/2010	03:09:55	0.227
1087	03/23/2010	03:10:55	0.225
1088	03/23/2010	03:11:55	0.224
1089	03/23/2010	03:12:55	0.220
1090	03/23/2010	03:13:55	0.213
1091	03/23/2010	03:14:55	0.205
1092	03/23/2010	03:15:55	0.200

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1093	03/23/2010	03:16:55	0.193
1094	03/23/2010	03:17:55	0.186
1095	03/23/2010	03:18:55	0.183
1096	03/23/2010	03:19:55	0.179
1097	03/23/2010	03:20:55	0.177
1098	03/23/2010	03:21:55	0.172
1099	03/23/2010	03:22:55	0.172
1100	03/23/2010	03:23:55	0.167
1101	03/23/2010	03:24:55	0.165
1102	03/23/2010	03:25:55	0.164
1103	03/23/2010	03:26:55	0.160
1104	03/23/2010	03:27:55	0.161
1105	03/23/2010	03:28:55	0.157
1106	03/23/2010	03:29:55	0.155
1107	03/23/2010	03:30:55	0.153
1108	03/23/2010	03:31:55	0.152
1109	03/23/2010	03:32:55	0.152
1110	03/23/2010	03:33:55	0.153
1111	03/23/2010	03:34:55	0.153
1112	03/23/2010	03:35:55	0.154
1113	03/23/2010	03:36:55	0.155
1114	03/23/2010	03:37:55	0.157
1115	03/23/2010	03:38:55	0.157
1116	03/23/2010	03:39:55	0.160
1117	03/23/2010	03:40:55	0.161
1118	03/23/2010	03:41:55	0.158
1119	03/23/2010	03:42:55	0.160
1120	03/23/2010	03:43:55	0.156
1121	03/23/2010	03:44:55	0.156
1122	03/23/2010	03:45:55	0.158
1123	03/23/2010	03:46:55	0.155
1124	03/23/2010	03:47:55	0.153
1125	03/23/2010	03:48:55	0.155
1126	03/23/2010	03:49:55	0.157
1127	03/23/2010	03:50:55	0.160
1128	03/23/2010	03:51:55	0.161
1129	03/23/2010	03:52:55	0.160
1130	03/23/2010	03:53:55	0.161
1131	03/23/2010	03:54:55	0.162
1132	03/23/2010	03:55:55	0.161
1133	03/23/2010	03:56:55	0.162
1134	03/23/2010	03:57:55	0.162
1135	03/23/2010	03:58:55	0.160
1136	03/23/2010	03:59:55	0.159
1137	03/23/2010	04:00:55	0.159
1138	03/23/2010	04:01:55	0.161

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1139	03/23/2010	04:02:55	0.159
1140	03/23/2010	04:03:55	0.160
1141	03/23/2010	04:04:55	0.157
1142	03/23/2010	04:05:55	0.158
1143	03/23/2010	04:06:55	0.155
1144	03/23/2010	04:07:55	0.151
1145	03/23/2010	04:08:55	0.148
1146	03/23/2010	04:09:55	0.147
1147	03/23/2010	04:10:55	0.147
1148	03/23/2010	04:11:55	0.146
1149	03/23/2010	04:12:55	0.144
1150	03/23/2010	04:13:55	0.144
1151	03/23/2010	04:14:55	0.143
1152	03/23/2010	04:15:55	0.141
1153	03/23/2010	04:16:55	0.141
1154	03/23/2010	04:17:55	0.139
1155	03/23/2010	04:18:55	0.142
1156	03/23/2010	04:19:55	0.140
1157	03/23/2010	04:20:55	0.141
1158	03/23/2010	04:21:55	0.140
1159	03/23/2010	04:22:55	0.137
1160	03/23/2010	04:23:55	0.138
1161	03/23/2010	04:24:55	0.139
1162	03/23/2010	04:25:55	0.139
1163	03/23/2010	04:26:55	0.138
1164	03/23/2010	04:27:55	0.137
1165	03/23/2010	04:28:55	0.138
1166	03/23/2010	04:29:55	0.138
1167	03/23/2010	04:30:55	0.137
1168	03/23/2010	04:31:55	0.138
1169	03/23/2010	04:32:55	0.137
1170	03/23/2010	04:33:55	0.137
1171	03/23/2010	04:34:55	0.135
1172	03/23/2010	04:35:55	0.136
1173	03/23/2010	04:36:55	0.134
1174	03/23/2010	04:37:55	0.134
1175	03/23/2010	04:38:55	0.137
1176	03/23/2010	04:39:55	0.135
1177	03/23/2010	04:40:55	0.134
1178	03/23/2010	04:41:55	0.136
1179	03/23/2010	04:42:55	0.139
1180	03/23/2010	04:43:55	0.139
1181	03/23/2010	04:44:55	0.144
1182	03/23/2010	04:45:55	0.142
1183	03/23/2010	04:46:55	0.144
1184	03/23/2010	04:47:55	0.142

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1185	03/23/2010	04:48:55	0.142
1186	03/23/2010	04:49:55	0.142
1187	03/23/2010	04:50:55	0.143
1188	03/23/2010	04:51:55	0.142
1189	03/23/2010	04:52:55	0.143
1190	03/23/2010	04:53:55	0.142
1191	03/23/2010	04:54:55	0.140
1192	03/23/2010	04:55:55	0.141
1193	03/23/2010	04:56:55	0.143
1194	03/23/2010	04:57:55	0.141
1195	03/23/2010	04:58:55	0.140
1196	03/23/2010	04:59:55	0.140
1197	03/23/2010	05:00:55	0.141
1198	03/23/2010	05:01:55	0.144
1199	03/23/2010	05:02:55	0.144
1200	03/23/2010	05:03:55	0.142
1201	03/23/2010	05:04:55	0.142
1202	03/23/2010	05:05:55	0.139
1203	03/23/2010	05:06:55	0.141
1204	03/23/2010	05:07:55	0.139
1205	03/23/2010	05:08:55	0.140
1206	03/23/2010	05:09:55	0.139
1207	03/23/2010	05:10:55	0.137
1208	03/23/2010	05:11:55	0.143
1209	03/23/2010	05:12:55	0.144
1210	03/23/2010	05:13:55	0.142
1211	03/23/2010	05:14:55	0.142
1212	03/23/2010	05:15:55	0.140
1213	03/23/2010	05:16:55	0.142
1214	03/23/2010	05:17:55	0.140
1215	03/23/2010	05:18:55	0.141
1216	03/23/2010	05:19:55	0.146
1217	03/23/2010	05:20:55	0.148
1218	03/23/2010	05:21:55	0.145
1219	03/23/2010	05:22:55	0.145
1220	03/23/2010	05:23:55	0.146
1221	03/23/2010	05:24:55	0.147
1222	03/23/2010	05:25:55	0.148
1223	03/23/2010	05:26:55	0.147
1224	03/23/2010	05:27:55	0.148
1225	03/23/2010	05:28:55	0.153
1226	03/23/2010	05:29:55	0.151
1227	03/23/2010	05:30:55	0.149
1228	03/23/2010	05:31:55	0.151
1229	03/23/2010	05:32:55	0.155
1230	03/23/2010	05:33:55	0.153

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1231	03/23/2010	05:34:55	0.154
1232	03/23/2010	05:35:55	0.153
1233	03/23/2010	05:36:55	0.153
1234	03/23/2010	05:37:55	0.152
1235	03/23/2010	05:38:55	0.151
1236	03/23/2010	05:39:55	0.153
1237	03/23/2010	05:40:55	0.157
1238	03/23/2010	05:41:55	0.152
1239	03/23/2010	05:42:55	0.152
1240	03/23/2010	05:43:55	0.144
1241	03/23/2010	05:44:55	0.140
1242	03/23/2010	05:45:55	0.142
1243	03/23/2010	05:46:55	0.151
1244	03/23/2010	05:47:55	0.151
1245	03/23/2010	05:48:55	0.150
1246	03/23/2010	05:49:55	0.148
1247	03/23/2010	05:50:55	0.147
1248	03/23/2010	05:51:55	0.147
1249	03/23/2010	05:52:55	0.146
1250	03/23/2010	05:53:55	0.152
1251	03/23/2010	05:54:55	0.154
1252	03/23/2010	05:55:55	0.162
1253	03/23/2010	05:56:55	0.162
1254	03/23/2010	05:57:55	0.163
1255	03/23/2010	05:58:55	0.167
1256	03/23/2010	05:59:55	0.168
1257	03/23/2010	06:00:55	0.163
1258	03/23/2010	06:01:55	0.166
1259	03/23/2010	06:02:55	0.163
1260	03/23/2010	06:03:55	0.161
1261	03/23/2010	06:04:55	0.163
1262	03/23/2010	06:05:55	0.166
1263	03/23/2010	06:06:55	0.166
1264	03/23/2010	06:07:55	0.168
1265	03/23/2010	06:08:55	0.167
1266	03/23/2010	06:09:55	0.169
1267	03/23/2010	06:10:55	0.171
1268	03/23/2010	06:11:55	0.170
1269	03/23/2010	06:12:55	0.175
1270	03/23/2010	06:13:55	0.172
1271	03/23/2010	06:14:55	0.173
1272	03/23/2010	06:15:55	0.176
1273	03/23/2010	06:16:55	0.176
1274	03/23/2010	06:17:55	0.183
1275	03/23/2010	06:18:55	0.184
1276	03/23/2010	06:19:55	0.187

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1277	03/23/2010	06:20:55	0.187
1278	03/23/2010	06:21:55	0.189
1279	03/23/2010	06:22:55	0.191
1280	03/23/2010	06:23:55	0.192
1281	03/23/2010	06:24:55	0.194
1282	03/23/2010	06:25:55	0.198
1283	03/23/2010	06:26:55	0.203
1284	03/23/2010	06:27:55	0.205
1285	03/23/2010	06:28:55	0.206
1286	03/23/2010	06:29:55	0.206
1287	03/23/2010	06:30:55	0.210
1288	03/23/2010	06:31:55	0.208
1289	03/23/2010	06:32:55	0.208
1290	03/23/2010	06:33:55	0.218
1291	03/23/2010	06:34:55	0.216
1292	03/23/2010	06:35:55	0.219
1293	03/23/2010	06:36:55	0.225
1294	03/23/2010	06:37:55	0.228
1295	03/23/2010	06:38:55	0.229
1296	03/23/2010	06:39:55	0.227
1297	03/23/2010	06:40:55	0.232
1298	03/23/2010	06:41:55	0.229
1299	03/23/2010	06:42:55	0.228
1300	03/23/2010	06:43:55	0.236
1301	03/23/2010	06:44:55	0.231
1302	03/23/2010	06:45:55	0.235
1303	03/23/2010	06:46:55	0.228
1304	03/23/2010	06:47:55	0.237
1305	03/23/2010	06:48:55	0.235
1306	03/23/2010	06:49:55	0.232
1307	03/23/2010	06:50:55	0.227
1308	03/23/2010	06:51:55	0.217
1309	03/23/2010	06:52:55	0.214
1310	03/23/2010	06:53:55	0.220
1311	03/23/2010	06:54:55	0.219
1312	03/23/2010	06:55:55	0.212
1313	03/23/2010	06:56:55	0.205
1314	03/23/2010	06:57:55	0.206
1315	03/23/2010	06:58:55	0.204
1316	03/23/2010	06:59:55	0.199
1317	03/23/2010	07:00:55	0.195
1318	03/23/2010	07:01:55	0.193
1319	03/23/2010	07:02:55	0.188
1320	03/23/2010	07:03:55	0.187
1321	03/23/2010	07:04:55	0.171
1322	03/23/2010	07:05:55	0.161

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1323	03/23/2010	07:06:55	0.153
1324	03/23/2010	07:07:55	0.144
1325	03/23/2010	07:08:55	0.139
1326	03/23/2010	07:09:55	0.146
1327	03/23/2010	07:10:55	0.144
1328	03/23/2010	07:11:55	0.131
1329	03/23/2010	07:12:55	0.138
1330	03/23/2010	07:13:55	0.135
1331	03/23/2010	07:14:55	0.137
1332	03/23/2010	07:15:55	0.136
1333	03/23/2010	07:16:55	0.135
1334	03/23/2010	07:17:55	0.136
1335	03/23/2010	07:18:55	0.136
1336	03/23/2010	07:19:55	0.143
1337	03/23/2010	07:20:55	0.142
1338	03/23/2010	07:21:55	0.141
1339	03/23/2010	07:22:55	0.145
1340	03/23/2010	07:23:55	0.144
1341	03/23/2010	07:24:55	0.141
1342	03/23/2010	07:25:55	0.141
1343	03/23/2010	07:26:55	0.147
1344	03/23/2010	07:27:55	0.144
1345	03/23/2010	07:28:55	0.139
1346	03/23/2010	07:29:55	0.137
1347	03/23/2010	07:30:55	0.139
1348	03/23/2010	07:31:55	0.148
1349	03/23/2010	07:32:55	0.131
1350	03/23/2010	07:33:55	0.129
1351	03/23/2010	07:34:55	0.128
1352	03/23/2010	07:35:55	0.133
1353	03/23/2010	07:36:55	0.126
1354	03/23/2010	07:37:55	0.120
1355	03/23/2010	07:38:55	0.129
1356	03/23/2010	07:39:55	0.131
1357	03/23/2010	07:40:55	0.123
1358	03/23/2010	07:41:55	0.119
1359	03/23/2010	07:42:55	0.112
1360	03/23/2010	07:43:55	0.117
1361	03/23/2010	07:44:55	0.114
1362	03/23/2010	07:45:55	0.105
1363	03/23/2010	07:46:55	0.098
1364	03/23/2010	07:47:55	0.100
1365	03/23/2010	07:48:55	0.103
1366	03/23/2010	07:49:55	0.107
1367	03/23/2010	07:50:55	0.107
1368	03/23/2010	07:51:55	0.106

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1369	03/23/2010	07:52:55	0.103
1370	03/23/2010	07:53:55	0.094
1371	03/23/2010	07:54:55	0.093
1372	03/23/2010	07:55:55	0.088
1373	03/23/2010	07:56:55	0.087
1374	03/23/2010	07:57:55	0.083
1375	03/23/2010	07:58:55	0.081
1376	03/23/2010	07:59:55	0.077
1377	03/23/2010	08:00:55	0.081
1378	03/23/2010	08:01:55	0.081
1379	03/23/2010	08:02:55	0.081
1380	03/23/2010	08:03:55	0.076
1381	03/23/2010	08:04:55	0.073
1382	03/23/2010	08:05:55	0.071
1383	03/23/2010	08:06:55	0.067
1384	03/23/2010	08:07:55	0.067
1385	03/23/2010	08:08:55	0.067
1386	03/23/2010	08:09:55	0.069
1387	03/23/2010	08:10:55	0.071
1388	03/23/2010	08:11:55	0.075
1389	03/23/2010	08:12:55	0.078
1390	03/23/2010	08:13:55	0.076
1391	03/23/2010	08:14:55	0.076
1392	03/23/2010	08:15:55	0.078
1393	03/23/2010	08:16:55	0.079
1394	03/23/2010	08:17:55	0.076
1395	03/23/2010	08:18:55	0.079
1396	03/23/2010	08:19:55	0.080
1397	03/23/2010	08:20:55	0.083
1398	03/23/2010	08:21:55	0.081
1399	03/23/2010	08:22:55	0.071
1400	03/23/2010	08:23:55	0.068
1401	03/23/2010	08:24:55	0.068
1402	03/23/2010	08:25:55	0.069
1403	03/23/2010	08:26:55	0.068
1404	03/23/2010	08:27:55	0.066
1405	03/23/2010	08:28:55	0.071
1406	03/23/2010	08:29:55	0.070
1407	03/23/2010	08:30:55	0.073
1408	03/23/2010	08:31:55	0.071
1409	03/23/2010	08:32:55	0.070
1410	03/23/2010	08:33:55	0.070
1411	03/23/2010	08:34:55	0.069
1412	03/23/2010	08:35:55	0.069
1413	03/23/2010	08:36:55	0.064
1414	03/23/2010	08:37:55	0.062

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1415	03/23/2010	08:38:55	0.054
1416	03/23/2010	08:39:55	0.051
1417	03/23/2010	08:40:55	0.052
1418	03/23/2010	08:41:55	0.049
1419	03/23/2010	08:42:55	0.050
1420	03/23/2010	08:43:55	0.048
1421	03/23/2010	08:44:55	0.050
1422	03/23/2010	08:45:55	0.052
1423	03/23/2010	08:46:55	0.051
1424	03/23/2010	08:47:55	0.054
1425	03/23/2010	08:48:55	0.053
1426	03/23/2010	08:49:55	0.057
1427	03/23/2010	08:50:55	0.055
1428	03/23/2010	08:51:55	0.055
1429	03/23/2010	08:52:55	0.051
1430	03/23/2010	08:53:55	0.053
1431	03/23/2010	08:54:55	0.054
1432	03/23/2010	08:55:55	0.053
1433	03/23/2010	08:56:55	0.055
1434	03/23/2010	08:57:55	0.053
1435	03/23/2010	08:58:55	0.059
1436	03/23/2010	08:59:55	0.058
1437	03/23/2010	09:00:55	0.058
1438	03/23/2010	09:01:55	0.057
1439	03/23/2010	09:02:55	0.056
1440	03/23/2010	09:03:55	0.059
1441	03/23/2010	09:04:55	0.059
1442	03/23/2010	09:05:55	0.057
1443	03/23/2010	09:06:55	0.062
1444	03/23/2010	09:07:55	0.060
1445	03/23/2010	09:08:55	0.064
1446	03/23/2010	09:09:55	0.061
1447	03/23/2010	09:10:55	0.062
1448	03/23/2010	09:11:55	0.061
1449	03/23/2010	09:12:55	0.070
1450	03/23/2010	09:13:55	0.073
1451	03/23/2010	09:14:55	0.062
1452	03/23/2010	09:15:55	0.062
1453	03/23/2010	09:16:55	0.063
1454	03/23/2010	09:17:55	0.064
1455	03/23/2010	09:18:55	0.060
1456	03/23/2010	09:19:55	0.064
1457	03/23/2010	09:20:55	0.062
1458	03/23/2010	09:21:55	0.059
1459	03/23/2010	09:22:55	0.055
1460	03/23/2010	09:23:55	0.052

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1461	03/23/2010	09:24:55	0.050
1462	03/23/2010	09:25:55	0.047
1463	03/23/2010	09:26:55	0.050
1464	03/23/2010	09:27:55	0.051
1465	03/23/2010	09:28:55	0.051
1466	03/23/2010	09:29:55	0.048
1467	03/23/2010	09:30:55	0.048
1468	03/23/2010	09:31:55	0.043
1469	03/23/2010	09:32:55	0.042
1470	03/23/2010	09:33:55	0.043
1471	03/23/2010	09:34:55	0.041

Test 001

San Fernando WWTP

Instrument		Data Properties	
Model	Dust Trak	Start Date	04/19/2010
Meter S/N	85202707	Start Time	11:13:29
		Stop Date	04/20/2010
		Stop Time	12:11:29
		Total Time	1:00:58:00
		Logging Interval	60 seconds

Test Data

Data Point	Date	Time	Aerosol mg/m^3
1	04/19/2010	11:14:29	0.081
2	04/19/2010	11:15:29	0.028
3	04/19/2010	11:16:29	0.028
4	04/19/2010	11:17:29	0.020
5	04/19/2010	11:18:29	0.028
6	04/19/2010	11:19:29	0.044
7	04/19/2010	11:20:29	0.020
8	04/19/2010	11:21:29	0.022
9	04/19/2010	11:22:29	0.036
10	04/19/2010	11:23:29	0.019
11	04/19/2010	11:24:29	0.015
12	04/19/2010	11:25:29	0.015
13	04/19/2010	11:26:29	0.021
14	04/19/2010	11:27:29	0.036
15	04/19/2010	11:28:29	0.035
16	04/19/2010	11:29:29	0.032
17	04/19/2010	11:30:29	0.032
18	04/19/2010	11:31:29	0.032
19	04/19/2010	11:32:29	0.031
20	04/19/2010	11:33:29	0.042
21	04/19/2010	11:34:29	0.026
22	04/19/2010	11:35:29	0.026
23	04/19/2010	11:36:29	0.016
24	04/19/2010	11:37:29	0.013
25	04/19/2010	11:38:29	0.036
26	04/19/2010	11:39:29	0.035
27	04/19/2010	11:40:29	0.023
28	04/19/2010	11:41:29	0.033
29	04/19/2010	11:42:29	0.053
30	04/19/2010	11:43:29	0.036
31	04/19/2010	11:44:29	0.032
32	04/19/2010	11:45:29	0.029
33	04/19/2010	11:46:29	0.034
34	04/19/2010	11:47:29	0.025

Test Data

Data Point	Date	Time	Aerosol mg/m^3
35	04/19/2010	11:48:29	0.020
36	04/19/2010	11:49:29	0.023
37	04/19/2010	11:50:29	0.023
38	04/19/2010	11:51:29	0.017
39	04/19/2010	11:52:29	0.021
40	04/19/2010	11:53:29	0.018
41	04/19/2010	11:54:29	0.020
42	04/19/2010	11:55:29	0.028
43	04/19/2010	11:56:29	0.030
44	04/19/2010	11:57:29	0.029
45	04/19/2010	11:58:29	0.036
46	04/19/2010	11:59:29	0.031
47	04/19/2010	12:00:29	0.030
48	04/19/2010	12:01:29	0.038
49	04/19/2010	12:02:29	0.033
50	04/19/2010	12:03:29	0.044
51	04/19/2010	12:04:29	0.029
52	04/19/2010	12:05:29	0.020
53	04/19/2010	12:06:29	0.034
54	04/19/2010	12:07:29	0.063
55	04/19/2010	12:08:29	0.036
56	04/19/2010	12:09:29	0.026
57	04/19/2010	12:10:29	0.017
58	04/19/2010	12:11:29	0.028
59	04/19/2010	12:12:29	0.024
60	04/19/2010	12:13:29	0.030
61	04/19/2010	12:14:29	0.063
62	04/19/2010	12:15:29	0.030
63	04/19/2010	12:16:29	0.021
64	04/19/2010	12:17:29	0.019
65	04/19/2010	12:18:29	0.030
66	04/19/2010	12:19:29	0.025
67	04/19/2010	12:20:29	0.026
68	04/19/2010	12:21:29	0.025
69	04/19/2010	12:22:29	0.022
70	04/19/2010	12:23:29	0.026
71	04/19/2010	12:24:29	0.029
72	04/19/2010	12:25:29	0.025
73	04/19/2010	12:26:29	0.021
74	04/19/2010	12:27:29	0.021
75	04/19/2010	12:28:29	0.020
76	04/19/2010	12:29:29	0.020
77	04/19/2010	12:30:29	0.023
78	04/19/2010	12:31:29	0.028
79	04/19/2010	12:32:29	0.039
80	04/19/2010	12:33:29	0.033

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
81	04/19/2010	12:34:29	0.035
82	04/19/2010	12:35:29	0.036
83	04/19/2010	12:36:29	0.031
84	04/19/2010	12:37:29	0.025
85	04/19/2010	12:38:29	0.030
86	04/19/2010	12:39:29	0.023
87	04/19/2010	12:40:29	0.038
88	04/19/2010	12:41:29	0.026
89	04/19/2010	12:42:29	0.036
90	04/19/2010	12:43:29	0.030
91	04/19/2010	12:44:29	0.027
92	04/19/2010	12:45:29	0.028
93	04/19/2010	12:46:29	0.031
94	04/19/2010	12:47:29	0.033
95	04/19/2010	12:48:29	0.023
96	04/19/2010	12:49:29	0.029
97	04/19/2010	12:50:29	0.029
98	04/19/2010	12:51:29	0.030
99	04/19/2010	12:52:29	0.024
100	04/19/2010	12:53:29	0.030
101	04/19/2010	12:54:29	0.027
102	04/19/2010	12:55:29	0.027
103	04/19/2010	12:56:29	0.041
104	04/19/2010	12:57:29	0.042
105	04/19/2010	12:58:29	0.029
106	04/19/2010	12:59:29	0.026
107	04/19/2010	13:00:29	0.020
108	04/19/2010	13:01:29	0.020
109	04/19/2010	13:02:29	0.036
110	04/19/2010	13:03:29	0.046
111	04/19/2010	13:04:29	0.037
112	04/19/2010	13:05:29	0.065
113	04/19/2010	13:06:29	0.046
114	04/19/2010	13:07:29	0.049
115	04/19/2010	13:08:29	0.050
116	04/19/2010	13:09:29	0.044
117	04/19/2010	13:10:29	0.069
118	04/19/2010	13:11:29	0.058
119	04/19/2010	13:12:29	0.061
120	04/19/2010	13:13:29	0.056
121	04/19/2010	13:14:29	0.054
122	04/19/2010	13:15:29	0.058
123	04/19/2010	13:16:29	0.055
124	04/19/2010	13:17:29	0.045
125	04/19/2010	13:18:29	0.043
126	04/19/2010	13:19:29	0.043

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
127	04/19/2010	13:20:29	0.049
128	04/19/2010	13:21:29	0.064
129	04/19/2010	13:22:29	0.044
130	04/19/2010	13:23:29	0.041
131	04/19/2010	13:24:29	0.053
132	04/19/2010	13:25:29	0.046
133	04/19/2010	13:26:29	0.043
134	04/19/2010	13:27:29	0.039
135	04/19/2010	13:28:29	0.039
136	04/19/2010	13:29:29	0.027
137	04/19/2010	13:30:29	0.039
138	04/19/2010	13:31:29	0.030
139	04/19/2010	13:32:29	0.028
140	04/19/2010	13:33:29	0.034
141	04/19/2010	13:34:29	0.029
142	04/19/2010	13:35:29	0.064
143	04/19/2010	13:36:29	0.085
144	04/19/2010	13:37:29	0.093
145	04/19/2010	13:38:29	0.091
146	04/19/2010	13:39:29	0.087
147	04/19/2010	13:40:29	0.094
148	04/19/2010	13:41:29	0.095
149	04/19/2010	13:42:29	0.099
150	04/19/2010	13:43:29	0.100
151	04/19/2010	13:44:29	0.104
152	04/19/2010	13:45:29	0.082
153	04/19/2010	13:46:29	0.073
154	04/19/2010	13:47:29	0.073
155	04/19/2010	13:48:29	0.098
156	04/19/2010	13:49:29	0.076
157	04/19/2010	13:50:29	0.078
158	04/19/2010	13:51:29	0.068
159	04/19/2010	13:52:29	0.072
160	04/19/2010	13:53:29	0.077
161	04/19/2010	13:54:29	0.089
162	04/19/2010	13:55:29	0.112
163	04/19/2010	13:56:29	0.136
164	04/19/2010	13:57:29	0.144
165	04/19/2010	13:58:29	0.144
166	04/19/2010	13:59:29	0.130
167	04/19/2010	14:00:29	0.115
168	04/19/2010	14:01:29	0.114
169	04/19/2010	14:02:29	0.119
170	04/19/2010	14:03:29	0.144
171	04/19/2010	14:04:29	0.111
172	04/19/2010	14:05:29	0.112

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
173	04/19/2010	14:06:29	0.106
174	04/19/2010	14:07:29	0.113
175	04/19/2010	14:08:29	0.159
176	04/19/2010	14:09:29	0.141
177	04/19/2010	14:10:29	0.195
178	04/19/2010	14:11:29	0.229
179	04/19/2010	14:12:29	0.122
180	04/19/2010	14:13:29	0.103
181	04/19/2010	14:14:29	0.109
182	04/19/2010	14:15:29	0.102
183	04/19/2010	14:16:29	0.121
184	04/19/2010	14:17:29	0.105
185	04/19/2010	14:18:29	0.101
186	04/19/2010	14:19:29	0.091
187	04/19/2010	14:20:29	0.090
188	04/19/2010	14:21:29	0.077
189	04/19/2010	14:22:29	0.078
190	04/19/2010	14:23:29	0.076
191	04/19/2010	14:24:29	0.077
192	04/19/2010	14:25:29	0.079
193	04/19/2010	14:26:29	0.085
194	04/19/2010	14:27:29	0.085
195	04/19/2010	14:28:29	0.103
196	04/19/2010	14:29:29	0.088
197	04/19/2010	14:30:29	0.092
198	04/19/2010	14:31:29	0.091
199	04/19/2010	14:32:29	0.094
200	04/19/2010	14:33:29	0.079
201	04/19/2010	14:34:29	0.080
202	04/19/2010	14:35:29	0.071
203	04/19/2010	14:36:29	0.077
204	04/19/2010	14:37:29	0.085
205	04/19/2010	14:38:29	0.079
206	04/19/2010	14:39:29	0.077
207	04/19/2010	14:40:29	0.075
208	04/19/2010	14:41:29	0.077
209	04/19/2010	14:42:29	0.076
210	04/19/2010	14:43:29	0.070
211	04/19/2010	14:44:29	0.072
212	04/19/2010	14:45:29	0.075
213	04/19/2010	14:46:29	0.064
214	04/19/2010	14:47:29	0.065
215	04/19/2010	14:48:29	0.068
216	04/19/2010	14:49:29	0.068
217	04/19/2010	14:50:29	0.065
218	04/19/2010	14:51:29	0.068

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
219	04/19/2010	14:52:29	0.062
220	04/19/2010	14:53:29	0.059
221	04/19/2010	14:54:29	0.058
222	04/19/2010	14:55:29	0.065
223	04/19/2010	14:56:29	0.059
224	04/19/2010	14:57:29	0.058
225	04/19/2010	14:58:29	0.059
226	04/19/2010	14:59:29	0.055
227	04/19/2010	15:00:29	0.055
228	04/19/2010	15:01:29	0.060
229	04/19/2010	15:02:29	0.066
230	04/19/2010	15:03:29	0.062
231	04/19/2010	15:04:29	0.062
232	04/19/2010	15:05:29	0.058
233	04/19/2010	15:06:29	0.057
234	04/19/2010	15:07:29	0.058
235	04/19/2010	15:08:29	0.056
236	04/19/2010	15:09:29	0.055
237	04/19/2010	15:10:29	0.058
238	04/19/2010	15:11:29	0.058
239	04/19/2010	15:12:29	0.056
240	04/19/2010	15:13:29	0.055
241	04/19/2010	15:14:29	0.056
242	04/19/2010	15:15:29	0.056
243	04/19/2010	15:16:29	0.055
244	04/19/2010	15:17:29	0.051
245	04/19/2010	15:18:29	0.055
246	04/19/2010	15:19:29	0.053
247	04/19/2010	15:20:29	0.050
248	04/19/2010	15:21:29	0.055
249	04/19/2010	15:22:29	0.053
250	04/19/2010	15:23:29	0.052
251	04/19/2010	15:24:29	0.052
252	04/19/2010	15:25:29	0.052
253	04/19/2010	15:26:29	0.055
254	04/19/2010	15:27:29	0.054
255	04/19/2010	15:28:29	0.054
256	04/19/2010	15:29:29	0.054
257	04/19/2010	15:30:29	0.057
258	04/19/2010	15:31:29	0.050
259	04/19/2010	15:32:29	0.056
260	04/19/2010	15:33:29	0.047
261	04/19/2010	15:34:29	0.048
262	04/19/2010	15:35:29	0.046
263	04/19/2010	15:36:29	0.046
264	04/19/2010	15:37:29	0.045

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
265	04/19/2010	15:38:29	0.045
266	04/19/2010	15:39:29	0.046
267	04/19/2010	15:40:29	0.044
268	04/19/2010	15:41:29	0.043
269	04/19/2010	15:42:29	0.043
270	04/19/2010	15:43:29	0.044
271	04/19/2010	15:44:29	0.042
272	04/19/2010	15:45:29	0.044
273	04/19/2010	15:46:29	0.046
274	04/19/2010	15:47:29	0.052
275	04/19/2010	15:48:29	0.047
276	04/19/2010	15:49:29	0.050
277	04/19/2010	15:50:29	0.053
278	04/19/2010	15:51:29	0.053
279	04/19/2010	15:52:29	0.055
280	04/19/2010	15:53:29	0.051
281	04/19/2010	15:54:29	0.056
282	04/19/2010	15:55:29	0.057
283	04/19/2010	15:56:29	0.052
284	04/19/2010	15:57:29	0.054
285	04/19/2010	15:58:29	0.056
286	04/19/2010	15:59:29	0.051
287	04/19/2010	16:00:29	0.054
288	04/19/2010	16:01:29	0.053
289	04/19/2010	16:02:29	0.052
290	04/19/2010	16:03:29	0.050
291	04/19/2010	16:04:29	0.057
292	04/19/2010	16:05:29	0.053
293	04/19/2010	16:06:29	0.055
294	04/19/2010	16:07:29	0.051
295	04/19/2010	16:08:29	0.047
296	04/19/2010	16:09:29	0.045
297	04/19/2010	16:10:29	0.051
298	04/19/2010	16:11:29	0.049
299	04/19/2010	16:12:29	0.052
300	04/19/2010	16:13:29	0.049
301	04/19/2010	16:14:29	0.049
302	04/19/2010	16:15:29	0.050
303	04/19/2010	16:16:29	0.052
304	04/19/2010	16:17:29	0.055
305	04/19/2010	16:18:29	0.054
306	04/19/2010	16:19:29	0.052
307	04/19/2010	16:20:29	0.052
308	04/19/2010	16:21:29	0.053
309	04/19/2010	16:22:29	0.054
310	04/19/2010	16:23:29	0.053

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
311	04/19/2010	16:24:29	0.056
312	04/19/2010	16:25:29	0.060
313	04/19/2010	16:26:29	0.054
314	04/19/2010	16:27:29	0.067
315	04/19/2010	16:28:29	0.103
316	04/19/2010	16:29:29	0.082
317	04/19/2010	16:30:29	0.086
318	04/19/2010	16:31:29	0.069
319	04/19/2010	16:32:29	0.071
320	04/19/2010	16:33:29	0.072
321	04/19/2010	16:34:29	0.068
322	04/19/2010	16:35:29	0.073
323	04/19/2010	16:36:29	0.064
324	04/19/2010	16:37:29	0.059
325	04/19/2010	16:38:29	0.065
326	04/19/2010	16:39:29	0.081
327	04/19/2010	16:40:29	0.089
328	04/19/2010	16:41:29	0.086
329	04/19/2010	16:42:29	0.084
330	04/19/2010	16:43:29	0.072
331	04/19/2010	16:44:29	0.072
332	04/19/2010	16:45:29	0.071
333	04/19/2010	16:46:29	0.067
334	04/19/2010	16:47:29	0.068
335	04/19/2010	16:48:29	0.070
336	04/19/2010	16:49:29	0.077
337	04/19/2010	16:50:29	0.072
338	04/19/2010	16:51:29	0.057
339	04/19/2010	16:52:29	0.051
340	04/19/2010	16:53:29	0.038
341	04/19/2010	16:54:29	0.038
342	04/19/2010	16:55:29	0.035
343	04/19/2010	16:56:29	0.034
344	04/19/2010	16:57:29	0.034
345	04/19/2010	16:58:29	0.039
346	04/19/2010	16:59:29	0.041
347	04/19/2010	17:00:29	0.045
348	04/19/2010	17:01:29	0.046
349	04/19/2010	17:02:29	0.052
350	04/19/2010	17:03:29	0.057
351	04/19/2010	17:04:29	0.064
352	04/19/2010	17:05:29	0.065
353	04/19/2010	17:06:29	0.074
354	04/19/2010	17:07:29	0.069
355	04/19/2010	17:08:29	0.068
356	04/19/2010	17:09:29	0.083

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
357	04/19/2010	17:10:29	0.057
358	04/19/2010	17:11:29	0.046
359	04/19/2010	17:12:29	0.046
360	04/19/2010	17:13:29	0.050
361	04/19/2010	17:14:29	0.050
362	04/19/2010	17:15:29	0.051
363	04/19/2010	17:16:29	0.054
364	04/19/2010	17:17:29	0.055
365	04/19/2010	17:18:29	0.054
366	04/19/2010	17:19:29	0.053
367	04/19/2010	17:20:29	0.069
368	04/19/2010	17:21:29	0.066
369	04/19/2010	17:22:29	0.054
370	04/19/2010	17:23:29	0.055
371	04/19/2010	17:24:29	0.057
372	04/19/2010	17:25:29	0.050
373	04/19/2010	17:26:29	0.046
374	04/19/2010	17:27:29	0.031
375	04/19/2010	17:28:29	0.047
376	04/19/2010	17:29:29	0.052
377	04/19/2010	17:30:29	0.054
378	04/19/2010	17:31:29	0.055
379	04/19/2010	17:32:29	0.044
380	04/19/2010	17:33:29	0.045
381	04/19/2010	17:34:29	0.042
382	04/19/2010	17:35:29	0.039
383	04/19/2010	17:36:29	0.060
384	04/19/2010	17:37:29	0.046
385	04/19/2010	17:38:29	0.051
386	04/19/2010	17:39:29	0.049
387	04/19/2010	17:40:29	0.039
388	04/19/2010	17:41:29	0.040
389	04/19/2010	17:42:29	0.045
390	04/19/2010	17:43:29	0.050
391	04/19/2010	17:44:29	0.050
392	04/19/2010	17:45:29	0.052
393	04/19/2010	17:46:29	0.060
394	04/19/2010	17:47:29	0.058
395	04/19/2010	17:48:29	0.053
396	04/19/2010	17:49:29	0.053
397	04/19/2010	17:50:29	0.055
398	04/19/2010	17:51:29	0.052
399	04/19/2010	17:52:29	0.047
400	04/19/2010	17:53:29	0.052
401	04/19/2010	17:54:29	0.053
402	04/19/2010	17:55:29	0.057

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
403	04/19/2010	17:56:29	0.055
404	04/19/2010	17:57:29	0.054
405	04/19/2010	17:58:29	0.058
406	04/19/2010	17:59:29	0.062
407	04/19/2010	18:00:29	0.061
408	04/19/2010	18:01:29	0.063
409	04/19/2010	18:02:29	0.059
410	04/19/2010	18:03:29	0.055
411	04/19/2010	18:04:29	0.057
412	04/19/2010	18:05:29	0.060
413	04/19/2010	18:06:29	0.063
414	04/19/2010	18:07:29	0.057
415	04/19/2010	18:08:29	0.058
416	04/19/2010	18:09:29	0.057
417	04/19/2010	18:10:29	0.055
418	04/19/2010	18:11:29	0.061
419	04/19/2010	18:12:29	0.073
420	04/19/2010	18:13:29	0.085
421	04/19/2010	18:14:29	0.085
422	04/19/2010	18:15:29	0.089
423	04/19/2010	18:16:29	0.093
424	04/19/2010	18:17:29	0.098
425	04/19/2010	18:18:29	0.101
426	04/19/2010	18:19:29	0.105
427	04/19/2010	18:20:29	0.101
428	04/19/2010	18:21:29	0.101
429	04/19/2010	18:22:29	0.103
430	04/19/2010	18:23:29	0.100
431	04/19/2010	18:24:29	0.100
432	04/19/2010	18:25:29	0.096
433	04/19/2010	18:26:29	0.089
434	04/19/2010	18:27:29	0.095
435	04/19/2010	18:28:29	0.090
436	04/19/2010	18:29:29	0.093
437	04/19/2010	18:30:29	0.091
438	04/19/2010	18:31:29	0.094
439	04/19/2010	18:32:29	0.099
440	04/19/2010	18:33:29	0.101
441	04/19/2010	18:34:29	0.101
442	04/19/2010	18:35:29	0.094
443	04/19/2010	18:36:29	0.095
444	04/19/2010	18:37:29	0.092
445	04/19/2010	18:38:29	0.082
446	04/19/2010	18:39:29	0.081
447	04/19/2010	18:40:29	0.089
448	04/19/2010	18:41:29	0.082

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
449	04/19/2010	18:42:29	0.089
450	04/19/2010	18:43:29	0.089
451	04/19/2010	18:44:29	0.082
452	04/19/2010	18:45:29	0.082
453	04/19/2010	18:46:29	0.085
454	04/19/2010	18:47:29	0.080
455	04/19/2010	18:48:29	0.079
456	04/19/2010	18:49:29	0.080
457	04/19/2010	18:50:29	0.081
458	04/19/2010	18:51:29	0.084
459	04/19/2010	18:52:29	0.083
460	04/19/2010	18:53:29	0.077
461	04/19/2010	18:54:29	0.070
462	04/19/2010	18:55:29	0.063
463	04/19/2010	18:56:29	0.070
464	04/19/2010	18:57:29	0.068
465	04/19/2010	18:58:29	0.074
466	04/19/2010	18:59:29	0.074
467	04/19/2010	19:00:29	0.069
468	04/19/2010	19:01:29	0.071
469	04/19/2010	19:02:29	0.071
470	04/19/2010	19:03:29	0.081
471	04/19/2010	19:04:29	0.085
472	04/19/2010	19:05:29	0.077
473	04/19/2010	19:06:29	0.080
474	04/19/2010	19:07:29	0.076
475	04/19/2010	19:08:29	0.072
476	04/19/2010	19:09:29	0.075
477	04/19/2010	19:10:29	0.074
478	04/19/2010	19:11:29	0.073
479	04/19/2010	19:12:29	0.076
480	04/19/2010	19:13:29	0.078
481	04/19/2010	19:14:29	0.074
482	04/19/2010	19:15:29	0.074
483	04/19/2010	19:16:29	0.080
484	04/19/2010	19:17:29	0.085
485	04/19/2010	19:18:29	0.079
486	04/19/2010	19:19:29	0.076
487	04/19/2010	19:20:29	0.073
488	04/19/2010	19:21:29	0.079
489	04/19/2010	19:22:29	0.078
490	04/19/2010	19:23:29	0.077
491	04/19/2010	19:24:29	0.077
492	04/19/2010	19:25:29	0.074
493	04/19/2010	19:26:29	0.082
494	04/19/2010	19:27:29	0.072

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
495	04/19/2010	19:28:29	0.073
496	04/19/2010	19:29:29	0.074
497	04/19/2010	19:30:29	0.072
498	04/19/2010	19:31:29	0.072
499	04/19/2010	19:32:29	0.076
500	04/19/2010	19:33:29	0.075
501	04/19/2010	19:34:29	0.071
502	04/19/2010	19:35:29	0.074
503	04/19/2010	19:36:29	0.072
504	04/19/2010	19:37:29	0.071
505	04/19/2010	19:38:29	0.064
506	04/19/2010	19:39:29	0.068
507	04/19/2010	19:40:29	0.066
508	04/19/2010	19:41:29	0.063
509	04/19/2010	19:42:29	0.065
510	04/19/2010	19:43:29	0.058
511	04/19/2010	19:44:29	0.064
512	04/19/2010	19:45:29	0.057
513	04/19/2010	19:46:29	0.056
514	04/19/2010	19:47:29	0.056
515	04/19/2010	19:48:29	0.057
516	04/19/2010	19:49:29	0.063
517	04/19/2010	19:50:29	0.061
518	04/19/2010	19:51:29	0.058
519	04/19/2010	19:52:29	0.061
520	04/19/2010	19:53:29	0.056
521	04/19/2010	19:54:29	0.058
522	04/19/2010	19:55:29	0.056
523	04/19/2010	19:56:29	0.063
524	04/19/2010	19:57:29	0.060
525	04/19/2010	19:58:29	0.059
526	04/19/2010	19:59:29	0.058
527	04/19/2010	20:00:29	0.057
528	04/19/2010	20:01:29	0.060
529	04/19/2010	20:02:29	0.058
530	04/19/2010	20:03:29	0.055
531	04/19/2010	20:04:29	0.063
532	04/19/2010	20:05:29	0.059
533	04/19/2010	20:06:29	0.062
534	04/19/2010	20:07:29	0.058
535	04/19/2010	20:08:29	0.058
536	04/19/2010	20:09:29	0.058
537	04/19/2010	20:10:29	0.056
538	04/19/2010	20:11:29	0.058
539	04/19/2010	20:12:29	0.063
540	04/19/2010	20:13:29	0.060

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
541	04/19/2010	20:14:29	0.064
542	04/19/2010	20:15:29	0.058
543	04/19/2010	20:16:29	0.053
544	04/19/2010	20:17:29	0.063
545	04/19/2010	20:18:29	0.061
546	04/19/2010	20:19:29	0.066
547	04/19/2010	20:20:29	0.072
548	04/19/2010	20:21:29	0.063
549	04/19/2010	20:22:29	0.062
550	04/19/2010	20:23:29	0.062
551	04/19/2010	20:24:29	0.065
552	04/19/2010	20:25:29	0.056
553	04/19/2010	20:26:29	0.060
554	04/19/2010	20:27:29	0.063
555	04/19/2010	20:28:29	0.061
556	04/19/2010	20:29:29	0.065
557	04/19/2010	20:30:29	0.065
558	04/19/2010	20:31:29	0.067
559	04/19/2010	20:32:29	0.063
560	04/19/2010	20:33:29	0.067
561	04/19/2010	20:34:29	0.066
562	04/19/2010	20:35:29	0.062
563	04/19/2010	20:36:29	0.074
564	04/19/2010	20:37:29	0.063
565	04/19/2010	20:38:29	0.066
566	04/19/2010	20:39:29	0.064
567	04/19/2010	20:40:29	0.064
568	04/19/2010	20:41:29	0.068
569	04/19/2010	20:42:29	0.072
570	04/19/2010	20:43:29	0.072
571	04/19/2010	20:44:29	0.067
572	04/19/2010	20:45:29	0.065
573	04/19/2010	20:46:29	0.071
574	04/19/2010	20:47:29	0.072
575	04/19/2010	20:48:29	0.068
576	04/19/2010	20:49:29	0.071
577	04/19/2010	20:50:29	0.073
578	04/19/2010	20:51:29	0.064
579	04/19/2010	20:52:29	0.071
580	04/19/2010	20:53:29	0.075
581	04/19/2010	20:54:29	0.075
582	04/19/2010	20:55:29	0.071
583	04/19/2010	20:56:29	0.076
584	04/19/2010	20:57:29	0.084
585	04/19/2010	20:58:29	0.087
586	04/19/2010	20:59:29	0.074

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
587	04/19/2010	21:00:29	0.070
588	04/19/2010	21:01:29	0.070
589	04/19/2010	21:02:29	0.070
590	04/19/2010	21:03:29	0.072
591	04/19/2010	21:04:29	0.076
592	04/19/2010	21:05:29	0.078
593	04/19/2010	21:06:29	0.074
594	04/19/2010	21:07:29	0.076
595	04/19/2010	21:08:29	0.066
596	04/19/2010	21:09:29	0.065
597	04/19/2010	21:10:29	0.070
598	04/19/2010	21:11:29	0.063
599	04/19/2010	21:12:29	0.063
600	04/19/2010	21:13:29	0.063
601	04/19/2010	21:14:29	0.057
602	04/19/2010	21:15:29	0.057
603	04/19/2010	21:16:29	0.059
604	04/19/2010	21:17:29	0.061
605	04/19/2010	21:18:29	0.056
606	04/19/2010	21:19:29	0.055
607	04/19/2010	21:20:29	0.057
608	04/19/2010	21:21:29	0.053
609	04/19/2010	21:22:29	0.056
610	04/19/2010	21:23:29	0.057
611	04/19/2010	21:24:29	0.056
612	04/19/2010	21:25:29	0.053
613	04/19/2010	21:26:29	0.051
614	04/19/2010	21:27:29	0.053
615	04/19/2010	21:28:29	0.051
616	04/19/2010	21:29:29	0.052
617	04/19/2010	21:30:29	0.049
618	04/19/2010	21:31:29	0.049
619	04/19/2010	21:32:29	0.049
620	04/19/2010	21:33:29	0.048
621	04/19/2010	21:34:29	0.047
622	04/19/2010	21:35:29	0.047
623	04/19/2010	21:36:29	0.047
624	04/19/2010	21:37:29	0.050
625	04/19/2010	21:38:29	0.048
626	04/19/2010	21:39:29	0.046
627	04/19/2010	21:40:29	0.045
628	04/19/2010	21:41:29	0.044
629	04/19/2010	21:42:29	0.047
630	04/19/2010	21:43:29	0.047
631	04/19/2010	21:44:29	0.046
632	04/19/2010	21:45:29	0.047

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
633	04/19/2010	21:46:29	0.049
634	04/19/2010	21:47:29	0.052
635	04/19/2010	21:48:29	0.045
636	04/19/2010	21:49:29	0.047
637	04/19/2010	21:50:29	0.046
638	04/19/2010	21:51:29	0.050
639	04/19/2010	21:52:29	0.048
640	04/19/2010	21:53:29	0.048
641	04/19/2010	21:54:29	0.048
642	04/19/2010	21:55:29	0.046
643	04/19/2010	21:56:29	0.050
644	04/19/2010	21:57:29	0.050
645	04/19/2010	21:58:29	0.049
646	04/19/2010	21:59:29	0.052
647	04/19/2010	22:00:29	0.046
648	04/19/2010	22:01:29	0.047
649	04/19/2010	22:02:29	0.048
650	04/19/2010	22:03:29	0.047
651	04/19/2010	22:04:29	0.049
652	04/19/2010	22:05:29	0.047
653	04/19/2010	22:06:29	0.046
654	04/19/2010	22:07:29	0.049
655	04/19/2010	22:08:29	0.047
656	04/19/2010	22:09:29	0.048
657	04/19/2010	22:10:29	0.046
658	04/19/2010	22:11:29	0.049
659	04/19/2010	22:12:29	0.050
660	04/19/2010	22:13:29	0.052
661	04/19/2010	22:14:29	0.048
662	04/19/2010	22:15:29	0.049
663	04/19/2010	22:16:29	0.049
664	04/19/2010	22:17:29	0.049
665	04/19/2010	22:18:29	0.044
666	04/19/2010	22:19:29	0.046
667	04/19/2010	22:20:29	0.045
668	04/19/2010	22:21:29	0.047
669	04/19/2010	22:22:29	0.046
670	04/19/2010	22:23:29	0.044
671	04/19/2010	22:24:29	0.045
672	04/19/2010	22:25:29	0.044
673	04/19/2010	22:26:29	0.044
674	04/19/2010	22:27:29	0.043
675	04/19/2010	22:28:29	0.045
676	04/19/2010	22:29:29	0.042
677	04/19/2010	22:30:29	0.041
678	04/19/2010	22:31:29	0.043

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
679	04/19/2010	22:32:29	0.042
680	04/19/2010	22:33:29	0.042
681	04/19/2010	22:34:29	0.044
682	04/19/2010	22:35:29	0.042
683	04/19/2010	22:36:29	0.042
684	04/19/2010	22:37:29	0.047
685	04/19/2010	22:38:29	0.043
686	04/19/2010	22:39:29	0.046
687	04/19/2010	22:40:29	0.046
688	04/19/2010	22:41:29	0.046
689	04/19/2010	22:42:29	0.043
690	04/19/2010	22:43:29	0.048
691	04/19/2010	22:44:29	0.045
692	04/19/2010	22:45:29	0.043
693	04/19/2010	22:46:29	0.047
694	04/19/2010	22:47:29	0.044
695	04/19/2010	22:48:29	0.044
696	04/19/2010	22:49:29	0.049
697	04/19/2010	22:50:29	0.044
698	04/19/2010	22:51:29	0.044
699	04/19/2010	22:52:29	0.045
700	04/19/2010	22:53:29	0.046
701	04/19/2010	22:54:29	0.046
702	04/19/2010	22:55:29	0.047
703	04/19/2010	22:56:29	0.047
704	04/19/2010	22:57:29	0.050
705	04/19/2010	22:58:29	0.050
706	04/19/2010	22:59:29	0.053
707	04/19/2010	23:00:29	0.054
708	04/19/2010	23:01:29	0.054
709	04/19/2010	23:02:29	0.057
710	04/19/2010	23:03:29	0.056
711	04/19/2010	23:04:29	0.061
712	04/19/2010	23:05:29	0.056
713	04/19/2010	23:06:29	0.058
714	04/19/2010	23:07:29	0.060
715	04/19/2010	23:08:29	0.059
716	04/19/2010	23:09:29	0.053
717	04/19/2010	23:10:29	0.064
718	04/19/2010	23:11:29	0.055
719	04/19/2010	23:12:29	0.055
720	04/19/2010	23:13:29	0.064
721	04/19/2010	23:14:29	0.053
722	04/19/2010	23:15:29	0.054
723	04/19/2010	23:16:29	0.054
724	04/19/2010	23:17:29	0.051

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
725	04/19/2010	23:18:29	0.052
726	04/19/2010	23:19:29	0.050
727	04/19/2010	23:20:29	0.048
728	04/19/2010	23:21:29	0.050
729	04/19/2010	23:22:29	0.048
730	04/19/2010	23:23:29	0.051
731	04/19/2010	23:24:29	0.051
732	04/19/2010	23:25:29	0.048
733	04/19/2010	23:26:29	0.049
734	04/19/2010	23:27:29	0.049
735	04/19/2010	23:28:29	0.047
736	04/19/2010	23:29:29	0.044
737	04/19/2010	23:30:29	0.047
738	04/19/2010	23:31:29	0.047
739	04/19/2010	23:32:29	0.045
740	04/19/2010	23:33:29	0.047
741	04/19/2010	23:34:29	0.045
742	04/19/2010	23:35:29	0.046
743	04/19/2010	23:36:29	0.044
744	04/19/2010	23:37:29	0.045
745	04/19/2010	23:38:29	0.042
746	04/19/2010	23:39:29	0.042
747	04/19/2010	23:40:29	0.042
748	04/19/2010	23:41:29	0.042
749	04/19/2010	23:42:29	0.041
750	04/19/2010	23:43:29	0.046
751	04/19/2010	23:44:29	0.040
752	04/19/2010	23:45:29	0.041
753	04/19/2010	23:46:29	0.044
754	04/19/2010	23:47:29	0.039
755	04/19/2010	23:48:29	0.042
756	04/19/2010	23:49:29	0.044
757	04/19/2010	23:50:29	0.045
758	04/19/2010	23:51:29	0.043
759	04/19/2010	23:52:29	0.041
760	04/19/2010	23:53:29	0.040
761	04/19/2010	23:54:29	0.041
762	04/19/2010	23:55:29	0.042
763	04/19/2010	23:56:29	0.041
764	04/19/2010	23:57:29	0.042
765	04/19/2010	23:58:29	0.044
766	04/19/2010	23:59:29	0.039
767	04/20/2010	00:00:29	0.045
768	04/20/2010	00:01:29	0.040
769	04/20/2010	00:02:29	0.041
770	04/20/2010	00:03:29	0.041

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
771	04/20/2010	00:04:29	0.041
772	04/20/2010	00:05:29	0.041
773	04/20/2010	00:06:29	0.043
774	04/20/2010	00:07:29	0.043
775	04/20/2010	00:08:29	0.045
776	04/20/2010	00:09:29	0.042
777	04/20/2010	00:10:29	0.042
778	04/20/2010	00:11:29	0.041
779	04/20/2010	00:12:29	0.040
780	04/20/2010	00:13:29	0.040
781	04/20/2010	00:14:29	0.040
782	04/20/2010	00:15:29	0.043
783	04/20/2010	00:16:29	0.040
784	04/20/2010	00:17:29	0.044
785	04/20/2010	00:18:29	0.044
786	04/20/2010	00:19:29	0.045
787	04/20/2010	00:20:29	0.044
788	04/20/2010	00:21:29	0.044
789	04/20/2010	00:22:29	0.042
790	04/20/2010	00:23:29	0.045
791	04/20/2010	00:24:29	0.041
792	04/20/2010	00:25:29	0.044
793	04/20/2010	00:26:29	0.044
794	04/20/2010	00:27:29	0.045
795	04/20/2010	00:28:29	0.044
796	04/20/2010	00:29:29	0.044
797	04/20/2010	00:30:29	0.042
798	04/20/2010	00:31:29	0.042
799	04/20/2010	00:32:29	0.042
800	04/20/2010	00:33:29	0.045
801	04/20/2010	00:34:29	0.042
802	04/20/2010	00:35:29	0.046
803	04/20/2010	00:36:29	0.044
804	04/20/2010	00:37:29	0.043
805	04/20/2010	00:38:29	0.045
806	04/20/2010	00:39:29	0.046
807	04/20/2010	00:40:29	0.045
808	04/20/2010	00:41:29	0.049
809	04/20/2010	00:42:29	0.045
810	04/20/2010	00:43:29	0.044
811	04/20/2010	00:44:29	0.045
812	04/20/2010	00:45:29	0.045
813	04/20/2010	00:46:29	0.045
814	04/20/2010	00:47:29	0.049
815	04/20/2010	00:48:29	0.044
816	04/20/2010	00:49:29	0.044

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
817	04/20/2010	00:50:29	0.046
818	04/20/2010	00:51:29	0.046
819	04/20/2010	00:52:29	0.043
820	04/20/2010	00:53:29	0.045
821	04/20/2010	00:54:29	0.044
822	04/20/2010	00:55:29	0.044
823	04/20/2010	00:56:29	0.043
824	04/20/2010	00:57:29	0.046
825	04/20/2010	00:58:29	0.044
826	04/20/2010	00:59:29	0.045
827	04/20/2010	01:00:29	0.043
828	04/20/2010	01:01:29	0.045
829	04/20/2010	01:02:29	0.044
830	04/20/2010	01:03:29	0.042
831	04/20/2010	01:04:29	0.044
832	04/20/2010	01:05:29	0.044
833	04/20/2010	01:06:29	0.048
834	04/20/2010	01:07:29	0.044
835	04/20/2010	01:08:29	0.045
836	04/20/2010	01:09:29	0.045
837	04/20/2010	01:10:29	0.045
838	04/20/2010	01:11:29	0.041
839	04/20/2010	01:12:29	0.044
840	04/20/2010	01:13:29	0.047
841	04/20/2010	01:14:29	0.045
842	04/20/2010	01:15:29	0.047
843	04/20/2010	01:16:29	0.043
844	04/20/2010	01:17:29	0.046
845	04/20/2010	01:18:29	0.045
846	04/20/2010	01:19:29	0.047
847	04/20/2010	01:20:29	0.046
848	04/20/2010	01:21:29	0.045
849	04/20/2010	01:22:29	0.045
850	04/20/2010	01:23:29	0.046
851	04/20/2010	01:24:29	0.046
852	04/20/2010	01:25:29	0.047
853	04/20/2010	01:26:29	0.046
854	04/20/2010	01:27:29	0.044
855	04/20/2010	01:28:29	0.046
856	04/20/2010	01:29:29	0.047
857	04/20/2010	01:30:29	0.046
858	04/20/2010	01:31:29	0.043
859	04/20/2010	01:32:29	0.048
860	04/20/2010	01:33:29	0.042
861	04/20/2010	01:34:29	0.045
862	04/20/2010	01:35:29	0.042

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
863	04/20/2010	01:36:29	0.043
864	04/20/2010	01:37:29	0.047
865	04/20/2010	01:38:29	0.043
866	04/20/2010	01:39:29	0.042
867	04/20/2010	01:40:29	0.047
868	04/20/2010	01:41:29	0.041
869	04/20/2010	01:42:29	0.044
870	04/20/2010	01:43:29	0.044
871	04/20/2010	01:44:29	0.043
872	04/20/2010	01:45:29	0.045
873	04/20/2010	01:46:29	0.044
874	04/20/2010	01:47:29	0.046
875	04/20/2010	01:48:29	0.044
876	04/20/2010	01:49:29	0.046
877	04/20/2010	01:50:29	0.046
878	04/20/2010	01:51:29	0.048
879	04/20/2010	01:52:29	0.046
880	04/20/2010	01:53:29	0.048
881	04/20/2010	01:54:29	0.047
882	04/20/2010	01:55:29	0.044
883	04/20/2010	01:56:29	0.047
884	04/20/2010	01:57:29	0.047
885	04/20/2010	01:58:29	0.045
886	04/20/2010	01:59:29	0.045
887	04/20/2010	02:00:29	0.046
888	04/20/2010	02:01:29	0.043
889	04/20/2010	02:02:29	0.043
890	04/20/2010	02:03:29	0.045
891	04/20/2010	02:04:29	0.045
892	04/20/2010	02:05:29	0.045
893	04/20/2010	02:06:29	0.049
894	04/20/2010	02:07:29	0.044
895	04/20/2010	02:08:29	0.046
896	04/20/2010	02:09:29	0.047
897	04/20/2010	02:10:29	0.045
898	04/20/2010	02:11:29	0.046
899	04/20/2010	02:12:29	0.045
900	04/20/2010	02:13:29	0.048
901	04/20/2010	02:14:29	0.043
902	04/20/2010	02:15:29	0.045
903	04/20/2010	02:16:29	0.048
904	04/20/2010	02:17:29	0.046
905	04/20/2010	02:18:29	0.047
906	04/20/2010	02:19:29	0.046
907	04/20/2010	02:20:29	0.047
908	04/20/2010	02:21:29	0.051

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
909	04/20/2010	02:22:29	0.045
910	04/20/2010	02:23:29	0.050
911	04/20/2010	02:24:29	0.048
912	04/20/2010	02:25:29	0.046
913	04/20/2010	02:26:29	0.048
914	04/20/2010	02:27:29	0.047
915	04/20/2010	02:28:29	0.047
916	04/20/2010	02:29:29	0.047
917	04/20/2010	02:30:29	0.046
918	04/20/2010	02:31:29	0.046
919	04/20/2010	02:32:29	0.047
920	04/20/2010	02:33:29	0.047
921	04/20/2010	02:34:29	0.049
922	04/20/2010	02:35:29	0.053
923	04/20/2010	02:36:29	0.048
924	04/20/2010	02:37:29	0.053
925	04/20/2010	02:38:29	0.051
926	04/20/2010	02:39:29	0.053
927	04/20/2010	02:40:29	0.047
928	04/20/2010	02:41:29	0.047
929	04/20/2010	02:42:29	0.049
930	04/20/2010	02:43:29	0.050
931	04/20/2010	02:44:29	0.051
932	04/20/2010	02:45:29	0.051
933	04/20/2010	02:46:29	0.052
934	04/20/2010	02:47:29	0.049
935	04/20/2010	02:48:29	0.052
936	04/20/2010	02:49:29	0.053
937	04/20/2010	02:50:29	0.050
938	04/20/2010	02:51:29	0.049
939	04/20/2010	02:52:29	0.049
940	04/20/2010	02:53:29	0.050
941	04/20/2010	02:54:29	0.048
942	04/20/2010	02:55:29	0.051
943	04/20/2010	02:56:29	0.050
944	04/20/2010	02:57:29	0.052
945	04/20/2010	02:58:29	0.050
946	04/20/2010	02:59:29	0.050
947	04/20/2010	03:00:29	0.048
948	04/20/2010	03:01:29	0.052
949	04/20/2010	03:02:29	0.050
950	04/20/2010	03:03:29	0.056
951	04/20/2010	03:04:29	0.051
952	04/20/2010	03:05:29	0.050
953	04/20/2010	03:06:29	0.050
954	04/20/2010	03:07:29	0.049

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
955	04/20/2010	03:08:29	0.051
956	04/20/2010	03:09:29	0.052
957	04/20/2010	03:10:29	0.048
958	04/20/2010	03:11:29	0.050
959	04/20/2010	03:12:29	0.051
960	04/20/2010	03:13:29	0.051
961	04/20/2010	03:14:29	0.048
962	04/20/2010	03:15:29	0.050
963	04/20/2010	03:16:29	0.052
964	04/20/2010	03:17:29	0.053
965	04/20/2010	03:18:29	0.051
966	04/20/2010	03:19:29	0.052
967	04/20/2010	03:20:29	0.053
968	04/20/2010	03:21:29	0.051
969	04/20/2010	03:22:29	0.053
970	04/20/2010	03:23:29	0.056
971	04/20/2010	03:24:29	0.055
972	04/20/2010	03:25:29	0.052
973	04/20/2010	03:26:29	0.051
974	04/20/2010	03:27:29	0.051
975	04/20/2010	03:28:29	0.048
976	04/20/2010	03:29:29	0.053
977	04/20/2010	03:30:29	0.051
978	04/20/2010	03:31:29	0.052
979	04/20/2010	03:32:29	0.064
980	04/20/2010	03:33:29	0.057
981	04/20/2010	03:34:29	0.057
982	04/20/2010	03:35:29	0.054
983	04/20/2010	03:36:29	0.052
984	04/20/2010	03:37:29	0.060
985	04/20/2010	03:38:29	0.051
986	04/20/2010	03:39:29	0.046
987	04/20/2010	03:40:29	0.054
988	04/20/2010	03:41:29	0.070
989	04/20/2010	03:42:29	0.061
990	04/20/2010	03:43:29	0.055
991	04/20/2010	03:44:29	0.052
992	04/20/2010	03:45:29	0.058
993	04/20/2010	03:46:29	0.055
994	04/20/2010	03:47:29	0.050
995	04/20/2010	03:48:29	0.050
996	04/20/2010	03:49:29	0.053
997	04/20/2010	03:50:29	0.056
998	04/20/2010	03:51:29	0.053
999	04/20/2010	03:52:29	0.054
1000	04/20/2010	03:53:29	0.053

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1001	04/20/2010	03:54:29	0.054
1002	04/20/2010	03:55:29	0.056
1003	04/20/2010	03:56:29	0.059
1004	04/20/2010	03:57:29	0.061
1005	04/20/2010	03:58:29	0.062
1006	04/20/2010	03:59:29	0.058
1007	04/20/2010	04:00:29	0.054
1008	04/20/2010	04:01:29	0.055
1009	04/20/2010	04:02:29	0.058
1010	04/20/2010	04:03:29	0.054
1011	04/20/2010	04:04:29	0.050
1012	04/20/2010	04:05:29	0.052
1013	04/20/2010	04:06:29	0.054
1014	04/20/2010	04:07:29	0.049
1015	04/20/2010	04:08:29	0.048
1016	04/20/2010	04:09:29	0.048
1017	04/20/2010	04:10:29	0.054
1018	04/20/2010	04:11:29	0.047
1019	04/20/2010	04:12:29	0.046
1020	04/20/2010	04:13:29	0.048
1021	04/20/2010	04:14:29	0.052
1022	04/20/2010	04:15:29	0.049
1023	04/20/2010	04:16:29	0.050
1024	04/20/2010	04:17:29	0.048
1025	04/20/2010	04:18:29	0.048
1026	04/20/2010	04:19:29	0.045
1027	04/20/2010	04:20:29	0.049
1028	04/20/2010	04:21:29	0.050
1029	04/20/2010	04:22:29	0.048
1030	04/20/2010	04:23:29	0.048
1031	04/20/2010	04:24:29	0.049
1032	04/20/2010	04:25:29	0.049
1033	04/20/2010	04:26:29	0.051
1034	04/20/2010	04:27:29	0.049
1035	04/20/2010	04:28:29	0.050
1036	04/20/2010	04:29:29	0.045
1037	04/20/2010	04:30:29	0.051
1038	04/20/2010	04:31:29	0.055
1039	04/20/2010	04:32:29	0.056
1040	04/20/2010	04:33:29	0.058
1041	04/20/2010	04:34:29	0.059
1042	04/20/2010	04:35:29	0.061
1043	04/20/2010	04:36:29	0.059
1044	04/20/2010	04:37:29	0.054
1045	04/20/2010	04:38:29	0.056
1046	04/20/2010	04:39:29	0.052

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1047	04/20/2010	04:40:29	0.058
1048	04/20/2010	04:41:29	0.054
1049	04/20/2010	04:42:29	0.055
1050	04/20/2010	04:43:29	0.055
1051	04/20/2010	04:44:29	0.051
1052	04/20/2010	04:45:29	0.056
1053	04/20/2010	04:46:29	0.054
1054	04/20/2010	04:47:29	0.054
1055	04/20/2010	04:48:29	0.055
1056	04/20/2010	04:49:29	0.058
1057	04/20/2010	04:50:29	0.060
1058	04/20/2010	04:51:29	0.054
1059	04/20/2010	04:52:29	0.056
1060	04/20/2010	04:53:29	0.058
1061	04/20/2010	04:54:29	0.061
1062	04/20/2010	04:55:29	0.055
1063	04/20/2010	04:56:29	0.058
1064	04/20/2010	04:57:29	0.057
1065	04/20/2010	04:58:29	0.055
1066	04/20/2010	04:59:29	0.053
1067	04/20/2010	05:00:29	0.059
1068	04/20/2010	05:01:29	0.054
1069	04/20/2010	05:02:29	0.053
1070	04/20/2010	05:03:29	0.053
1071	04/20/2010	05:04:29	0.057
1072	04/20/2010	05:05:29	0.055
1073	04/20/2010	05:06:29	0.058
1074	04/20/2010	05:07:29	0.058
1075	04/20/2010	05:08:29	0.058
1076	04/20/2010	05:09:29	0.058
1077	04/20/2010	05:10:29	0.065
1078	04/20/2010	05:11:29	0.060
1079	04/20/2010	05:12:29	0.066
1080	04/20/2010	05:13:29	0.064
1081	04/20/2010	05:14:29	0.063
1082	04/20/2010	05:15:29	0.062
1083	04/20/2010	05:16:29	0.062
1084	04/20/2010	05:17:29	0.060
1085	04/20/2010	05:18:29	0.062
1086	04/20/2010	05:19:29	0.065
1087	04/20/2010	05:20:29	0.064
1088	04/20/2010	05:21:29	0.064
1089	04/20/2010	05:22:29	0.061
1090	04/20/2010	05:23:29	0.064
1091	04/20/2010	05:24:29	0.064
1092	04/20/2010	05:25:29	0.057

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1093	04/20/2010	05:26:29	0.058
1094	04/20/2010	05:27:29	0.056
1095	04/20/2010	05:28:29	0.061
1096	04/20/2010	05:29:29	0.056
1097	04/20/2010	05:30:29	0.055
1098	04/20/2010	05:31:29	0.063
1099	04/20/2010	05:32:29	0.062
1100	04/20/2010	05:33:29	0.066
1101	04/20/2010	05:34:29	0.061
1102	04/20/2010	05:35:29	0.073
1103	04/20/2010	05:36:29	0.071
1104	04/20/2010	05:37:29	0.071
1105	04/20/2010	05:38:29	0.070
1106	04/20/2010	05:39:29	0.073
1107	04/20/2010	05:40:29	0.073
1108	04/20/2010	05:41:29	0.070
1109	04/20/2010	05:42:29	0.070
1110	04/20/2010	05:43:29	0.072
1111	04/20/2010	05:44:29	0.068
1112	04/20/2010	05:45:29	0.072
1113	04/20/2010	05:46:29	0.074
1114	04/20/2010	05:47:29	0.075
1115	04/20/2010	05:48:29	0.078
1116	04/20/2010	05:49:29	0.076
1117	04/20/2010	05:50:29	0.070
1118	04/20/2010	05:51:29	0.071
1119	04/20/2010	05:52:29	0.073
1120	04/20/2010	05:53:29	0.075
1121	04/20/2010	05:54:29	0.074
1122	04/20/2010	05:55:29	0.078
1123	04/20/2010	05:56:29	0.080
1124	04/20/2010	05:57:29	0.073
1125	04/20/2010	05:58:29	0.074
1126	04/20/2010	05:59:29	0.078
1127	04/20/2010	06:00:29	0.077
1128	04/20/2010	06:01:29	0.076
1129	04/20/2010	06:02:29	0.081
1130	04/20/2010	06:03:29	0.085
1131	04/20/2010	06:04:29	0.085
1132	04/20/2010	06:05:29	0.079
1133	04/20/2010	06:06:29	0.084
1134	04/20/2010	06:07:29	0.089
1135	04/20/2010	06:08:29	0.081
1136	04/20/2010	06:09:29	0.081
1137	04/20/2010	06:10:29	0.089
1138	04/20/2010	06:11:29	0.083

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1139	04/20/2010	06:12:29	0.083
1140	04/20/2010	06:13:29	0.080
1141	04/20/2010	06:14:29	0.078
1142	04/20/2010	06:15:29	0.094
1143	04/20/2010	06:16:29	0.088
1144	04/20/2010	06:17:29	0.089
1145	04/20/2010	06:18:29	0.078
1146	04/20/2010	06:19:29	0.083
1147	04/20/2010	06:20:29	0.085
1148	04/20/2010	06:21:29	0.084
1149	04/20/2010	06:22:29	0.077
1150	04/20/2010	06:23:29	0.076
1151	04/20/2010	06:24:29	0.078
1152	04/20/2010	06:25:29	0.076
1153	04/20/2010	06:26:29	0.078
1154	04/20/2010	06:27:29	0.081
1155	04/20/2010	06:28:29	0.088
1156	04/20/2010	06:29:29	0.082
1157	04/20/2010	06:30:29	0.081
1158	04/20/2010	06:31:29	0.082
1159	04/20/2010	06:32:29	0.081
1160	04/20/2010	06:33:29	0.077
1161	04/20/2010	06:34:29	0.080
1162	04/20/2010	06:35:29	0.079
1163	04/20/2010	06:36:29	0.081
1164	04/20/2010	06:37:29	0.089
1165	04/20/2010	06:38:29	0.086
1166	04/20/2010	06:39:29	0.084
1167	04/20/2010	06:40:29	0.085
1168	04/20/2010	06:41:29	0.090
1169	04/20/2010	06:42:29	0.093
1170	04/20/2010	06:43:29	0.089
1171	04/20/2010	06:44:29	0.085
1172	04/20/2010	06:45:29	0.082
1173	04/20/2010	06:46:29	0.077
1174	04/20/2010	06:47:29	0.087
1175	04/20/2010	06:48:29	0.085
1176	04/20/2010	06:49:29	0.085
1177	04/20/2010	06:50:29	0.088
1178	04/20/2010	06:51:29	0.086
1179	04/20/2010	06:52:29	0.085
1180	04/20/2010	06:53:29	0.085
1181	04/20/2010	06:54:29	0.081
1182	04/20/2010	06:55:29	0.080
1183	04/20/2010	06:56:29	0.084
1184	04/20/2010	06:57:29	0.083

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1185	04/20/2010	06:58:29	0.079
1186	04/20/2010	06:59:29	0.078
1187	04/20/2010	07:00:29	0.081
1188	04/20/2010	07:01:29	0.075
1189	04/20/2010	07:02:29	0.074
1190	04/20/2010	07:03:29	0.072
1191	04/20/2010	07:04:29	0.068
1192	04/20/2010	07:05:29	0.072
1193	04/20/2010	07:06:29	0.061
1194	04/20/2010	07:07:29	0.070
1195	04/20/2010	07:08:29	0.067
1196	04/20/2010	07:09:29	0.063
1197	04/20/2010	07:10:29	0.067
1198	04/20/2010	07:11:29	0.069
1199	04/20/2010	07:12:29	0.067
1200	04/20/2010	07:13:29	0.069
1201	04/20/2010	07:14:29	0.067
1202	04/20/2010	07:15:29	0.062
1203	04/20/2010	07:16:29	0.065
1204	04/20/2010	07:17:29	0.065
1205	04/20/2010	07:18:29	0.068
1206	04/20/2010	07:19:29	0.067
1207	04/20/2010	07:20:29	0.066
1208	04/20/2010	07:21:29	0.069
1209	04/20/2010	07:22:29	0.068
1210	04/20/2010	07:23:29	0.069
1211	04/20/2010	07:24:29	0.066
1212	04/20/2010	07:25:29	0.075
1213	04/20/2010	07:26:29	0.066
1214	04/20/2010	07:27:29	0.088
1215	04/20/2010	07:28:29	0.073
1216	04/20/2010	07:29:29	0.077
1217	04/20/2010	07:30:29	0.078
1218	04/20/2010	07:31:29	0.080
1219	04/20/2010	07:32:29	0.074
1220	04/20/2010	07:33:29	0.073
1221	04/20/2010	07:34:29	0.071
1222	04/20/2010	07:35:29	0.061
1223	04/20/2010	07:36:29	0.055
1224	04/20/2010	07:37:29	0.055
1225	04/20/2010	07:38:29	0.058
1226	04/20/2010	07:39:29	0.060
1227	04/20/2010	07:40:29	0.056
1228	04/20/2010	07:41:29	0.050
1229	04/20/2010	07:42:29	0.050
1230	04/20/2010	07:43:29	0.052

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1231	04/20/2010	07:44:29	0.051
1232	04/20/2010	07:45:29	0.054
1233	04/20/2010	07:46:29	0.048
1234	04/20/2010	07:47:29	0.066
1235	04/20/2010	07:48:29	0.061
1236	04/20/2010	07:49:29	0.058
1237	04/20/2010	07:50:29	0.054
1238	04/20/2010	07:51:29	0.036
1239	04/20/2010	07:52:29	0.039
1240	04/20/2010	07:53:29	0.037
1241	04/20/2010	07:54:29	0.036
1242	04/20/2010	07:55:29	0.037
1243	04/20/2010	07:56:29	0.037
1244	04/20/2010	07:57:29	0.033
1245	04/20/2010	07:58:29	0.041
1246	04/20/2010	07:59:29	0.038
1247	04/20/2010	08:00:29	0.044
1248	04/20/2010	08:01:29	0.042
1249	04/20/2010	08:02:29	0.040
1250	04/20/2010	08:03:29	0.039
1251	04/20/2010	08:04:29	0.042
1252	04/20/2010	08:05:29	0.047
1253	04/20/2010	08:06:29	0.044
1254	04/20/2010	08:07:29	0.036
1255	04/20/2010	08:08:29	0.044
1256	04/20/2010	08:09:29	0.040
1257	04/20/2010	08:10:29	0.039
1258	04/20/2010	08:11:29	0.047
1259	04/20/2010	08:12:29	0.044
1260	04/20/2010	08:13:29	0.037
1261	04/20/2010	08:14:29	0.032
1262	04/20/2010	08:15:29	0.034
1263	04/20/2010	08:16:29	0.030
1264	04/20/2010	08:17:29	0.030
1265	04/20/2010	08:18:29	0.033
1266	04/20/2010	08:19:29	0.040
1267	04/20/2010	08:20:29	0.038
1268	04/20/2010	08:21:29	0.030
1269	04/20/2010	08:22:29	0.034
1270	04/20/2010	08:23:29	0.045
1271	04/20/2010	08:24:29	0.034
1272	04/20/2010	08:25:29	0.035
1273	04/20/2010	08:26:29	0.037
1274	04/20/2010	08:27:29	0.039
1275	04/20/2010	08:28:29	0.033
1276	04/20/2010	08:29:29	0.034

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1277	04/20/2010	08:30:29	0.028
1278	04/20/2010	08:31:29	0.034
1279	04/20/2010	08:32:29	0.029
1280	04/20/2010	08:33:29	0.025
1281	04/20/2010	08:34:29	0.023
1282	04/20/2010	08:35:29	0.027
1283	04/20/2010	08:36:29	0.028
1284	04/20/2010	08:37:29	0.035
1285	04/20/2010	08:38:29	0.037
1286	04/20/2010	08:39:29	0.042
1287	04/20/2010	08:40:29	0.037
1288	04/20/2010	08:41:29	0.033
1289	04/20/2010	08:42:29	0.031
1290	04/20/2010	08:43:29	0.033
1291	04/20/2010	08:44:29	0.031
1292	04/20/2010	08:45:29	0.036
1293	04/20/2010	08:46:29	0.032
1294	04/20/2010	08:47:29	0.029
1295	04/20/2010	08:48:29	0.027
1296	04/20/2010	08:49:29	0.036
1297	04/20/2010	08:50:29	0.028
1298	04/20/2010	08:51:29	0.031
1299	04/20/2010	08:52:29	0.029
1300	04/20/2010	08:53:29	0.029
1301	04/20/2010	08:54:29	0.028
1302	04/20/2010	08:55:29	0.027
1303	04/20/2010	08:56:29	0.023
1304	04/20/2010	08:57:29	0.023
1305	04/20/2010	08:58:29	0.032
1306	04/20/2010	08:59:29	0.030
1307	04/20/2010	09:00:29	0.028
1308	04/20/2010	09:01:29	0.030
1309	04/20/2010	09:02:29	0.026
1310	04/20/2010	09:03:29	0.030
1311	04/20/2010	09:04:29	0.029
1312	04/20/2010	09:05:29	0.030
1313	04/20/2010	09:06:29	0.027
1314	04/20/2010	09:07:29	0.025
1315	04/20/2010	09:08:29	0.027
1316	04/20/2010	09:09:29	0.024
1317	04/20/2010	09:10:29	0.031
1318	04/20/2010	09:11:29	0.033
1319	04/20/2010	09:12:29	0.031
1320	04/20/2010	09:13:29	0.028
1321	04/20/2010	09:14:29	0.036
1322	04/20/2010	09:15:29	0.031

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1323	04/20/2010	09:16:29	0.032
1324	04/20/2010	09:17:29	0.032
1325	04/20/2010	09:18:29	0.023
1326	04/20/2010	09:19:29	0.023
1327	04/20/2010	09:20:29	0.027
1328	04/20/2010	09:21:29	0.037
1329	04/20/2010	09:22:29	0.024
1330	04/20/2010	09:23:29	0.045
1331	04/20/2010	09:24:29	0.025
1332	04/20/2010	09:25:29	0.028
1333	04/20/2010	09:26:29	0.028
1334	04/20/2010	09:27:29	0.027
1335	04/20/2010	09:28:29	0.029
1336	04/20/2010	09:29:29	0.026
1337	04/20/2010	09:30:29	0.027
1338	04/20/2010	09:31:29	0.029
1339	04/20/2010	09:32:29	0.036
1340	04/20/2010	09:33:29	0.033
1341	04/20/2010	09:34:29	0.026
1342	04/20/2010	09:35:29	0.028
1343	04/20/2010	09:36:29	0.027
1344	04/20/2010	09:37:29	0.023
1345	04/20/2010	09:38:29	0.022
1346	04/20/2010	09:39:29	0.027
1347	04/20/2010	09:40:29	0.027
1348	04/20/2010	09:41:29	0.037
1349	04/20/2010	09:42:29	0.036
1350	04/20/2010	09:43:29	0.038
1351	04/20/2010	09:44:29	0.034
1352	04/20/2010	09:45:29	0.028
1353	04/20/2010	09:46:29	0.028
1354	04/20/2010	09:47:29	0.029
1355	04/20/2010	09:48:29	0.026
1356	04/20/2010	09:49:29	0.026
1357	04/20/2010	09:50:29	0.027
1358	04/20/2010	09:51:29	0.023
1359	04/20/2010	09:52:29	0.028
1360	04/20/2010	09:53:29	0.035
1361	04/20/2010	09:54:29	0.032
1362	04/20/2010	09:55:29	0.027
1363	04/20/2010	09:56:29	0.032
1364	04/20/2010	09:57:29	0.038
1365	04/20/2010	09:58:29	0.036
1366	04/20/2010	09:59:29	0.030
1367	04/20/2010	10:00:29	0.032
1368	04/20/2010	10:01:29	0.052

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1369	04/20/2010	10:02:29	0.047
1370	04/20/2010	10:03:29	0.043
1371	04/20/2010	10:04:29	0.022
1372	04/20/2010	10:05:29	0.070
1373	04/20/2010	10:06:29	0.046
1374	04/20/2010	10:07:29	0.084
1375	04/20/2010	10:08:29	0.034
1376	04/20/2010	10:09:29	0.039
1377	04/20/2010	10:10:29	0.027
1378	04/20/2010	10:11:29	0.027
1379	04/20/2010	10:12:29	0.024
1380	04/20/2010	10:13:29	0.022
1381	04/20/2010	10:14:29	0.029
1382	04/20/2010	10:15:29	0.034
1383	04/20/2010	10:16:29	0.028
1384	04/20/2010	10:17:29	0.032
1385	04/20/2010	10:18:29	0.031
1386	04/20/2010	10:19:29	0.026
1387	04/20/2010	10:20:29	0.030
1388	04/20/2010	10:21:29	0.026
1389	04/20/2010	10:22:29	0.014
1390	04/20/2010	10:23:29	0.012
1391	04/20/2010	10:24:29	0.025
1392	04/20/2010	10:25:29	0.022
1393	04/20/2010	10:26:29	0.022
1394	04/20/2010	10:27:29	0.021
1395	04/20/2010	10:28:29	0.017
1396	04/20/2010	10:29:29	0.019
1397	04/20/2010	10:30:29	0.027
1398	04/20/2010	10:31:29	0.029
1399	04/20/2010	10:32:29	0.032
1400	04/20/2010	10:33:29	0.022
1401	04/20/2010	10:34:29	0.024
1402	04/20/2010	10:35:29	0.020
1403	04/20/2010	10:36:29	0.039
1404	04/20/2010	10:37:29	0.023
1405	04/20/2010	10:38:29	0.029
1406	04/20/2010	10:39:29	0.019
1407	04/20/2010	10:40:29	0.029
1408	04/20/2010	10:41:29	0.030
1409	04/20/2010	10:42:29	0.028
1410	04/20/2010	10:43:29	0.039
1411	04/20/2010	10:44:29	0.030
1412	04/20/2010	10:45:29	0.027
1413	04/20/2010	10:46:29	0.022
1414	04/20/2010	10:47:29	0.023

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1415	04/20/2010	10:48:29	0.023
1416	04/20/2010	10:49:29	0.020
1417	04/20/2010	10:50:29	0.020
1418	04/20/2010	10:51:29	0.016
1419	04/20/2010	10:52:29	0.019
1420	04/20/2010	10:53:29	0.035
1421	04/20/2010	10:54:29	0.041
1422	04/20/2010	10:55:29	0.044
1423	04/20/2010	10:56:29	0.052
1424	04/20/2010	10:57:29	0.050
1425	04/20/2010	10:58:29	0.033
1426	04/20/2010	10:59:29	0.028
1427	04/20/2010	11:00:29	0.027
1428	04/20/2010	11:01:29	0.031
1429	04/20/2010	11:02:29	0.047
1430	04/20/2010	11:03:29	0.036
1431	04/20/2010	11:04:29	0.029
1432	04/20/2010	11:05:29	0.037
1433	04/20/2010	11:06:29	0.028
1434	04/20/2010	11:07:29	0.038
1435	04/20/2010	11:08:29	0.036
1436	04/20/2010	11:09:29	0.029
1437	04/20/2010	11:10:29	0.025
1438	04/20/2010	11:11:29	0.024
1439	04/20/2010	11:12:29	0.039
1440	04/20/2010	11:13:29	0.036
1441	04/20/2010	11:14:29	0.019
1442	04/20/2010	11:15:29	0.040
1443	04/20/2010	11:16:29	0.034
1444	04/20/2010	11:17:29	0.054
1445	04/20/2010	11:18:29	0.047
1446	04/20/2010	11:19:29	0.040
1447	04/20/2010	11:20:29	0.024
1448	04/20/2010	11:21:29	0.027
1449	04/20/2010	11:22:29	0.051
1450	04/20/2010	11:23:29	0.062
1451	04/20/2010	11:24:29	0.047
1452	04/20/2010	11:25:29	0.040
1453	04/20/2010	11:26:29	0.023
1454	04/20/2010	11:27:29	0.048
1455	04/20/2010	11:28:29	0.073
1456	04/20/2010	11:29:29	0.075
1457	04/20/2010	11:30:29	0.045
1458	04/20/2010	11:31:29	0.040
1459	04/20/2010	11:32:29	0.042
1460	04/20/2010	11:33:29	0.038

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1461	04/20/2010	11:34:29	0.032
1462	04/20/2010	11:35:29	0.022
1463	04/20/2010	11:36:29	0.027
1464	04/20/2010	11:37:29	0.033
1465	04/20/2010	11:38:29	0.020
1466	04/20/2010	11:39:29	0.018
1467	04/20/2010	11:40:29	0.024
1468	04/20/2010	11:41:29	0.029
1469	04/20/2010	11:42:29	0.028
1470	04/20/2010	11:43:29	0.038
1471	04/20/2010	11:44:29	0.062
1472	04/20/2010	11:45:29	0.046
1473	04/20/2010	11:46:29	0.047
1474	04/20/2010	11:47:29	0.039
1475	04/20/2010	11:48:29	0.060
1476	04/20/2010	11:49:29	0.036
1477	04/20/2010	11:50:29	0.030
1478	04/20/2010	11:51:29	0.026
1479	04/20/2010	11:52:29	0.025
1480	04/20/2010	11:53:29	0.024
1481	04/20/2010	11:54:29	0.016
1482	04/20/2010	11:55:29	0.021
1483	04/20/2010	11:56:29	0.022
1484	04/20/2010	11:57:29	0.026
1485	04/20/2010	11:58:29	0.018
1486	04/20/2010	11:59:29	0.019
1487	04/20/2010	12:00:29	0.020
1488	04/20/2010	12:01:29	0.019
1489	04/20/2010	12:02:29	0.047
1490	04/20/2010	12:03:29	0.030
1491	04/20/2010	12:04:29	0.028
1492	04/20/2010	12:05:29	0.031
1493	04/20/2010	12:06:29	0.023
1494	04/20/2010	12:07:29	0.022
1495	04/20/2010	12:08:29	0.018
1496	04/20/2010	12:09:29	0.016
1497	04/20/2010	12:10:29	0.017
1498	04/20/2010	12:11:29	0.076

Test 001

Harmony Hall Lift Station

Instrument		Data Properties	
Model	Dust Trak	Start Date	03/24/2010
Meter S/N	23567	Start Time	13:38:22
		Stop Date	03/25/2010
		Stop Time	14:10:22
		Total Time	1:00:32:00
		Logging Interval	60 seconds

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1	03/24/2010	13:39:22	0.018
2	03/24/2010	13:40:22	0.018
3	03/24/2010	13:41:22	0.018
4	03/24/2010	13:42:22	0.018
5	03/24/2010	13:43:22	0.017
6	03/24/2010	13:44:22	0.020
7	03/24/2010	13:45:22	0.017
8	03/24/2010	13:46:22	0.020
9	03/24/2010	13:47:22	0.017
10	03/24/2010	13:48:22	0.018
11	03/24/2010	13:49:22	0.018
12	03/24/2010	13:50:22	0.018
13	03/24/2010	13:51:22	0.017
14	03/24/2010	13:52:22	0.017
15	03/24/2010	13:53:22	0.017
16	03/24/2010	13:54:22	0.017
17	03/24/2010	13:55:22	0.018
18	03/24/2010	13:56:22	0.016
19	03/24/2010	13:57:22	0.016
20	03/24/2010	13:58:22	0.016
21	03/24/2010	13:59:22	0.016
22	03/24/2010	14:00:22	0.019
23	03/24/2010	14:01:22	0.017
24	03/24/2010	14:02:22	0.017
25	03/24/2010	14:03:22	0.018
26	03/24/2010	14:04:22	0.016
27	03/24/2010	14:05:22	0.017
28	03/24/2010	14:06:22	0.016
29	03/24/2010	14:07:22	0.015
30	03/24/2010	14:08:22	0.017
31	03/24/2010	14:09:22	0.017
32	03/24/2010	14:10:22	0.016
33	03/24/2010	14:11:22	0.016
34	03/24/2010	14:12:22	0.019

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
35	03/24/2010	14:13:22	0.022
36	03/24/2010	14:14:22	0.018
37	03/24/2010	14:15:22	0.022
38	03/24/2010	14:16:22	0.021
39	03/24/2010	14:17:22	0.017
40	03/24/2010	14:18:22	0.017
41	03/24/2010	14:19:22	0.017
42	03/24/2010	14:20:22	0.018
43	03/24/2010	14:21:22	0.017
44	03/24/2010	14:22:22	0.018
45	03/24/2010	14:23:22	0.018
46	03/24/2010	14:24:22	0.019
47	03/24/2010	14:25:22	0.019
48	03/24/2010	14:26:22	0.018
49	03/24/2010	14:27:22	0.018
50	03/24/2010	14:28:22	0.019
51	03/24/2010	14:29:22	0.019
52	03/24/2010	14:30:22	0.019
53	03/24/2010	14:31:22	0.019
54	03/24/2010	14:32:22	0.026
55	03/24/2010	14:33:22	0.019
56	03/24/2010	14:34:22	0.018
57	03/24/2010	14:35:22	0.019
58	03/24/2010	14:36:22	0.020
59	03/24/2010	14:37:22	0.022
60	03/24/2010	14:38:22	0.019
61	03/24/2010	14:39:22	0.020
62	03/24/2010	14:40:22	0.020
63	03/24/2010	14:41:22	0.019
64	03/24/2010	14:42:22	0.019
65	03/24/2010	14:43:22	0.019
66	03/24/2010	14:44:22	0.019
67	03/24/2010	14:45:22	0.019
68	03/24/2010	14:46:22	0.020
69	03/24/2010	14:47:22	0.021
70	03/24/2010	14:48:22	0.020
71	03/24/2010	14:49:22	0.019
72	03/24/2010	14:50:22	0.022
73	03/24/2010	14:51:22	0.022
74	03/24/2010	14:52:22	0.021
75	03/24/2010	14:53:22	0.022
76	03/24/2010	14:54:22	0.022
77	03/24/2010	14:55:22	0.023
78	03/24/2010	14:56:22	0.020
79	03/24/2010	14:57:22	0.021
80	03/24/2010	14:58:22	0.025

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
81	03/24/2010	14:59:22	0.024
82	03/24/2010	15:00:22	0.023
83	03/24/2010	15:01:22	0.021
84	03/24/2010	15:02:22	0.020
85	03/24/2010	15:03:22	0.021
86	03/24/2010	15:04:22	0.023
87	03/24/2010	15:05:22	0.020
88	03/24/2010	15:06:22	0.021
89	03/24/2010	15:07:22	0.021
90	03/24/2010	15:08:22	0.021
91	03/24/2010	15:09:22	0.021
92	03/24/2010	15:10:22	0.021
93	03/24/2010	15:11:22	0.020
94	03/24/2010	15:12:22	0.021
95	03/24/2010	15:13:22	0.020
96	03/24/2010	15:14:22	0.024
97	03/24/2010	15:15:22	0.023
98	03/24/2010	15:16:22	0.022
99	03/24/2010	15:17:22	0.023
100	03/24/2010	15:18:22	0.023
101	03/24/2010	15:19:22	0.020
102	03/24/2010	15:20:22	0.021
103	03/24/2010	15:21:22	0.021
104	03/24/2010	15:22:22	0.020
105	03/24/2010	15:23:22	0.021
106	03/24/2010	15:24:22	0.020
107	03/24/2010	15:25:22	0.021
108	03/24/2010	15:26:22	0.020
109	03/24/2010	15:27:22	0.020
110	03/24/2010	15:28:22	0.022
111	03/24/2010	15:29:22	0.021
112	03/24/2010	15:30:22	0.022
113	03/24/2010	15:31:22	0.022
114	03/24/2010	15:32:22	0.023
115	03/24/2010	15:33:22	0.021
116	03/24/2010	15:34:22	0.021
117	03/24/2010	15:35:22	0.020
118	03/24/2010	15:36:22	0.021
119	03/24/2010	15:37:22	0.022
120	03/24/2010	15:38:22	0.020
121	03/24/2010	15:39:22	0.019
122	03/24/2010	15:40:22	0.020
123	03/24/2010	15:41:22	0.020
124	03/24/2010	15:42:22	0.022
125	03/24/2010	15:43:22	0.019
126	03/24/2010	15:44:22	0.020

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
127	03/24/2010	15:45:22	0.019
128	03/24/2010	15:46:22	0.019
129	03/24/2010	15:47:22	0.021
130	03/24/2010	15:48:22	0.020
131	03/24/2010	15:49:22	0.020
132	03/24/2010	15:50:22	0.020
133	03/24/2010	15:51:22	0.022
134	03/24/2010	15:52:22	0.021
135	03/24/2010	15:53:22	0.021
136	03/24/2010	15:54:22	0.022
137	03/24/2010	15:55:22	0.021
138	03/24/2010	15:56:22	0.021
139	03/24/2010	15:57:22	0.025
140	03/24/2010	15:58:22	0.020
141	03/24/2010	15:59:22	0.021
142	03/24/2010	16:00:22	0.021
143	03/24/2010	16:01:22	0.021
144	03/24/2010	16:02:22	0.022
145	03/24/2010	16:03:22	0.022
146	03/24/2010	16:04:22	0.021
147	03/24/2010	16:05:22	0.022
148	03/24/2010	16:06:22	0.022
149	03/24/2010	16:07:22	0.023
150	03/24/2010	16:08:22	0.022
151	03/24/2010	16:09:22	0.021
152	03/24/2010	16:10:22	0.021
153	03/24/2010	16:11:22	0.020
154	03/24/2010	16:12:22	0.020
155	03/24/2010	16:13:22	0.021
156	03/24/2010	16:14:22	0.021
157	03/24/2010	16:15:22	0.021
158	03/24/2010	16:16:22	0.020
159	03/24/2010	16:17:22	0.022
160	03/24/2010	16:18:22	0.021
161	03/24/2010	16:19:22	0.022
162	03/24/2010	16:20:22	0.022
163	03/24/2010	16:21:22	0.020
164	03/24/2010	16:22:22	0.021
165	03/24/2010	16:23:22	0.021
166	03/24/2010	16:24:22	0.019
167	03/24/2010	16:25:22	0.020
168	03/24/2010	16:26:22	0.020
169	03/24/2010	16:27:22	0.021
170	03/24/2010	16:28:22	0.021
171	03/24/2010	16:29:22	0.023
172	03/24/2010	16:30:22	0.022

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
173	03/24/2010	16:31:22	0.020
174	03/24/2010	16:32:22	0.020
175	03/24/2010	16:33:22	0.023
176	03/24/2010	16:34:22	0.021
177	03/24/2010	16:35:22	0.021
178	03/24/2010	16:36:22	0.023
179	03/24/2010	16:37:22	0.024
180	03/24/2010	16:38:22	0.023
181	03/24/2010	16:39:22	0.022
182	03/24/2010	16:40:22	0.022
183	03/24/2010	16:41:22	0.021
184	03/24/2010	16:42:22	0.023
185	03/24/2010	16:43:22	0.020
186	03/24/2010	16:44:22	0.019
187	03/24/2010	16:45:22	0.024
188	03/24/2010	16:46:22	0.020
189	03/24/2010	16:47:22	0.020
190	03/24/2010	16:48:22	0.021
191	03/24/2010	16:49:22	0.021
192	03/24/2010	16:50:22	0.022
193	03/24/2010	16:51:22	0.020
194	03/24/2010	16:52:22	0.021
195	03/24/2010	16:53:22	0.022
196	03/24/2010	16:54:22	0.022
197	03/24/2010	16:55:22	0.022
198	03/24/2010	16:56:22	0.021
199	03/24/2010	16:57:22	0.022
200	03/24/2010	16:58:22	0.023
201	03/24/2010	16:59:22	0.024
202	03/24/2010	17:00:22	0.020
203	03/24/2010	17:01:22	0.022
204	03/24/2010	17:02:22	0.022
205	03/24/2010	17:03:22	0.024
206	03/24/2010	17:04:22	0.023
207	03/24/2010	17:05:22	0.019
208	03/24/2010	17:06:22	0.020
209	03/24/2010	17:07:22	0.018
210	03/24/2010	17:08:22	0.019
211	03/24/2010	17:09:22	0.019
212	03/24/2010	17:10:22	0.024
213	03/24/2010	17:11:22	0.020
214	03/24/2010	17:12:22	0.019
215	03/24/2010	17:13:22	0.018
216	03/24/2010	17:14:22	0.019
217	03/24/2010	17:15:22	0.018
218	03/24/2010	17:16:22	0.019

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
219	03/24/2010	17:17:22	0.019
220	03/24/2010	17:18:22	0.019
221	03/24/2010	17:19:22	0.019
222	03/24/2010	17:20:22	0.018
223	03/24/2010	17:21:22	0.018
224	03/24/2010	17:22:22	0.017
225	03/24/2010	17:23:22	0.019
226	03/24/2010	17:24:22	0.019
227	03/24/2010	17:25:22	0.020
228	03/24/2010	17:26:22	0.020
229	03/24/2010	17:27:22	0.019
230	03/24/2010	17:28:22	0.019
231	03/24/2010	17:29:22	0.020
232	03/24/2010	17:30:22	0.021
233	03/24/2010	17:31:22	0.020
234	03/24/2010	17:32:22	0.019
235	03/24/2010	17:33:22	0.019
236	03/24/2010	17:34:22	0.019
237	03/24/2010	17:35:22	0.018
238	03/24/2010	17:36:22	0.018
239	03/24/2010	17:37:22	0.018
240	03/24/2010	17:38:22	0.017
241	03/24/2010	17:39:22	0.017
242	03/24/2010	17:40:22	0.017
243	03/24/2010	17:41:22	0.016
244	03/24/2010	17:42:22	0.017
245	03/24/2010	17:43:22	0.016
246	03/24/2010	17:44:22	0.016
247	03/24/2010	17:45:22	0.017
248	03/24/2010	17:46:22	0.016
249	03/24/2010	17:47:22	0.017
250	03/24/2010	17:48:22	0.016
251	03/24/2010	17:49:22	0.017
252	03/24/2010	17:50:22	0.016
253	03/24/2010	17:51:22	0.016
254	03/24/2010	17:52:22	0.018
255	03/24/2010	17:53:22	0.018
256	03/24/2010	17:54:22	0.016
257	03/24/2010	17:55:22	0.017
258	03/24/2010	17:56:22	0.018
259	03/24/2010	17:57:22	0.017
260	03/24/2010	17:58:22	0.019
261	03/24/2010	17:59:22	0.018
262	03/24/2010	18:00:22	0.020
263	03/24/2010	18:01:22	0.019
264	03/24/2010	18:02:22	0.019

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
265	03/24/2010	18:03:22	0.018
266	03/24/2010	18:04:22	0.018
267	03/24/2010	18:05:22	0.018
268	03/24/2010	18:06:22	0.018
269	03/24/2010	18:07:22	0.019
270	03/24/2010	18:08:22	0.019
271	03/24/2010	18:09:22	0.019
272	03/24/2010	18:10:22	0.020
273	03/24/2010	18:11:22	0.020
274	03/24/2010	18:12:22	0.031
275	03/24/2010	18:13:22	0.021
276	03/24/2010	18:14:22	0.021
277	03/24/2010	18:15:22	0.021
278	03/24/2010	18:16:22	0.020
279	03/24/2010	18:17:22	0.021
280	03/24/2010	18:18:22	0.020
281	03/24/2010	18:19:22	0.022
282	03/24/2010	18:20:22	0.020
283	03/24/2010	18:21:22	0.020
284	03/24/2010	18:22:22	0.020
285	03/24/2010	18:23:22	0.022
286	03/24/2010	18:24:22	0.021
287	03/24/2010	18:25:22	0.023
288	03/24/2010	18:26:22	0.021
289	03/24/2010	18:27:22	0.023
290	03/24/2010	18:28:22	0.024
291	03/24/2010	18:29:22	0.024
292	03/24/2010	18:30:22	0.024
293	03/24/2010	18:31:22	0.024
294	03/24/2010	18:32:22	0.024
295	03/24/2010	18:33:22	0.024
296	03/24/2010	18:34:22	0.022
297	03/24/2010	18:35:22	0.024
298	03/24/2010	18:36:22	0.023
299	03/24/2010	18:37:22	0.023
300	03/24/2010	18:38:22	0.022
301	03/24/2010	18:39:22	0.024
302	03/24/2010	18:40:22	0.026
303	03/24/2010	18:41:22	0.024
304	03/24/2010	18:42:22	0.058
305	03/24/2010	18:43:22	0.032
306	03/24/2010	18:44:22	0.024
307	03/24/2010	18:45:22	0.022
308	03/24/2010	18:46:22	0.021
309	03/24/2010	18:47:22	0.021
310	03/24/2010	18:48:22	0.022

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
311	03/24/2010	18:49:22	0.021
312	03/24/2010	18:50:22	0.021
313	03/24/2010	18:51:22	0.022
314	03/24/2010	18:52:22	0.021
315	03/24/2010	18:53:22	0.022
316	03/24/2010	18:54:22	0.022
317	03/24/2010	18:55:22	0.021
318	03/24/2010	18:56:22	0.021
319	03/24/2010	18:57:22	0.022
320	03/24/2010	18:58:22	0.024
321	03/24/2010	18:59:22	0.026
322	03/24/2010	19:00:22	0.025
323	03/24/2010	19:01:22	0.026
324	03/24/2010	19:02:22	0.026
325	03/24/2010	19:03:22	0.026
326	03/24/2010	19:04:22	0.025
327	03/24/2010	19:05:22	0.026
328	03/24/2010	19:06:22	0.025
329	03/24/2010	19:07:22	0.025
330	03/24/2010	19:08:22	0.024
331	03/24/2010	19:09:22	0.025
332	03/24/2010	19:10:22	0.025
333	03/24/2010	19:11:22	0.025
334	03/24/2010	19:12:22	0.025
335	03/24/2010	19:13:22	0.026
336	03/24/2010	19:14:22	0.025
337	03/24/2010	19:15:22	0.025
338	03/24/2010	19:16:22	0.024
339	03/24/2010	19:17:22	0.025
340	03/24/2010	19:18:22	0.025
341	03/24/2010	19:19:22	0.025
342	03/24/2010	19:20:22	0.024
343	03/24/2010	19:21:22	0.025
344	03/24/2010	19:22:22	0.026
345	03/24/2010	19:23:22	0.026
346	03/24/2010	19:24:22	0.025
347	03/24/2010	19:25:22	0.024
348	03/24/2010	19:26:22	0.023
349	03/24/2010	19:27:22	0.025
350	03/24/2010	19:28:22	0.023
351	03/24/2010	19:29:22	0.023
352	03/24/2010	19:30:22	0.023
353	03/24/2010	19:31:22	0.025
354	03/24/2010	19:32:22	0.024
355	03/24/2010	19:33:22	0.023
356	03/24/2010	19:34:22	0.024

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
357	03/24/2010	19:35:22	0.024
358	03/24/2010	19:36:22	0.029
359	03/24/2010	19:37:22	0.022
360	03/24/2010	19:38:22	0.021
361	03/24/2010	19:39:22	0.019
362	03/24/2010	19:40:22	0.017
363	03/24/2010	19:41:22	0.018
364	03/24/2010	19:42:22	0.018
365	03/24/2010	19:43:22	0.018
366	03/24/2010	19:44:22	0.018
367	03/24/2010	19:45:22	0.017
368	03/24/2010	19:46:22	0.018
369	03/24/2010	19:47:22	0.016
370	03/24/2010	19:48:22	0.015
371	03/24/2010	19:49:22	0.014
372	03/24/2010	19:50:22	0.015
373	03/24/2010	19:51:22	0.014
374	03/24/2010	19:52:22	0.014
375	03/24/2010	19:53:22	0.016
376	03/24/2010	19:54:22	0.015
377	03/24/2010	19:55:22	0.016
378	03/24/2010	19:56:22	0.017
379	03/24/2010	19:57:22	0.014
380	03/24/2010	19:58:22	0.014
381	03/24/2010	19:59:22	0.016
382	03/24/2010	20:00:22	0.015
383	03/24/2010	20:01:22	0.013
384	03/24/2010	20:02:22	0.012
385	03/24/2010	20:03:22	0.013
386	03/24/2010	20:04:22	0.011
387	03/24/2010	20:05:22	0.012
388	03/24/2010	20:06:22	0.014
389	03/24/2010	20:07:22	0.011
390	03/24/2010	20:08:22	0.011
391	03/24/2010	20:09:22	0.010
392	03/24/2010	20:10:22	0.011
393	03/24/2010	20:11:22	0.014
394	03/24/2010	20:12:22	0.013
395	03/24/2010	20:13:22	0.015
396	03/24/2010	20:14:22	0.026
397	03/24/2010	20:15:22	0.019
398	03/24/2010	20:16:22	0.014
399	03/24/2010	20:17:22	0.015
400	03/24/2010	20:18:22	0.014
401	03/24/2010	20:19:22	0.014
402	03/24/2010	20:20:22	0.014

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
403	03/24/2010	20:21:22	0.014
404	03/24/2010	20:22:22	0.015
405	03/24/2010	20:23:22	0.014
406	03/24/2010	20:24:22	0.015
407	03/24/2010	20:25:22	0.015
408	03/24/2010	20:26:22	0.014
409	03/24/2010	20:27:22	0.015
410	03/24/2010	20:28:22	0.015
411	03/24/2010	20:29:22	0.014
412	03/24/2010	20:30:22	0.016
413	03/24/2010	20:31:22	0.014
414	03/24/2010	20:32:22	0.015
415	03/24/2010	20:33:22	0.015
416	03/24/2010	20:34:22	0.015
417	03/24/2010	20:35:22	0.016
418	03/24/2010	20:36:22	0.016
419	03/24/2010	20:37:22	0.015
420	03/24/2010	20:38:22	0.015
421	03/24/2010	20:39:22	0.015
422	03/24/2010	20:40:22	0.015
423	03/24/2010	20:41:22	0.015
424	03/24/2010	20:42:22	0.015
425	03/24/2010	20:43:22	0.014
426	03/24/2010	20:44:22	0.016
427	03/24/2010	20:45:22	0.016
428	03/24/2010	20:46:22	0.016
429	03/24/2010	20:47:22	0.016
430	03/24/2010	20:48:22	0.016
431	03/24/2010	20:49:22	0.017
432	03/24/2010	20:50:22	0.016
433	03/24/2010	20:51:22	0.017
434	03/24/2010	20:52:22	0.016
435	03/24/2010	20:53:22	0.018
436	03/24/2010	20:54:22	0.017
437	03/24/2010	20:55:22	0.018
438	03/24/2010	20:56:22	0.018
439	03/24/2010	20:57:22	0.018
440	03/24/2010	20:58:22	0.017
441	03/24/2010	20:59:22	0.018
442	03/24/2010	21:00:22	0.018
443	03/24/2010	21:01:22	0.019
444	03/24/2010	21:02:22	0.017
445	03/24/2010	21:03:22	0.018
446	03/24/2010	21:04:22	0.018
447	03/24/2010	21:05:22	0.019
448	03/24/2010	21:06:22	0.019

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
449	03/24/2010	21:07:22	0.020
450	03/24/2010	21:08:22	0.019
451	03/24/2010	21:09:22	0.019
452	03/24/2010	21:10:22	0.019
453	03/24/2010	21:11:22	0.018
454	03/24/2010	21:12:22	0.019
455	03/24/2010	21:13:22	0.019
456	03/24/2010	21:14:22	0.020
457	03/24/2010	21:15:22	0.019
458	03/24/2010	21:16:22	0.020
459	03/24/2010	21:17:22	0.020
460	03/24/2010	21:18:22	0.019
461	03/24/2010	21:19:22	0.020
462	03/24/2010	21:20:22	0.020
463	03/24/2010	21:21:22	0.021
464	03/24/2010	21:22:22	0.021
465	03/24/2010	21:23:22	0.021
466	03/24/2010	21:24:22	0.021
467	03/24/2010	21:25:22	0.021
468	03/24/2010	21:26:22	0.021
469	03/24/2010	21:27:22	0.020
470	03/24/2010	21:28:22	0.025
471	03/24/2010	21:29:22	0.021
472	03/24/2010	21:30:22	0.021
473	03/24/2010	21:31:22	0.021
474	03/24/2010	21:32:22	0.020
475	03/24/2010	21:33:22	0.022
476	03/24/2010	21:34:22	0.022
477	03/24/2010	21:35:22	0.022
478	03/24/2010	21:36:22	0.022
479	03/24/2010	21:37:22	0.023
480	03/24/2010	21:38:22	0.023
481	03/24/2010	21:39:22	0.022
482	03/24/2010	21:40:22	0.021
483	03/24/2010	21:41:22	0.023
484	03/24/2010	21:42:22	0.023
485	03/24/2010	21:43:22	0.024
486	03/24/2010	21:44:22	0.024
487	03/24/2010	21:45:22	0.025
488	03/24/2010	21:46:22	0.024
489	03/24/2010	21:47:22	0.025
490	03/24/2010	21:48:22	0.026
491	03/24/2010	21:49:22	0.027
492	03/24/2010	21:50:22	0.027
493	03/24/2010	21:51:22	0.025
494	03/24/2010	21:52:22	0.026

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
495	03/24/2010	21:53:22	0.025
496	03/24/2010	21:54:22	0.024
497	03/24/2010	21:55:22	0.026
498	03/24/2010	21:56:22	0.025
499	03/24/2010	21:57:22	0.025
500	03/24/2010	21:58:22	0.028
501	03/24/2010	21:59:22	0.028
502	03/24/2010	22:00:22	0.027
503	03/24/2010	22:01:22	0.024
504	03/24/2010	22:02:22	0.025
505	03/24/2010	22:03:22	0.024
506	03/24/2010	22:04:22	0.024
507	03/24/2010	22:05:22	0.025
508	03/24/2010	22:06:22	0.027
509	03/24/2010	22:07:22	0.025
510	03/24/2010	22:08:22	0.025
511	03/24/2010	22:09:22	0.027
512	03/24/2010	22:10:22	0.026
513	03/24/2010	22:11:22	0.027
514	03/24/2010	22:12:22	0.025
515	03/24/2010	22:13:22	0.026
516	03/24/2010	22:14:22	0.025
517	03/24/2010	22:15:22	0.026
518	03/24/2010	22:16:22	0.027
519	03/24/2010	22:17:22	0.025
520	03/24/2010	22:18:22	0.025
521	03/24/2010	22:19:22	0.026
522	03/24/2010	22:20:22	0.026
523	03/24/2010	22:21:22	0.027
524	03/24/2010	22:22:22	0.027
525	03/24/2010	22:23:22	0.027
526	03/24/2010	22:24:22	0.027
527	03/24/2010	22:25:22	0.027
528	03/24/2010	22:26:22	0.027
529	03/24/2010	22:27:22	0.027
530	03/24/2010	22:28:22	0.027
531	03/24/2010	22:29:22	0.027
532	03/24/2010	22:30:22	0.027
533	03/24/2010	22:31:22	0.028
534	03/24/2010	22:32:22	0.027
535	03/24/2010	22:33:22	0.029
536	03/24/2010	22:34:22	0.026
537	03/24/2010	22:35:22	0.028
538	03/24/2010	22:36:22	0.029
539	03/24/2010	22:37:22	0.028
540	03/24/2010	22:38:22	0.028

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
541	03/24/2010	22:39:22	0.027
542	03/24/2010	22:40:22	0.026
543	03/24/2010	22:41:22	0.028
544	03/24/2010	22:42:22	0.027
545	03/24/2010	22:43:22	0.027
546	03/24/2010	22:44:22	0.028
547	03/24/2010	22:45:22	0.028
548	03/24/2010	22:46:22	0.028
549	03/24/2010	22:47:22	0.027
550	03/24/2010	22:48:22	0.027
551	03/24/2010	22:49:22	0.027
552	03/24/2010	22:50:22	0.028
553	03/24/2010	22:51:22	0.029
554	03/24/2010	22:52:22	0.028
555	03/24/2010	22:53:22	0.028
556	03/24/2010	22:54:22	0.029
557	03/24/2010	22:55:22	0.029
558	03/24/2010	22:56:22	0.027
559	03/24/2010	22:57:22	0.027
560	03/24/2010	22:58:22	0.029
561	03/24/2010	22:59:22	0.028
562	03/24/2010	23:00:22	0.027
563	03/24/2010	23:01:22	0.029
564	03/24/2010	23:02:22	0.028
565	03/24/2010	23:03:22	0.028
566	03/24/2010	23:04:22	0.028
567	03/24/2010	23:05:22	0.031
568	03/24/2010	23:06:22	0.028
569	03/24/2010	23:07:22	0.028
570	03/24/2010	23:08:22	0.029
571	03/24/2010	23:09:22	0.029
572	03/24/2010	23:10:22	0.029
573	03/24/2010	23:11:22	0.029
574	03/24/2010	23:12:22	0.029
575	03/24/2010	23:13:22	0.028
576	03/24/2010	23:14:22	0.028
577	03/24/2010	23:15:22	0.027
578	03/24/2010	23:16:22	0.028
579	03/24/2010	23:17:22	0.027
580	03/24/2010	23:18:22	0.027
581	03/24/2010	23:19:22	0.030
582	03/24/2010	23:20:22	0.028
583	03/24/2010	23:21:22	0.027
584	03/24/2010	23:22:22	0.027
585	03/24/2010	23:23:22	0.029
586	03/24/2010	23:24:22	0.030

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
587	03/24/2010	23:25:22	0.029
588	03/24/2010	23:26:22	0.028
589	03/24/2010	23:27:22	0.027
590	03/24/2010	23:28:22	0.028
591	03/24/2010	23:29:22	0.028
592	03/24/2010	23:30:22	0.028
593	03/24/2010	23:31:22	0.029
594	03/24/2010	23:32:22	0.029
595	03/24/2010	23:33:22	0.029
596	03/24/2010	23:34:22	0.029
597	03/24/2010	23:35:22	0.029
598	03/24/2010	23:36:22	0.027
599	03/24/2010	23:37:22	0.027
600	03/24/2010	23:38:22	0.028
601	03/24/2010	23:39:22	0.028
602	03/24/2010	23:40:22	0.028
603	03/24/2010	23:41:22	0.030
604	03/24/2010	23:42:22	0.027
605	03/24/2010	23:43:22	0.029
606	03/24/2010	23:44:22	0.029
607	03/24/2010	23:45:22	0.027
608	03/24/2010	23:46:22	0.029
609	03/24/2010	23:47:22	0.028
610	03/24/2010	23:48:22	0.030
611	03/24/2010	23:49:22	0.027
612	03/24/2010	23:50:22	0.028
613	03/24/2010	23:51:22	0.027
614	03/24/2010	23:52:22	0.028
615	03/24/2010	23:53:22	0.029
616	03/24/2010	23:54:22	0.028
617	03/24/2010	23:55:22	0.027
618	03/24/2010	23:56:22	0.028
619	03/24/2010	23:57:22	0.028
620	03/24/2010	23:58:22	0.029
621	03/24/2010	23:59:22	0.028
622	03/25/2010	00:00:22	0.029
623	03/25/2010	00:01:22	0.027
624	03/25/2010	00:02:22	0.028
625	03/25/2010	00:03:22	0.027
626	03/25/2010	00:04:22	0.029
627	03/25/2010	00:05:22	0.029
628	03/25/2010	00:06:22	0.027
629	03/25/2010	00:07:22	0.029
630	03/25/2010	00:08:22	0.028
631	03/25/2010	00:09:22	0.029
632	03/25/2010	00:10:22	0.027

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
633	03/25/2010	00:11:22	0.028
634	03/25/2010	00:12:22	0.027
635	03/25/2010	00:13:22	0.029
636	03/25/2010	00:14:22	0.029
637	03/25/2010	00:15:22	0.028
638	03/25/2010	00:16:22	0.028
639	03/25/2010	00:17:22	0.029
640	03/25/2010	00:18:22	0.029
641	03/25/2010	00:19:22	0.029
642	03/25/2010	00:20:22	0.027
643	03/25/2010	00:21:22	0.027
644	03/25/2010	00:22:22	0.030
645	03/25/2010	00:23:22	0.028
646	03/25/2010	00:24:22	0.029
647	03/25/2010	00:25:22	0.029
648	03/25/2010	00:26:22	0.029
649	03/25/2010	00:27:22	0.028
650	03/25/2010	00:28:22	0.029
651	03/25/2010	00:29:22	0.029
652	03/25/2010	00:30:22	0.028
653	03/25/2010	00:31:22	0.029
654	03/25/2010	00:32:22	0.027
655	03/25/2010	00:33:22	0.030
656	03/25/2010	00:34:22	0.029
657	03/25/2010	00:35:22	0.029
658	03/25/2010	00:36:22	0.029
659	03/25/2010	00:37:22	0.027
660	03/25/2010	00:38:22	0.027
661	03/25/2010	00:39:22	0.028
662	03/25/2010	00:40:22	0.030
663	03/25/2010	00:41:22	0.027
664	03/25/2010	00:42:22	0.028
665	03/25/2010	00:43:22	0.029
666	03/25/2010	00:44:22	0.029
667	03/25/2010	00:45:22	0.030
668	03/25/2010	00:46:22	0.027
669	03/25/2010	00:47:22	0.030
670	03/25/2010	00:48:22	0.029
671	03/25/2010	00:49:22	0.028
672	03/25/2010	00:50:22	0.028
673	03/25/2010	00:51:22	0.029
674	03/25/2010	00:52:22	0.028
675	03/25/2010	00:53:22	0.027
676	03/25/2010	00:54:22	0.029
677	03/25/2010	00:55:22	0.028
678	03/25/2010	00:56:22	0.031

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
679	03/25/2010	00:57:22	0.030
680	03/25/2010	00:58:22	0.027
681	03/25/2010	00:59:22	0.029
682	03/25/2010	01:00:22	0.029
683	03/25/2010	01:01:22	0.030
684	03/25/2010	01:02:22	0.029
685	03/25/2010	01:03:22	0.029
686	03/25/2010	01:04:22	0.027
687	03/25/2010	01:05:22	0.029
688	03/25/2010	01:06:22	0.027
689	03/25/2010	01:07:22	0.027
690	03/25/2010	01:08:22	0.028
691	03/25/2010	01:09:22	0.027
692	03/25/2010	01:10:22	0.027
693	03/25/2010	01:11:22	0.028
694	03/25/2010	01:12:22	0.026
695	03/25/2010	01:13:22	0.030
696	03/25/2010	01:14:22	0.028
697	03/25/2010	01:15:22	0.027
698	03/25/2010	01:16:22	0.029
699	03/25/2010	01:17:22	0.027
700	03/25/2010	01:18:22	0.027
701	03/25/2010	01:19:22	0.030
702	03/25/2010	01:20:22	0.027
703	03/25/2010	01:21:22	0.029
704	03/25/2010	01:22:22	0.028
705	03/25/2010	01:23:22	0.027
706	03/25/2010	01:24:22	0.029
707	03/25/2010	01:25:22	0.027
708	03/25/2010	01:26:22	0.027
709	03/25/2010	01:27:22	0.027
710	03/25/2010	01:28:22	0.029
711	03/25/2010	01:29:22	0.028
712	03/25/2010	01:30:22	0.028
713	03/25/2010	01:31:22	0.028
714	03/25/2010	01:32:22	0.027
715	03/25/2010	01:33:22	0.028
716	03/25/2010	01:34:22	0.030
717	03/25/2010	01:35:22	0.028
718	03/25/2010	01:36:22	0.026
719	03/25/2010	01:37:22	0.029
720	03/25/2010	01:38:22	0.026
721	03/25/2010	01:39:22	0.027
722	03/25/2010	01:40:22	0.027
723	03/25/2010	01:41:22	0.028
724	03/25/2010	01:42:22	0.028

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
725	03/25/2010	01:43:22	0.028
726	03/25/2010	01:44:22	0.027
727	03/25/2010	01:45:22	0.029
728	03/25/2010	01:46:22	0.027
729	03/25/2010	01:47:22	0.028
730	03/25/2010	01:48:22	0.027
731	03/25/2010	01:49:22	0.028
732	03/25/2010	01:50:22	0.029
733	03/25/2010	01:51:22	0.027
734	03/25/2010	01:52:22	0.028
735	03/25/2010	01:53:22	0.028
736	03/25/2010	01:54:22	0.029
737	03/25/2010	01:55:22	0.030
738	03/25/2010	01:56:22	0.029
739	03/25/2010	01:57:22	0.032
740	03/25/2010	01:58:22	0.033
741	03/25/2010	01:59:22	0.032
742	03/25/2010	02:00:22	0.032
743	03/25/2010	02:01:22	0.032
744	03/25/2010	02:02:22	0.033
745	03/25/2010	02:03:22	0.033
746	03/25/2010	02:04:22	0.033
747	03/25/2010	02:05:22	0.034
748	03/25/2010	02:06:22	0.033
749	03/25/2010	02:07:22	0.031
750	03/25/2010	02:08:22	0.033
751	03/25/2010	02:09:22	0.033
752	03/25/2010	02:10:22	0.034
753	03/25/2010	02:11:22	0.034
754	03/25/2010	02:12:22	0.034
755	03/25/2010	02:13:22	0.032
756	03/25/2010	02:14:22	0.036
757	03/25/2010	02:15:22	0.032
758	03/25/2010	02:16:22	0.034
759	03/25/2010	02:17:22	0.035
760	03/25/2010	02:18:22	0.034
761	03/25/2010	02:19:22	0.036
762	03/25/2010	02:20:22	0.035
763	03/25/2010	02:21:22	0.035
764	03/25/2010	02:22:22	0.033
765	03/25/2010	02:23:22	0.032
766	03/25/2010	02:24:22	0.033
767	03/25/2010	02:25:22	0.031
768	03/25/2010	02:26:22	0.032
769	03/25/2010	02:27:22	0.032
770	03/25/2010	02:28:22	0.031

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
771	03/25/2010	02:29:22	0.032
772	03/25/2010	02:30:22	0.031
773	03/25/2010	02:31:22	0.032
774	03/25/2010	02:32:22	0.032
775	03/25/2010	02:33:22	0.033
776	03/25/2010	02:34:22	0.033
777	03/25/2010	02:35:22	0.029
778	03/25/2010	02:36:22	0.031
779	03/25/2010	02:37:22	0.030
780	03/25/2010	02:38:22	0.030
781	03/25/2010	02:39:22	0.030
782	03/25/2010	02:40:22	0.032
783	03/25/2010	02:41:22	0.029
784	03/25/2010	02:42:22	0.030
785	03/25/2010	02:43:22	0.028
786	03/25/2010	02:44:22	0.030
787	03/25/2010	02:45:22	0.029
788	03/25/2010	02:46:22	0.028
789	03/25/2010	02:47:22	0.029
790	03/25/2010	02:48:22	0.029
791	03/25/2010	02:49:22	0.029
792	03/25/2010	02:50:22	0.028
793	03/25/2010	02:51:22	0.029
794	03/25/2010	02:52:22	0.029
795	03/25/2010	02:53:22	0.031
796	03/25/2010	02:54:22	0.028
797	03/25/2010	02:55:22	0.030
798	03/25/2010	02:56:22	0.029
799	03/25/2010	02:57:22	0.028
800	03/25/2010	02:58:22	0.028
801	03/25/2010	02:59:22	0.028
802	03/25/2010	03:00:22	0.028
803	03/25/2010	03:01:22	0.031
804	03/25/2010	03:02:22	0.029
805	03/25/2010	03:03:22	0.027
806	03/25/2010	03:04:22	0.028
807	03/25/2010	03:05:22	0.028
808	03/25/2010	03:06:22	0.027
809	03/25/2010	03:07:22	0.027
810	03/25/2010	03:08:22	0.028
811	03/25/2010	03:09:22	0.027
812	03/25/2010	03:10:22	0.029
813	03/25/2010	03:11:22	0.028
814	03/25/2010	03:12:22	0.029
815	03/25/2010	03:13:22	0.029
816	03/25/2010	03:14:22	0.028

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
817	03/25/2010	03:15:22	0.027
818	03/25/2010	03:16:22	0.028
819	03/25/2010	03:17:22	0.029
820	03/25/2010	03:18:22	0.027
821	03/25/2010	03:19:22	0.027
822	03/25/2010	03:20:22	0.026
823	03/25/2010	03:21:22	0.027
824	03/25/2010	03:22:22	0.026
825	03/25/2010	03:23:22	0.028
826	03/25/2010	03:24:22	0.027
827	03/25/2010	03:25:22	0.028
828	03/25/2010	03:26:22	0.029
829	03/25/2010	03:27:22	0.031
830	03/25/2010	03:28:22	0.028
831	03/25/2010	03:29:22	0.030
832	03/25/2010	03:30:22	0.030
833	03/25/2010	03:31:22	0.030
834	03/25/2010	03:32:22	0.028
835	03/25/2010	03:33:22	0.031
836	03/25/2010	03:34:22	0.030
837	03/25/2010	03:35:22	0.030
838	03/25/2010	03:36:22	0.028
839	03/25/2010	03:37:22	0.029
840	03/25/2010	03:38:22	0.029
841	03/25/2010	03:39:22	0.029
842	03/25/2010	03:40:22	0.028
843	03/25/2010	03:41:22	0.031
844	03/25/2010	03:42:22	0.031
845	03/25/2010	03:43:22	0.029
846	03/25/2010	03:44:22	0.030
847	03/25/2010	03:45:22	0.031
848	03/25/2010	03:46:22	0.030
849	03/25/2010	03:47:22	0.029
850	03/25/2010	03:48:22	0.032
851	03/25/2010	03:49:22	0.030
852	03/25/2010	03:50:22	0.031
853	03/25/2010	03:51:22	0.033
854	03/25/2010	03:52:22	0.030
855	03/25/2010	03:53:22	0.028
856	03/25/2010	03:54:22	0.031
857	03/25/2010	03:55:22	0.030
858	03/25/2010	03:56:22	0.030
859	03/25/2010	03:57:22	0.029
860	03/25/2010	03:58:22	0.031
861	03/25/2010	03:59:22	0.030
862	03/25/2010	04:00:22	0.031

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
863	03/25/2010	04:01:22	0.030
864	03/25/2010	04:02:22	0.031
865	03/25/2010	04:03:22	0.032
866	03/25/2010	04:04:22	0.031
867	03/25/2010	04:05:22	0.030
868	03/25/2010	04:06:22	0.029
869	03/25/2010	04:07:22	0.031
870	03/25/2010	04:08:22	0.033
871	03/25/2010	04:09:22	0.031
872	03/25/2010	04:10:22	0.031
873	03/25/2010	04:11:22	0.030
874	03/25/2010	04:12:22	0.031
875	03/25/2010	04:13:22	0.032
876	03/25/2010	04:14:22	0.033
877	03/25/2010	04:15:22	0.032
878	03/25/2010	04:16:22	0.033
879	03/25/2010	04:17:22	0.033
880	03/25/2010	04:18:22	0.033
881	03/25/2010	04:19:22	0.033
882	03/25/2010	04:20:22	0.034
883	03/25/2010	04:21:22	0.034
884	03/25/2010	04:22:22	0.034
885	03/25/2010	04:23:22	0.034
886	03/25/2010	04:24:22	0.033
887	03/25/2010	04:25:22	0.034
888	03/25/2010	04:26:22	0.034
889	03/25/2010	04:27:22	0.035
890	03/25/2010	04:28:22	0.034
891	03/25/2010	04:29:22	0.034
892	03/25/2010	04:30:22	0.035
893	03/25/2010	04:31:22	0.031
894	03/25/2010	04:32:22	0.035
895	03/25/2010	04:33:22	0.036
896	03/25/2010	04:34:22	0.036
897	03/25/2010	04:35:22	0.036
898	03/25/2010	04:36:22	0.033
899	03/25/2010	04:37:22	0.035
900	03/25/2010	04:38:22	0.034
901	03/25/2010	04:39:22	0.035
902	03/25/2010	04:40:22	0.035
903	03/25/2010	04:41:22	0.035
904	03/25/2010	04:42:22	0.034
905	03/25/2010	04:43:22	0.035
906	03/25/2010	04:44:22	0.034
907	03/25/2010	04:45:22	0.034
908	03/25/2010	04:46:22	0.032

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
909	03/25/2010	04:47:22	0.035
910	03/25/2010	04:48:22	0.035
911	03/25/2010	04:49:22	0.034
912	03/25/2010	04:50:22	0.041
913	03/25/2010	04:51:22	0.037
914	03/25/2010	04:52:22	0.036
915	03/25/2010	04:53:22	0.035
916	03/25/2010	04:54:22	0.035
917	03/25/2010	04:55:22	0.033
918	03/25/2010	04:56:22	0.035
919	03/25/2010	04:57:22	0.036
920	03/25/2010	04:58:22	0.036
921	03/25/2010	04:59:22	0.035
922	03/25/2010	05:00:22	0.037
923	03/25/2010	05:01:22	0.036
924	03/25/2010	05:02:22	0.037
925	03/25/2010	05:03:22	0.037
926	03/25/2010	05:04:22	0.036
927	03/25/2010	05:05:22	0.037
928	03/25/2010	05:06:22	0.037
929	03/25/2010	05:07:22	0.038
930	03/25/2010	05:08:22	0.039
931	03/25/2010	05:09:22	0.037
932	03/25/2010	05:10:22	0.037
933	03/25/2010	05:11:22	0.036
934	03/25/2010	05:12:22	0.035
935	03/25/2010	05:13:22	0.038
936	03/25/2010	05:14:22	0.038
937	03/25/2010	05:15:22	0.036
938	03/25/2010	05:16:22	0.038
939	03/25/2010	05:17:22	0.039
940	03/25/2010	05:18:22	0.037
941	03/25/2010	05:19:22	0.038
942	03/25/2010	05:20:22	0.041
943	03/25/2010	05:21:22	0.038
944	03/25/2010	05:22:22	0.038
945	03/25/2010	05:23:22	0.037
946	03/25/2010	05:24:22	0.041
947	03/25/2010	05:25:22	0.039
948	03/25/2010	05:26:22	0.038
949	03/25/2010	05:27:22	0.038
950	03/25/2010	05:28:22	0.040
951	03/25/2010	05:29:22	0.037
952	03/25/2010	05:30:22	0.038
953	03/25/2010	05:31:22	0.039
954	03/25/2010	05:32:22	0.040

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
955	03/25/2010	05:33:22	0.039
956	03/25/2010	05:34:22	0.041
957	03/25/2010	05:35:22	0.040
958	03/25/2010	05:36:22	0.041
959	03/25/2010	05:37:22	0.041
960	03/25/2010	05:38:22	0.042
961	03/25/2010	05:39:22	0.043
962	03/25/2010	05:40:22	0.039
963	03/25/2010	05:41:22	0.039
964	03/25/2010	05:42:22	0.041
965	03/25/2010	05:43:22	0.041
966	03/25/2010	05:44:22	0.039
967	03/25/2010	05:45:22	0.043
968	03/25/2010	05:46:22	0.041
969	03/25/2010	05:47:22	0.040
970	03/25/2010	05:48:22	0.040
971	03/25/2010	05:49:22	0.041
972	03/25/2010	05:50:22	0.045
973	03/25/2010	05:51:22	0.050
974	03/25/2010	05:52:22	0.052
975	03/25/2010	05:53:22	0.045
976	03/25/2010	05:54:22	0.042
977	03/25/2010	05:55:22	0.041
978	03/25/2010	05:56:22	0.042
979	03/25/2010	05:57:22	0.041
980	03/25/2010	05:58:22	0.041
981	03/25/2010	05:59:22	0.042
982	03/25/2010	06:00:22	0.043
983	03/25/2010	06:01:22	0.042
984	03/25/2010	06:02:22	0.042
985	03/25/2010	06:03:22	0.042
986	03/25/2010	06:04:22	0.040
987	03/25/2010	06:05:22	0.042
988	03/25/2010	06:06:22	0.043
989	03/25/2010	06:07:22	0.040
990	03/25/2010	06:08:22	0.043
991	03/25/2010	06:09:22	0.040
992	03/25/2010	06:10:22	0.043
993	03/25/2010	06:11:22	0.043
994	03/25/2010	06:12:22	0.043
995	03/25/2010	06:13:22	0.046
996	03/25/2010	06:14:22	0.045
997	03/25/2010	06:15:22	0.045
998	03/25/2010	06:16:22	0.047
999	03/25/2010	06:17:22	0.048
1000	03/25/2010	06:18:22	0.045

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1001	03/25/2010	06:19:22	0.044
1002	03/25/2010	06:20:22	0.045
1003	03/25/2010	06:21:22	0.047
1004	03/25/2010	06:22:22	0.050
1005	03/25/2010	06:23:22	0.049
1006	03/25/2010	06:24:22	0.050
1007	03/25/2010	06:25:22	0.052
1008	03/25/2010	06:26:22	0.051
1009	03/25/2010	06:27:22	0.053
1010	03/25/2010	06:28:22	0.056
1011	03/25/2010	06:29:22	0.057
1012	03/25/2010	06:30:22	0.056
1013	03/25/2010	06:31:22	0.058
1014	03/25/2010	06:32:22	0.058
1015	03/25/2010	06:33:22	0.057
1016	03/25/2010	06:34:22	0.058
1017	03/25/2010	06:35:22	0.060
1018	03/25/2010	06:36:22	0.063
1019	03/25/2010	06:37:22	0.063
1020	03/25/2010	06:38:22	0.064
1021	03/25/2010	06:39:22	0.064
1022	03/25/2010	06:40:22	0.068
1023	03/25/2010	06:41:22	0.069
1024	03/25/2010	06:42:22	0.069
1025	03/25/2010	06:43:22	0.066
1026	03/25/2010	06:44:22	0.066
1027	03/25/2010	06:45:22	0.066
1028	03/25/2010	06:46:22	0.067
1029	03/25/2010	06:47:22	0.066
1030	03/25/2010	06:48:22	0.069
1031	03/25/2010	06:49:22	0.068
1032	03/25/2010	06:50:22	0.073
1033	03/25/2010	06:51:22	0.078
1034	03/25/2010	06:52:22	0.088
1035	03/25/2010	06:53:22	0.118
1036	03/25/2010	06:54:22	0.075
1037	03/25/2010	06:55:22	0.084
1038	03/25/2010	06:56:22	0.094
1039	03/25/2010	06:57:22	0.080
1040	03/25/2010	06:58:22	0.084
1041	03/25/2010	06:59:22	0.123
1042	03/25/2010	07:00:22	0.092
1043	03/25/2010	07:01:22	0.117
1044	03/25/2010	07:02:22	0.138
1045	03/25/2010	07:03:22	0.104
1046	03/25/2010	07:04:22	0.161

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1047	03/25/2010	07:05:22	0.197
1048	03/25/2010	07:06:22	0.172
1049	03/25/2010	07:07:22	0.212
1050	03/25/2010	07:08:22	0.265
1051	03/25/2010	07:09:22	0.165
1052	03/25/2010	07:10:22	0.233
1053	03/25/2010	07:11:22	0.203
1054	03/25/2010	07:12:22	0.198
1055	03/25/2010	07:13:22	0.199
1056	03/25/2010	07:14:22	0.128
1057	03/25/2010	07:15:22	0.213
1058	03/25/2010	07:16:22	0.149
1059	03/25/2010	07:17:22	0.150
1060	03/25/2010	07:18:22	0.165
1061	03/25/2010	07:19:22	0.393
1062	03/25/2010	07:20:22	0.314
1063	03/25/2010	07:21:22	0.250
1064	03/25/2010	07:22:22	0.140
1065	03/25/2010	07:23:22	0.139
1066	03/25/2010	07:24:22	0.135
1067	03/25/2010	07:25:22	0.131
1068	03/25/2010	07:26:22	0.125
1069	03/25/2010	07:27:22	0.135
1070	03/25/2010	07:28:22	0.251
1071	03/25/2010	07:29:22	0.160
1072	03/25/2010	07:30:22	0.122
1073	03/25/2010	07:31:22	0.092
1074	03/25/2010	07:32:22	0.072
1075	03/25/2010	07:33:22	0.062
1076	03/25/2010	07:34:22	0.050
1077	03/25/2010	07:35:22	0.048
1078	03/25/2010	07:36:22	0.046
1079	03/25/2010	07:37:22	0.045
1080	03/25/2010	07:38:22	0.046
1081	03/25/2010	07:39:22	0.046
1082	03/25/2010	07:40:22	0.041
1083	03/25/2010	07:41:22	0.039
1084	03/25/2010	07:42:22	0.040
1085	03/25/2010	07:43:22	0.043
1086	03/25/2010	07:44:22	0.042
1087	03/25/2010	07:45:22	0.040
1088	03/25/2010	07:46:22	0.039
1089	03/25/2010	07:47:22	0.043
1090	03/25/2010	07:48:22	0.043
1091	03/25/2010	07:49:22	0.061
1092	03/25/2010	07:50:22	0.043

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1093	03/25/2010	07:51:22	0.043
1094	03/25/2010	07:52:22	0.041
1095	03/25/2010	07:53:22	0.042
1096	03/25/2010	07:54:22	0.043
1097	03/25/2010	07:55:22	0.043
1098	03/25/2010	07:56:22	0.042
1099	03/25/2010	07:57:22	0.043
1100	03/25/2010	07:58:22	0.040
1101	03/25/2010	07:59:22	0.041
1102	03/25/2010	08:00:22	0.041
1103	03/25/2010	08:01:22	0.041
1104	03/25/2010	08:02:22	0.040
1105	03/25/2010	08:03:22	0.047
1106	03/25/2010	08:04:22	0.043
1107	03/25/2010	08:05:22	0.042
1108	03/25/2010	08:06:22	0.042
1109	03/25/2010	08:07:22	0.041
1110	03/25/2010	08:08:22	0.038
1111	03/25/2010	08:09:22	0.040
1112	03/25/2010	08:10:22	0.039
1113	03/25/2010	08:11:22	0.042
1114	03/25/2010	08:12:22	0.040
1115	03/25/2010	08:13:22	0.042
1116	03/25/2010	08:14:22	0.038
1117	03/25/2010	08:15:22	0.042
1118	03/25/2010	08:16:22	0.040
1119	03/25/2010	08:17:22	0.038
1120	03/25/2010	08:18:22	0.040
1121	03/25/2010	08:19:22	0.036
1122	03/25/2010	08:20:22	0.037
1123	03/25/2010	08:21:22	0.037
1124	03/25/2010	08:22:22	0.038
1125	03/25/2010	08:23:22	0.035
1126	03/25/2010	08:24:22	0.038
1127	03/25/2010	08:25:22	0.044
1128	03/25/2010	08:26:22	0.040
1129	03/25/2010	08:27:22	0.037
1130	03/25/2010	08:28:22	0.037
1131	03/25/2010	08:29:22	0.042
1132	03/25/2010	08:30:22	0.037
1133	03/25/2010	08:31:22	0.041
1134	03/25/2010	08:32:22	0.040
1135	03/25/2010	08:33:22	0.037
1136	03/25/2010	08:34:22	0.036
1137	03/25/2010	08:35:22	0.038
1138	03/25/2010	08:36:22	0.035

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1139	03/25/2010	08:37:22	0.040
1140	03/25/2010	08:38:22	0.038
1141	03/25/2010	08:39:22	0.035
1142	03/25/2010	08:40:22	0.037
1143	03/25/2010	08:41:22	0.036
1144	03/25/2010	08:42:22	0.037
1145	03/25/2010	08:43:22	0.040
1146	03/25/2010	08:44:22	0.037
1147	03/25/2010	08:45:22	0.036
1148	03/25/2010	08:46:22	0.037
1149	03/25/2010	08:47:22	0.035
1150	03/25/2010	08:48:22	0.035
1151	03/25/2010	08:49:22	0.035
1152	03/25/2010	08:50:22	0.038
1153	03/25/2010	08:51:22	0.035
1154	03/25/2010	08:52:22	0.043
1155	03/25/2010	08:53:22	0.037
1156	03/25/2010	08:54:22	0.037
1157	03/25/2010	08:55:22	0.038
1158	03/25/2010	08:56:22	0.038
1159	03/25/2010	08:57:22	0.038
1160	03/25/2010	08:58:22	0.035
1161	03/25/2010	08:59:22	0.037
1162	03/25/2010	09:00:22	0.037
1163	03/25/2010	09:01:22	0.042
1164	03/25/2010	09:02:22	0.039
1165	03/25/2010	09:03:22	0.039
1166	03/25/2010	09:04:22	0.038
1167	03/25/2010	09:05:22	0.041
1168	03/25/2010	09:06:22	0.036
1169	03/25/2010	09:07:22	0.037
1170	03/25/2010	09:08:22	0.038
1171	03/25/2010	09:09:22	0.038
1172	03/25/2010	09:10:22	0.038
1173	03/25/2010	09:11:22	0.039
1174	03/25/2010	09:12:22	0.036
1175	03/25/2010	09:13:22	0.036
1176	03/25/2010	09:14:22	0.043
1177	03/25/2010	09:15:22	0.034
1178	03/25/2010	09:16:22	0.038
1179	03/25/2010	09:17:22	0.038
1180	03/25/2010	09:18:22	0.040
1181	03/25/2010	09:19:22	0.035
1182	03/25/2010	09:20:22	0.038
1183	03/25/2010	09:21:22	0.037
1184	03/25/2010	09:22:22	0.040

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1185	03/25/2010	09:23:22	0.041
1186	03/25/2010	09:24:22	0.039
1187	03/25/2010	09:25:22	0.038
1188	03/25/2010	09:26:22	0.039
1189	03/25/2010	09:27:22	0.039
1190	03/25/2010	09:28:22	0.036
1191	03/25/2010	09:29:22	0.038
1192	03/25/2010	09:30:22	0.062
1193	03/25/2010	09:31:22	0.037
1194	03/25/2010	09:32:22	0.036
1195	03/25/2010	09:33:22	0.037
1196	03/25/2010	09:34:22	0.038
1197	03/25/2010	09:35:22	0.038
1198	03/25/2010	09:36:22	0.035
1199	03/25/2010	09:37:22	0.033
1200	03/25/2010	09:38:22	0.034
1201	03/25/2010	09:39:22	0.035
1202	03/25/2010	09:40:22	0.035
1203	03/25/2010	09:41:22	0.036
1204	03/25/2010	09:42:22	0.034
1205	03/25/2010	09:43:22	0.033
1206	03/25/2010	09:44:22	0.034
1207	03/25/2010	09:45:22	0.034
1208	03/25/2010	09:46:22	0.035
1209	03/25/2010	09:47:22	0.033
1210	03/25/2010	09:48:22	0.032
1211	03/25/2010	09:49:22	0.032
1212	03/25/2010	09:50:22	0.032
1213	03/25/2010	09:51:22	0.031
1214	03/25/2010	09:52:22	0.034
1215	03/25/2010	09:53:22	0.035
1216	03/25/2010	09:54:22	0.033
1217	03/25/2010	09:55:22	0.035
1218	03/25/2010	09:56:22	0.034
1219	03/25/2010	09:57:22	0.032
1220	03/25/2010	09:58:22	0.035
1221	03/25/2010	09:59:22	0.032
1222	03/25/2010	10:00:22	0.033
1223	03/25/2010	10:01:22	0.032
1224	03/25/2010	10:02:22	0.034
1225	03/25/2010	10:03:22	0.031
1226	03/25/2010	10:04:22	0.032
1227	03/25/2010	10:05:22	0.033
1228	03/25/2010	10:06:22	0.033
1229	03/25/2010	10:07:22	0.034
1230	03/25/2010	10:08:22	0.032

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1231	03/25/2010	10:09:22	0.035
1232	03/25/2010	10:10:22	0.033
1233	03/25/2010	10:11:22	0.030
1234	03/25/2010	10:12:22	0.034
1235	03/25/2010	10:13:22	0.033
1236	03/25/2010	10:14:22	0.030
1237	03/25/2010	10:15:22	0.032
1238	03/25/2010	10:16:22	0.037
1239	03/25/2010	10:17:22	0.032
1240	03/25/2010	10:18:22	0.034
1241	03/25/2010	10:19:22	0.033
1242	03/25/2010	10:20:22	0.034
1243	03/25/2010	10:21:22	0.034
1244	03/25/2010	10:22:22	0.032
1245	03/25/2010	10:23:22	0.035
1246	03/25/2010	10:24:22	0.036
1247	03/25/2010	10:25:22	0.036
1248	03/25/2010	10:26:22	0.035
1249	03/25/2010	10:27:22	0.038
1250	03/25/2010	10:28:22	0.034
1251	03/25/2010	10:29:22	0.039
1252	03/25/2010	10:30:22	0.035
1253	03/25/2010	10:31:22	0.032
1254	03/25/2010	10:32:22	0.033
1255	03/25/2010	10:33:22	0.035
1256	03/25/2010	10:34:22	0.034
1257	03/25/2010	10:35:22	0.035
1258	03/25/2010	10:36:22	0.038
1259	03/25/2010	10:37:22	0.036
1260	03/25/2010	10:38:22	0.037
1261	03/25/2010	10:39:22	0.033
1262	03/25/2010	10:40:22	0.036
1263	03/25/2010	10:41:22	0.035
1264	03/25/2010	10:42:22	0.033
1265	03/25/2010	10:43:22	0.035
1266	03/25/2010	10:44:22	0.035
1267	03/25/2010	10:45:22	0.035
1268	03/25/2010	10:46:22	0.036
1269	03/25/2010	10:47:22	0.037
1270	03/25/2010	10:48:22	0.039
1271	03/25/2010	10:49:22	0.035
1272	03/25/2010	10:50:22	0.037
1273	03/25/2010	10:51:22	0.036
1274	03/25/2010	10:52:22	0.035
1275	03/25/2010	10:53:22	0.034
1276	03/25/2010	10:54:22	0.033

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1277	03/25/2010	10:55:22	0.033
1278	03/25/2010	10:56:22	0.031
1279	03/25/2010	10:57:22	0.034
1280	03/25/2010	10:58:22	0.034
1281	03/25/2010	10:59:22	0.033
1282	03/25/2010	11:00:22	0.038
1283	03/25/2010	11:01:22	0.042
1284	03/25/2010	11:02:22	0.031
1285	03/25/2010	11:03:22	0.032
1286	03/25/2010	11:04:22	0.029
1287	03/25/2010	11:05:22	0.028
1288	03/25/2010	11:06:22	0.030
1289	03/25/2010	11:07:22	0.028
1290	03/25/2010	11:08:22	0.028
1291	03/25/2010	11:09:22	0.030
1292	03/25/2010	11:10:22	0.030
1293	03/25/2010	11:11:22	0.028
1294	03/25/2010	11:12:22	0.028
1295	03/25/2010	11:13:22	0.029
1296	03/25/2010	11:14:22	0.029
1297	03/25/2010	11:15:22	0.029
1298	03/25/2010	11:16:22	0.033
1299	03/25/2010	11:17:22	0.037
1300	03/25/2010	11:18:22	0.034
1301	03/25/2010	11:19:22	0.033
1302	03/25/2010	11:20:22	0.032
1303	03/25/2010	11:21:22	0.034
1304	03/25/2010	11:22:22	0.032
1305	03/25/2010	11:23:22	0.035
1306	03/25/2010	11:24:22	0.035
1307	03/25/2010	11:25:22	0.034
1308	03/25/2010	11:26:22	0.031
1309	03/25/2010	11:27:22	0.033
1310	03/25/2010	11:28:22	0.031
1311	03/25/2010	11:29:22	0.034
1312	03/25/2010	11:30:22	0.033
1313	03/25/2010	11:31:22	0.029
1314	03/25/2010	11:32:22	0.031
1315	03/25/2010	11:33:22	0.034
1316	03/25/2010	11:34:22	0.031
1317	03/25/2010	11:35:22	0.032
1318	03/25/2010	11:36:22	0.035
1319	03/25/2010	11:37:22	0.031
1320	03/25/2010	11:38:22	0.033
1321	03/25/2010	11:39:22	0.033
1322	03/25/2010	11:40:22	0.034

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1323	03/25/2010	11:41:22	0.037
1324	03/25/2010	11:42:22	0.033
1325	03/25/2010	11:43:22	0.033
1326	03/25/2010	11:44:22	0.031
1327	03/25/2010	11:45:22	0.205
1328	03/25/2010	11:46:22	0.264
1329	03/25/2010	11:47:22	0.036
1330	03/25/2010	11:48:22	0.035
1331	03/25/2010	11:49:22	0.037
1332	03/25/2010	11:50:22	0.037
1333	03/25/2010	11:51:22	0.034
1334	03/25/2010	11:52:22	0.032
1335	03/25/2010	11:53:22	0.035
1336	03/25/2010	11:54:22	0.034
1337	03/25/2010	11:55:22	0.039
1338	03/25/2010	11:56:22	0.035
1339	03/25/2010	11:57:22	0.039
1340	03/25/2010	11:58:22	0.037
1341	03/25/2010	11:59:22	0.032
1342	03/25/2010	12:00:22	0.037
1343	03/25/2010	12:01:22	0.037
1344	03/25/2010	12:02:22	0.035
1345	03/25/2010	12:03:22	0.039
1346	03/25/2010	12:04:22	0.035
1347	03/25/2010	12:05:22	0.035
1348	03/25/2010	12:06:22	0.035
1349	03/25/2010	12:07:22	0.036
1350	03/25/2010	12:08:22	0.034
1351	03/25/2010	12:09:22	0.037
1352	03/25/2010	12:10:22	0.036
1353	03/25/2010	12:11:22	0.033
1354	03/25/2010	12:12:22	0.037
1355	03/25/2010	12:13:22	0.033
1356	03/25/2010	12:14:22	0.035
1357	03/25/2010	12:15:22	0.037
1358	03/25/2010	12:16:22	0.032
1359	03/25/2010	12:17:22	0.032
1360	03/25/2010	12:18:22	0.033
1361	03/25/2010	12:19:22	0.031
1362	03/25/2010	12:20:22	0.031
1363	03/25/2010	12:21:22	0.030
1364	03/25/2010	12:22:22	0.031
1365	03/25/2010	12:23:22	0.033
1366	03/25/2010	12:24:22	0.031
1367	03/25/2010	12:25:22	0.034
1368	03/25/2010	12:26:22	0.031

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1369	03/25/2010	12:27:22	0.032
1370	03/25/2010	12:28:22	0.033
1371	03/25/2010	12:29:22	0.030
1372	03/25/2010	12:30:22	0.030
1373	03/25/2010	12:31:22	0.032
1374	03/25/2010	12:32:22	0.031
1375	03/25/2010	12:33:22	0.029
1376	03/25/2010	12:34:22	0.027
1377	03/25/2010	12:35:22	0.029
1378	03/25/2010	12:36:22	0.028
1379	03/25/2010	12:37:22	0.030
1380	03/25/2010	12:38:22	0.031
1381	03/25/2010	12:39:22	0.033
1382	03/25/2010	12:40:22	0.031
1383	03/25/2010	12:41:22	0.033
1384	03/25/2010	12:42:22	0.033
1385	03/25/2010	12:43:22	0.034
1386	03/25/2010	12:44:22	0.034
1387	03/25/2010	12:45:22	0.033
1388	03/25/2010	12:46:22	0.032
1389	03/25/2010	12:47:22	0.033
1390	03/25/2010	12:48:22	0.035
1391	03/25/2010	12:49:22	0.035
1392	03/25/2010	12:50:22	0.032
1393	03/25/2010	12:51:22	0.032
1394	03/25/2010	12:52:22	0.030
1395	03/25/2010	12:53:22	0.032
1396	03/25/2010	12:54:22	0.031
1397	03/25/2010	12:55:22	0.029
1398	03/25/2010	12:56:22	0.033
1399	03/25/2010	12:57:22	0.033
1400	03/25/2010	12:58:22	0.034
1401	03/25/2010	12:59:22	0.034
1402	03/25/2010	13:00:22	0.033
1403	03/25/2010	13:01:22	0.035
1404	03/25/2010	13:02:22	0.034
1405	03/25/2010	13:03:22	0.037
1406	03/25/2010	13:04:22	0.034
1407	03/25/2010	13:05:22	0.032
1408	03/25/2010	13:06:22	0.038
1409	03/25/2010	13:07:22	0.043
1410	03/25/2010	13:08:22	0.041
1411	03/25/2010	13:09:22	0.041
1412	03/25/2010	13:10:22	0.032
1413	03/25/2010	13:11:22	0.032
1414	03/25/2010	13:12:22	0.036

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1415	03/25/2010	13:13:22	0.035
1416	03/25/2010	13:14:22	0.041
1417	03/25/2010	13:15:22	0.032
1418	03/25/2010	13:16:22	0.033
1419	03/25/2010	13:17:22	0.033
1420	03/25/2010	13:18:22	0.032
1421	03/25/2010	13:19:22	0.033
1422	03/25/2010	13:20:22	0.035
1423	03/25/2010	13:21:22	0.034
1424	03/25/2010	13:22:22	0.031
1425	03/25/2010	13:23:22	0.034
1426	03/25/2010	13:24:22	0.033
1427	03/25/2010	13:25:22	0.035
1428	03/25/2010	13:26:22	0.034
1429	03/25/2010	13:27:22	0.033
1430	03/25/2010	13:28:22	0.033
1431	03/25/2010	13:29:22	0.036
1432	03/25/2010	13:30:22	0.033
1433	03/25/2010	13:31:22	0.033
1434	03/25/2010	13:32:22	0.035
1435	03/25/2010	13:33:22	0.035
1436	03/25/2010	13:34:22	0.040
1437	03/25/2010	13:35:22	0.036
1438	03/25/2010	13:36:22	0.033
1439	03/25/2010	13:37:22	0.035
1440	03/25/2010	13:38:22	0.035
1441	03/25/2010	13:39:22	0.033
1442	03/25/2010	13:40:22	0.034
1443	03/25/2010	13:41:22	0.033
1444	03/25/2010	13:42:22	0.033
1445	03/25/2010	13:43:22	0.031
1446	03/25/2010	13:44:22	0.032
1447	03/25/2010	13:45:22	0.031
1448	03/25/2010	13:46:22	0.033
1449	03/25/2010	13:47:22	0.032
1450	03/25/2010	13:48:22	0.037
1451	03/25/2010	13:49:22	0.032
1452	03/25/2010	13:50:22	0.031
1453	03/25/2010	13:51:22	0.032
1454	03/25/2010	13:52:22	0.029
1455	03/25/2010	13:53:22	0.029
1456	03/25/2010	13:54:22	0.034
1457	03/25/2010	13:55:22	0.033
1458	03/25/2010	13:56:22	0.032
1459	03/25/2010	13:57:22	0.034
1460	03/25/2010	13:58:22	0.033

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1461	03/25/2010	13:59:22	0.033
1462	03/25/2010	14:00:22	0.036
1463	03/25/2010	14:01:22	0.034
1464	03/25/2010	14:02:22	0.035
1465	03/25/2010	14:03:22	0.034
1466	03/25/2010	14:04:22	0.031
1467	03/25/2010	14:05:22	0.032
1468	03/25/2010	14:06:22	0.038
1469	03/25/2010	14:07:22	0.039
1470	03/25/2010	14:08:22	0.035
1471	03/25/2010	14:09:22	0.037
1472	03/25/2010	14:10:22	0.042

Test 001

Pleasantville Lift Station

Instrument		Data Properties	
Model	Dust Trak	Start Date	03/26/2010
Meter S/N	23567	Start Time	16:54:11
		Stop Date	03/27/2010
		Stop Time	17:22:11
		Total Time	1:00:28:00
		Logging Interval	60 seconds

Test Data

Data Point	Date	Time	Aerosol mg/m^3
1	03/26/2010	16:55:11	0.029
2	03/26/2010	16:56:11	0.037
3	03/26/2010	16:57:11	0.047
4	03/26/2010	16:58:11	0.064
5	03/26/2010	16:59:11	0.056
6	03/26/2010	17:00:11	0.032
7	03/26/2010	17:01:11	0.031
8	03/26/2010	17:02:11	0.035
9	03/26/2010	17:03:11	0.029
10	03/26/2010	17:04:11	0.034
11	03/26/2010	17:05:11	0.033
12	03/26/2010	17:06:11	0.030
13	03/26/2010	17:07:11	0.029
14	03/26/2010	17:08:11	0.037
15	03/26/2010	17:09:11	0.040
16	03/26/2010	17:10:11	0.044
17	03/26/2010	17:11:11	0.045
18	03/26/2010	17:12:11	0.040
19	03/26/2010	17:13:11	0.029
20	03/26/2010	17:14:11	0.025
21	03/26/2010	17:15:11	0.032
22	03/26/2010	17:16:11	0.028
23	03/26/2010	17:17:11	0.038
24	03/26/2010	17:18:11	0.028
25	03/26/2010	17:19:11	0.048
26	03/26/2010	17:20:11	0.056
27	03/26/2010	17:21:11	0.052
28	03/26/2010	17:22:11	0.054
29	03/26/2010	17:23:11	0.052
30	03/26/2010	17:24:11	0.038
31	03/26/2010	17:25:11	0.040
32	03/26/2010	17:26:11	0.032
33	03/26/2010	17:27:11	0.041
34	03/26/2010	17:28:11	0.026

Test Data

Data Point	Date	Time	Aerosol mg/m^3
35	03/26/2010	17:29:11	0.028
36	03/26/2010	17:30:11	0.024
37	03/26/2010	17:31:11	0.027
38	03/26/2010	17:32:11	0.026
39	03/26/2010	17:33:11	0.025
40	03/26/2010	17:34:11	0.034
41	03/26/2010	17:35:11	0.027
42	03/26/2010	17:36:11	0.031
43	03/26/2010	17:37:11	0.025
44	03/26/2010	17:38:11	0.029
45	03/26/2010	17:39:11	0.026
46	03/26/2010	17:40:11	0.024
47	03/26/2010	17:41:11	0.025
48	03/26/2010	17:42:11	0.027
49	03/26/2010	17:43:11	0.029
50	03/26/2010	17:44:11	0.030
51	03/26/2010	17:45:11	0.030
52	03/26/2010	17:46:11	0.033
53	03/26/2010	17:47:11	0.029
54	03/26/2010	17:48:11	0.026
55	03/26/2010	17:49:11	0.027
56	03/26/2010	17:50:11	0.025
57	03/26/2010	17:51:11	0.024
58	03/26/2010	17:52:11	0.023
59	03/26/2010	17:53:11	0.024
60	03/26/2010	17:54:11	0.023
61	03/26/2010	17:55:11	0.029
62	03/26/2010	17:56:11	0.033
63	03/26/2010	17:57:11	0.030
64	03/26/2010	17:58:11	0.035
65	03/26/2010	17:59:11	0.032
66	03/26/2010	18:00:11	0.031
67	03/26/2010	18:01:11	0.028
68	03/26/2010	18:02:11	0.031
69	03/26/2010	18:03:11	0.039
70	03/26/2010	18:04:11	0.034
71	03/26/2010	18:05:11	0.034
72	03/26/2010	18:06:11	0.033
73	03/26/2010	18:07:11	0.037
74	03/26/2010	18:08:11	0.059
75	03/26/2010	18:09:11	0.034
76	03/26/2010	18:10:11	0.034
77	03/26/2010	18:11:11	0.038
78	03/26/2010	18:12:11	0.036
79	03/26/2010	18:13:11	0.036
80	03/26/2010	18:14:11	0.041

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
81	03/26/2010	18:15:11	0.042
82	03/26/2010	18:16:11	0.037
83	03/26/2010	18:17:11	0.036
84	03/26/2010	18:18:11	0.031
85	03/26/2010	18:19:11	0.032
86	03/26/2010	18:20:11	0.037
87	03/26/2010	18:21:11	0.040
88	03/26/2010	18:22:11	0.040
89	03/26/2010	18:23:11	0.038
90	03/26/2010	18:24:11	0.049
91	03/26/2010	18:25:11	0.036
92	03/26/2010	18:26:11	0.035
93	03/26/2010	18:27:11	0.042
94	03/26/2010	18:28:11	0.044
95	03/26/2010	18:29:11	0.045
96	03/26/2010	18:30:11	0.052
97	03/26/2010	18:31:11	0.051
98	03/26/2010	18:32:11	0.046
99	03/26/2010	18:33:11	0.045
100	03/26/2010	18:34:11	0.046
101	03/26/2010	18:35:11	0.047
102	03/26/2010	18:36:11	0.045
103	03/26/2010	18:37:11	0.058
104	03/26/2010	18:38:11	0.040
105	03/26/2010	18:39:11	0.035
106	03/26/2010	18:40:11	0.030
107	03/26/2010	18:41:11	0.029
108	03/26/2010	18:42:11	0.029
109	03/26/2010	18:43:11	0.030
110	03/26/2010	18:44:11	0.033
111	03/26/2010	18:45:11	0.034
112	03/26/2010	18:46:11	0.037
113	03/26/2010	18:47:11	0.038
114	03/26/2010	18:48:11	0.036
115	03/26/2010	18:49:11	0.036
116	03/26/2010	18:50:11	0.040
117	03/26/2010	18:51:11	0.039
118	03/26/2010	18:52:11	0.045
119	03/26/2010	18:53:11	0.042
120	03/26/2010	18:54:11	0.035
121	03/26/2010	18:55:11	0.034
122	03/26/2010	18:56:11	0.032
123	03/26/2010	18:57:11	0.034
124	03/26/2010	18:58:11	0.032
125	03/26/2010	18:59:11	0.057
126	03/26/2010	19:00:11	0.036

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
127	03/26/2010	19:01:11	0.034
128	03/26/2010	19:02:11	0.033
129	03/26/2010	19:03:11	0.033
130	03/26/2010	19:04:11	0.033
131	03/26/2010	19:05:11	0.034
132	03/26/2010	19:06:11	0.033
133	03/26/2010	19:07:11	0.039
134	03/26/2010	19:08:11	0.041
135	03/26/2010	19:09:11	0.038
136	03/26/2010	19:10:11	0.035
137	03/26/2010	19:11:11	0.032
138	03/26/2010	19:12:11	0.034
139	03/26/2010	19:13:11	0.052
140	03/26/2010	19:14:11	0.042
141	03/26/2010	19:15:11	0.040
142	03/26/2010	19:16:11	0.038
143	03/26/2010	19:17:11	0.038
144	03/26/2010	19:18:11	0.041
145	03/26/2010	19:19:11	0.044
146	03/26/2010	19:20:11	0.043
147	03/26/2010	19:21:11	0.045
148	03/26/2010	19:22:11	0.046
149	03/26/2010	19:23:11	0.042
150	03/26/2010	19:24:11	0.041
151	03/26/2010	19:25:11	0.046
152	03/26/2010	19:26:11	0.046
153	03/26/2010	19:27:11	0.046
154	03/26/2010	19:28:11	0.045
155	03/26/2010	19:29:11	0.044
156	03/26/2010	19:30:11	0.043
157	03/26/2010	19:31:11	0.040
158	03/26/2010	19:32:11	0.038
159	03/26/2010	19:33:11	0.038
160	03/26/2010	19:34:11	0.037
161	03/26/2010	19:35:11	0.034
162	03/26/2010	19:36:11	0.035
163	03/26/2010	19:37:11	0.037
164	03/26/2010	19:38:11	0.035
165	03/26/2010	19:39:11	0.038
166	03/26/2010	19:40:11	0.035
167	03/26/2010	19:41:11	0.040
168	03/26/2010	19:42:11	0.037
169	03/26/2010	19:43:11	0.036
170	03/26/2010	19:44:11	0.034
171	03/26/2010	19:45:11	0.034
172	03/26/2010	19:46:11	0.037

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
173	03/26/2010	19:47:11	0.033
174	03/26/2010	19:48:11	0.035
175	03/26/2010	19:49:11	0.035
176	03/26/2010	19:50:11	0.031
177	03/26/2010	19:51:11	0.034
178	03/26/2010	19:52:11	0.030
179	03/26/2010	19:53:11	0.030
180	03/26/2010	19:54:11	0.031
181	03/26/2010	19:55:11	0.028
182	03/26/2010	19:56:11	0.027
183	03/26/2010	19:57:11	0.030
184	03/26/2010	19:58:11	0.043
185	03/26/2010	19:59:11	0.035
186	03/26/2010	20:00:11	0.028
187	03/26/2010	20:01:11	0.027
188	03/26/2010	20:02:11	0.025
189	03/26/2010	20:03:11	0.027
190	03/26/2010	20:04:11	0.028
191	03/26/2010	20:05:11	0.027
192	03/26/2010	20:06:11	0.028
193	03/26/2010	20:07:11	0.026
194	03/26/2010	20:08:11	0.027
195	03/26/2010	20:09:11	0.026
196	03/26/2010	20:10:11	0.026
197	03/26/2010	20:11:11	0.029
198	03/26/2010	20:12:11	0.026
199	03/26/2010	20:13:11	0.026
200	03/26/2010	20:14:11	0.026
201	03/26/2010	20:15:11	0.026
202	03/26/2010	20:16:11	0.043
203	03/26/2010	20:17:11	0.027
204	03/26/2010	20:18:11	0.029
205	03/26/2010	20:19:11	0.031
206	03/26/2010	20:20:11	0.030
207	03/26/2010	20:21:11	0.028
208	03/26/2010	20:22:11	0.031
209	03/26/2010	20:23:11	0.030
210	03/26/2010	20:24:11	0.033
211	03/26/2010	20:25:11	0.035
212	03/26/2010	20:26:11	0.040
213	03/26/2010	20:27:11	0.041
214	03/26/2010	20:28:11	0.044
215	03/26/2010	20:29:11	0.042
216	03/26/2010	20:30:11	0.041
217	03/26/2010	20:31:11	0.045
218	03/26/2010	20:32:11	0.043

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
219	03/26/2010	20:33:11	0.043
220	03/26/2010	20:34:11	0.044
221	03/26/2010	20:35:11	0.040
222	03/26/2010	20:36:11	0.041
223	03/26/2010	20:37:11	0.042
224	03/26/2010	20:38:11	0.041
225	03/26/2010	20:39:11	0.043
226	03/26/2010	20:40:11	0.041
227	03/26/2010	20:41:11	0.045
228	03/26/2010	20:42:11	0.038
229	03/26/2010	20:43:11	0.038
230	03/26/2010	20:44:11	0.036
231	03/26/2010	20:45:11	0.036
232	03/26/2010	20:46:11	0.034
233	03/26/2010	20:47:11	0.035
234	03/26/2010	20:48:11	0.034
235	03/26/2010	20:49:11	0.036
236	03/26/2010	20:50:11	0.046
237	03/26/2010	20:51:11	0.033
238	03/26/2010	20:52:11	0.035
239	03/26/2010	20:53:11	0.030
240	03/26/2010	20:54:11	0.030
241	03/26/2010	20:55:11	0.031
242	03/26/2010	20:56:11	0.090
243	03/26/2010	20:57:11	0.085
244	03/26/2010	20:58:11	0.030
245	03/26/2010	20:59:11	0.025
246	03/26/2010	21:00:11	0.028
247	03/26/2010	21:01:11	0.025
248	03/26/2010	21:02:11	0.025
249	03/26/2010	21:03:11	0.026
250	03/26/2010	21:04:11	0.027
251	03/26/2010	21:05:11	0.026
252	03/26/2010	21:06:11	0.024
253	03/26/2010	21:07:11	0.023
254	03/26/2010	21:08:11	0.034
255	03/26/2010	21:09:11	0.034
256	03/26/2010	21:10:11	0.027
257	03/26/2010	21:11:11	0.028
258	03/26/2010	21:12:11	0.025
259	03/26/2010	21:13:11	0.038
260	03/26/2010	21:14:11	0.078
261	03/26/2010	21:15:11	0.030
262	03/26/2010	21:16:11	0.028
263	03/26/2010	21:17:11	0.026
264	03/26/2010	21:18:11	0.030

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
265	03/26/2010	21:19:11	0.029
266	03/26/2010	21:20:11	0.028
267	03/26/2010	21:21:11	0.027
268	03/26/2010	21:22:11	0.026
269	03/26/2010	21:23:11	0.030
270	03/26/2010	21:24:11	0.035
271	03/26/2010	21:25:11	0.031
272	03/26/2010	21:26:11	0.026
273	03/26/2010	21:27:11	0.028
274	03/26/2010	21:28:11	0.028
275	03/26/2010	21:29:11	0.028
276	03/26/2010	21:30:11	0.029
277	03/26/2010	21:31:11	0.030
278	03/26/2010	21:32:11	0.035
279	03/26/2010	21:33:11	0.038
280	03/26/2010	21:34:11	0.034
281	03/26/2010	21:35:11	0.037
282	03/26/2010	21:36:11	0.035
283	03/26/2010	21:37:11	0.031
284	03/26/2010	21:38:11	0.031
285	03/26/2010	21:39:11	0.033
286	03/26/2010	21:40:11	0.035
287	03/26/2010	21:41:11	0.033
288	03/26/2010	21:42:11	0.033
289	03/26/2010	21:43:11	0.034
290	03/26/2010	21:44:11	0.031
291	03/26/2010	21:45:11	0.029
292	03/26/2010	21:46:11	0.027
293	03/26/2010	21:47:11	0.025
294	03/26/2010	21:48:11	0.028
295	03/26/2010	21:49:11	0.029
296	03/26/2010	21:50:11	0.027
297	03/26/2010	21:51:11	0.026
298	03/26/2010	21:52:11	0.026
299	03/26/2010	21:53:11	0.027
300	03/26/2010	21:54:11	0.024
301	03/26/2010	21:55:11	0.027
302	03/26/2010	21:56:11	0.025
303	03/26/2010	21:57:11	0.027
304	03/26/2010	21:58:11	0.027
305	03/26/2010	21:59:11	0.026
306	03/26/2010	22:00:11	0.024
307	03/26/2010	22:01:11	0.027
308	03/26/2010	22:02:11	0.026
309	03/26/2010	22:03:11	0.027
310	03/26/2010	22:04:11	0.026

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
311	03/26/2010	22:05:11	0.025
312	03/26/2010	22:06:11	0.029
313	03/26/2010	22:07:11	0.026
314	03/26/2010	22:08:11	0.026
315	03/26/2010	22:09:11	0.026
316	03/26/2010	22:10:11	0.027
317	03/26/2010	22:11:11	0.027
318	03/26/2010	22:12:11	0.027
319	03/26/2010	22:13:11	0.028
320	03/26/2010	22:14:11	0.024
321	03/26/2010	22:15:11	0.024
322	03/26/2010	22:16:11	0.024
323	03/26/2010	22:17:11	0.029
324	03/26/2010	22:18:11	0.026
325	03/26/2010	22:19:11	0.026
326	03/26/2010	22:20:11	0.030
327	03/26/2010	22:21:11	0.028
328	03/26/2010	22:22:11	0.026
329	03/26/2010	22:23:11	0.026
330	03/26/2010	22:24:11	0.023
331	03/26/2010	22:25:11	0.023
332	03/26/2010	22:26:11	0.022
333	03/26/2010	22:27:11	0.021
334	03/26/2010	22:28:11	0.021
335	03/26/2010	22:29:11	0.021
336	03/26/2010	22:30:11	0.022
337	03/26/2010	22:31:11	0.022
338	03/26/2010	22:32:11	0.023
339	03/26/2010	22:33:11	0.022
340	03/26/2010	22:34:11	0.026
341	03/26/2010	22:35:11	0.023
342	03/26/2010	22:36:11	0.026
343	03/26/2010	22:37:11	0.023
344	03/26/2010	22:38:11	0.024
345	03/26/2010	22:39:11	0.022
346	03/26/2010	22:40:11	0.024
347	03/26/2010	22:41:11	0.023
348	03/26/2010	22:42:11	0.024
349	03/26/2010	22:43:11	0.024
350	03/26/2010	22:44:11	0.022
351	03/26/2010	22:45:11	0.025
352	03/26/2010	22:46:11	0.026
353	03/26/2010	22:47:11	0.026
354	03/26/2010	22:48:11	0.024
355	03/26/2010	22:49:11	0.025
356	03/26/2010	22:50:11	0.025

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
357	03/26/2010	22:51:11	0.025
358	03/26/2010	22:52:11	0.026
359	03/26/2010	22:53:11	0.025
360	03/26/2010	22:54:11	0.025
361	03/26/2010	22:55:11	0.025
362	03/26/2010	22:56:11	0.025
363	03/26/2010	22:57:11	0.025
364	03/26/2010	22:58:11	0.024
365	03/26/2010	22:59:11	0.025
366	03/26/2010	23:00:11	0.023
367	03/26/2010	23:01:11	0.024
368	03/26/2010	23:02:11	0.023
369	03/26/2010	23:03:11	0.024
370	03/26/2010	23:04:11	0.023
371	03/26/2010	23:05:11	0.024
372	03/26/2010	23:06:11	0.032
373	03/26/2010	23:07:11	0.038
374	03/26/2010	23:08:11	0.037
375	03/26/2010	23:09:11	0.030
376	03/26/2010	23:10:11	0.027
377	03/26/2010	23:11:11	0.026
378	03/26/2010	23:12:11	0.023
379	03/26/2010	23:13:11	0.024
380	03/26/2010	23:14:11	0.021
381	03/26/2010	23:15:11	0.020
382	03/26/2010	23:16:11	0.020
383	03/26/2010	23:17:11	0.027
384	03/26/2010	23:18:11	0.029
385	03/26/2010	23:19:11	0.046
386	03/26/2010	23:20:11	0.031
387	03/26/2010	23:21:11	0.023
388	03/26/2010	23:22:11	0.022
389	03/26/2010	23:23:11	0.022
390	03/26/2010	23:24:11	0.023
391	03/26/2010	23:25:11	0.023
392	03/26/2010	23:26:11	0.022
393	03/26/2010	23:27:11	0.021
394	03/26/2010	23:28:11	0.023
395	03/26/2010	23:29:11	0.021
396	03/26/2010	23:30:11	0.020
397	03/26/2010	23:31:11	0.023
398	03/26/2010	23:32:11	0.022
399	03/26/2010	23:33:11	0.021
400	03/26/2010	23:34:11	0.022
401	03/26/2010	23:35:11	0.024
402	03/26/2010	23:36:11	0.030

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
403	03/26/2010	23:37:11	0.023
404	03/26/2010	23:38:11	0.022
405	03/26/2010	23:39:11	0.022
406	03/26/2010	23:40:11	0.022
407	03/26/2010	23:41:11	0.022
408	03/26/2010	23:42:11	0.022
409	03/26/2010	23:43:11	0.023
410	03/26/2010	23:44:11	0.023
411	03/26/2010	23:45:11	0.023
412	03/26/2010	23:46:11	0.023
413	03/26/2010	23:47:11	0.023
414	03/26/2010	23:48:11	0.034
415	03/26/2010	23:49:11	0.027
416	03/26/2010	23:50:11	0.025
417	03/26/2010	23:51:11	0.026
418	03/26/2010	23:52:11	0.026
419	03/26/2010	23:53:11	0.026
420	03/26/2010	23:54:11	0.025
421	03/26/2010	23:55:11	0.025
422	03/26/2010	23:56:11	0.029
423	03/26/2010	23:57:11	0.027
424	03/26/2010	23:58:11	0.026
425	03/26/2010	23:59:11	0.024
426	03/27/2010	00:00:11	0.026
427	03/27/2010	00:01:11	0.027
428	03/27/2010	00:02:11	0.025
429	03/27/2010	00:03:11	0.026
430	03/27/2010	00:04:11	0.026
431	03/27/2010	00:05:11	0.026
432	03/27/2010	00:06:11	0.026
433	03/27/2010	00:07:11	0.027
434	03/27/2010	00:08:11	0.025
435	03/27/2010	00:09:11	0.026
436	03/27/2010	00:10:11	0.026
437	03/27/2010	00:11:11	0.026
438	03/27/2010	00:12:11	0.025
439	03/27/2010	00:13:11	0.025
440	03/27/2010	00:14:11	0.026
441	03/27/2010	00:15:11	0.025
442	03/27/2010	00:16:11	0.024
443	03/27/2010	00:17:11	0.024
444	03/27/2010	00:18:11	0.024
445	03/27/2010	00:19:11	0.026
446	03/27/2010	00:20:11	0.025
447	03/27/2010	00:21:11	0.025
448	03/27/2010	00:22:11	0.025

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
449	03/27/2010	00:23:11	0.025
450	03/27/2010	00:24:11	0.024
451	03/27/2010	00:25:11	0.025
452	03/27/2010	00:26:11	0.024
453	03/27/2010	00:27:11	0.024
454	03/27/2010	00:28:11	0.024
455	03/27/2010	00:29:11	0.023
456	03/27/2010	00:30:11	0.024
457	03/27/2010	00:31:11	0.024
458	03/27/2010	00:32:11	0.024
459	03/27/2010	00:33:11	0.024
460	03/27/2010	00:34:11	0.025
461	03/27/2010	00:35:11	0.024
462	03/27/2010	00:36:11	0.024
463	03/27/2010	00:37:11	0.025
464	03/27/2010	00:38:11	0.024
465	03/27/2010	00:39:11	0.023
466	03/27/2010	00:40:11	0.024
467	03/27/2010	00:41:11	0.022
468	03/27/2010	00:42:11	0.022
469	03/27/2010	00:43:11	0.022
470	03/27/2010	00:44:11	0.021
471	03/27/2010	00:45:11	0.021
472	03/27/2010	00:46:11	0.022
473	03/27/2010	00:47:11	0.021
474	03/27/2010	00:48:11	0.023
475	03/27/2010	00:49:11	0.022
476	03/27/2010	00:50:11	0.022
477	03/27/2010	00:51:11	0.023
478	03/27/2010	00:52:11	0.021
479	03/27/2010	00:53:11	0.022
480	03/27/2010	00:54:11	0.024
481	03/27/2010	00:55:11	0.022
482	03/27/2010	00:56:11	0.023
483	03/27/2010	00:57:11	0.023
484	03/27/2010	00:58:11	0.024
485	03/27/2010	00:59:11	0.024
486	03/27/2010	01:00:11	0.023
487	03/27/2010	01:01:11	0.023
488	03/27/2010	01:02:11	0.025
489	03/27/2010	01:03:11	0.023
490	03/27/2010	01:04:11	0.021
491	03/27/2010	01:05:11	0.022
492	03/27/2010	01:06:11	0.025
493	03/27/2010	01:07:11	0.023
494	03/27/2010	01:08:11	0.025

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
495	03/27/2010	01:09:11	0.023
496	03/27/2010	01:10:11	0.023
497	03/27/2010	01:11:11	0.022
498	03/27/2010	01:12:11	0.023
499	03/27/2010	01:13:11	0.024
500	03/27/2010	01:14:11	0.024
501	03/27/2010	01:15:11	0.024
502	03/27/2010	01:16:11	0.025
503	03/27/2010	01:17:11	0.025
504	03/27/2010	01:18:11	0.024
505	03/27/2010	01:19:11	0.023
506	03/27/2010	01:20:11	0.022
507	03/27/2010	01:21:11	0.023
508	03/27/2010	01:22:11	0.023
509	03/27/2010	01:23:11	0.024
510	03/27/2010	01:24:11	0.023
511	03/27/2010	01:25:11	0.023
512	03/27/2010	01:26:11	0.021
513	03/27/2010	01:27:11	0.022
514	03/27/2010	01:28:11	0.023
515	03/27/2010	01:29:11	0.020
516	03/27/2010	01:30:11	0.021
517	03/27/2010	01:31:11	0.022
518	03/27/2010	01:32:11	0.020
519	03/27/2010	01:33:11	0.020
520	03/27/2010	01:34:11	0.019
521	03/27/2010	01:35:11	0.023
522	03/27/2010	01:36:11	0.024
523	03/27/2010	01:37:11	0.023
524	03/27/2010	01:38:11	0.023
525	03/27/2010	01:39:11	0.024
526	03/27/2010	01:40:11	0.024
527	03/27/2010	01:41:11	0.022
528	03/27/2010	01:42:11	0.024
529	03/27/2010	01:43:11	0.023
530	03/27/2010	01:44:11	0.022
531	03/27/2010	01:45:11	0.022
532	03/27/2010	01:46:11	0.024
533	03/27/2010	01:47:11	0.025
534	03/27/2010	01:48:11	0.023
535	03/27/2010	01:49:11	0.020
536	03/27/2010	01:50:11	0.021
537	03/27/2010	01:51:11	0.023
538	03/27/2010	01:52:11	0.021
539	03/27/2010	01:53:11	0.022
540	03/27/2010	01:54:11	0.022

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
541	03/27/2010	01:55:11	0.022
542	03/27/2010	01:56:11	0.022
543	03/27/2010	01:57:11	0.022
544	03/27/2010	01:58:11	0.023
545	03/27/2010	01:59:11	0.023
546	03/27/2010	02:00:11	0.024
547	03/27/2010	02:01:11	0.023
548	03/27/2010	02:02:11	0.022
549	03/27/2010	02:03:11	0.026
550	03/27/2010	02:04:11	0.027
551	03/27/2010	02:05:11	0.030
552	03/27/2010	02:06:11	0.030
553	03/27/2010	02:07:11	0.026
554	03/27/2010	02:08:11	0.026
555	03/27/2010	02:09:11	0.024
556	03/27/2010	02:10:11	0.026
557	03/27/2010	02:11:11	0.027
558	03/27/2010	02:12:11	0.028
559	03/27/2010	02:13:11	0.030
560	03/27/2010	02:14:11	0.033
561	03/27/2010	02:15:11	0.034
562	03/27/2010	02:16:11	0.038
563	03/27/2010	02:17:11	0.039
564	03/27/2010	02:18:11	0.041
565	03/27/2010	02:19:11	0.043
566	03/27/2010	02:20:11	0.042
567	03/27/2010	02:21:11	0.039
568	03/27/2010	02:22:11	0.037
569	03/27/2010	02:23:11	0.038
570	03/27/2010	02:24:11	0.036
571	03/27/2010	02:25:11	0.033
572	03/27/2010	02:26:11	0.032
573	03/27/2010	02:27:11	0.031
574	03/27/2010	02:28:11	0.027
575	03/27/2010	02:29:11	0.024
576	03/27/2010	02:30:11	0.023
577	03/27/2010	02:31:11	0.023
578	03/27/2010	02:32:11	0.022
579	03/27/2010	02:33:11	0.020
580	03/27/2010	02:34:11	0.020
581	03/27/2010	02:35:11	0.019
582	03/27/2010	02:36:11	0.019
583	03/27/2010	02:37:11	0.020
584	03/27/2010	02:38:11	0.020
585	03/27/2010	02:39:11	0.023
586	03/27/2010	02:40:11	0.021

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
587	03/27/2010	02:41:11	0.019
588	03/27/2010	02:42:11	0.020
589	03/27/2010	02:43:11	0.019
590	03/27/2010	02:44:11	0.020
591	03/27/2010	02:45:11	0.022
592	03/27/2010	02:46:11	0.019
593	03/27/2010	02:47:11	0.021
594	03/27/2010	02:48:11	0.020
595	03/27/2010	02:49:11	0.020
596	03/27/2010	02:50:11	0.023
597	03/27/2010	02:51:11	0.023
598	03/27/2010	02:52:11	0.023
599	03/27/2010	02:53:11	0.025
600	03/27/2010	02:54:11	0.024
601	03/27/2010	02:55:11	0.025
602	03/27/2010	02:56:11	0.025
603	03/27/2010	02:57:11	0.025
604	03/27/2010	02:58:11	0.025
605	03/27/2010	02:59:11	0.026
606	03/27/2010	03:00:11	0.025
607	03/27/2010	03:01:11	0.025
608	03/27/2010	03:02:11	0.023
609	03/27/2010	03:03:11	0.023
610	03/27/2010	03:04:11	0.023
611	03/27/2010	03:05:11	0.023
612	03/27/2010	03:06:11	0.021
613	03/27/2010	03:07:11	0.022
614	03/27/2010	03:08:11	0.021
615	03/27/2010	03:09:11	0.020
616	03/27/2010	03:10:11	0.021
617	03/27/2010	03:11:11	0.020
618	03/27/2010	03:12:11	0.021
619	03/27/2010	03:13:11	0.020
620	03/27/2010	03:14:11	0.021
621	03/27/2010	03:15:11	0.019
622	03/27/2010	03:16:11	0.019
623	03/27/2010	03:17:11	0.018
624	03/27/2010	03:18:11	0.019
625	03/27/2010	03:19:11	0.022
626	03/27/2010	03:20:11	0.023
627	03/27/2010	03:21:11	0.021
628	03/27/2010	03:22:11	0.021
629	03/27/2010	03:23:11	0.019
630	03/27/2010	03:24:11	0.018
631	03/27/2010	03:25:11	0.018
632	03/27/2010	03:26:11	0.018

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
633	03/27/2010	03:27:11	0.019
634	03/27/2010	03:28:11	0.019
635	03/27/2010	03:29:11	0.020
636	03/27/2010	03:30:11	0.019
637	03/27/2010	03:31:11	0.019
638	03/27/2010	03:32:11	0.019
639	03/27/2010	03:33:11	0.020
640	03/27/2010	03:34:11	0.019
641	03/27/2010	03:35:11	0.020
642	03/27/2010	03:36:11	0.019
643	03/27/2010	03:37:11	0.019
644	03/27/2010	03:38:11	0.018
645	03/27/2010	03:39:11	0.019
646	03/27/2010	03:40:11	0.020
647	03/27/2010	03:41:11	0.019
648	03/27/2010	03:42:11	0.019
649	03/27/2010	03:43:11	0.019
650	03/27/2010	03:44:11	0.020
651	03/27/2010	03:45:11	0.021
652	03/27/2010	03:46:11	0.019
653	03/27/2010	03:47:11	0.020
654	03/27/2010	03:48:11	0.019
655	03/27/2010	03:49:11	0.017
656	03/27/2010	03:50:11	0.020
657	03/27/2010	03:51:11	0.018
658	03/27/2010	03:52:11	0.020
659	03/27/2010	03:53:11	0.018
660	03/27/2010	03:54:11	0.018
661	03/27/2010	03:55:11	0.019
662	03/27/2010	03:56:11	0.019
663	03/27/2010	03:57:11	0.023
664	03/27/2010	03:58:11	0.020
665	03/27/2010	03:59:11	0.026
666	03/27/2010	04:00:11	0.022
667	03/27/2010	04:01:11	0.021
668	03/27/2010	04:02:11	0.020
669	03/27/2010	04:03:11	0.020
670	03/27/2010	04:04:11	0.021
671	03/27/2010	04:05:11	0.020
672	03/27/2010	04:06:11	0.020
673	03/27/2010	04:07:11	0.019
674	03/27/2010	04:08:11	0.019
675	03/27/2010	04:09:11	0.018
676	03/27/2010	04:10:11	0.019
677	03/27/2010	04:11:11	0.019
678	03/27/2010	04:12:11	0.019

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
679	03/27/2010	04:13:11	0.019
680	03/27/2010	04:14:11	0.019
681	03/27/2010	04:15:11	0.019
682	03/27/2010	04:16:11	0.019
683	03/27/2010	04:17:11	0.019
684	03/27/2010	04:18:11	0.019
685	03/27/2010	04:19:11	0.019
686	03/27/2010	04:20:11	0.020
687	03/27/2010	04:21:11	0.020
688	03/27/2010	04:22:11	0.019
689	03/27/2010	04:23:11	0.020
690	03/27/2010	04:24:11	0.019
691	03/27/2010	04:25:11	0.020
692	03/27/2010	04:26:11	0.021
693	03/27/2010	04:27:11	0.021
694	03/27/2010	04:28:11	0.023
695	03/27/2010	04:29:11	0.024
696	03/27/2010	04:30:11	0.021
697	03/27/2010	04:31:11	0.021
698	03/27/2010	04:32:11	0.021
699	03/27/2010	04:33:11	0.021
700	03/27/2010	04:34:11	0.021
701	03/27/2010	04:35:11	0.021
702	03/27/2010	04:36:11	0.021
703	03/27/2010	04:37:11	0.023
704	03/27/2010	04:38:11	0.022
705	03/27/2010	04:39:11	0.021
706	03/27/2010	04:40:11	0.023
707	03/27/2010	04:41:11	0.024
708	03/27/2010	04:42:11	0.022
709	03/27/2010	04:43:11	0.021
710	03/27/2010	04:44:11	0.023
711	03/27/2010	04:45:11	0.022
712	03/27/2010	04:46:11	0.022
713	03/27/2010	04:47:11	0.021
714	03/27/2010	04:48:11	0.023
715	03/27/2010	04:49:11	0.022
716	03/27/2010	04:50:11	0.023
717	03/27/2010	04:51:11	0.022
718	03/27/2010	04:52:11	0.022
719	03/27/2010	04:53:11	0.023
720	03/27/2010	04:54:11	0.023
721	03/27/2010	04:55:11	0.024
722	03/27/2010	04:56:11	0.022
723	03/27/2010	04:57:11	0.024
724	03/27/2010	04:58:11	0.025

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
725	03/27/2010	04:59:11	0.023
726	03/27/2010	05:00:11	0.022
727	03/27/2010	05:01:11	0.023
728	03/27/2010	05:02:11	0.023
729	03/27/2010	05:03:11	0.023
730	03/27/2010	05:04:11	0.021
731	03/27/2010	05:05:11	0.022
732	03/27/2010	05:06:11	0.022
733	03/27/2010	05:07:11	0.023
734	03/27/2010	05:08:11	0.021
735	03/27/2010	05:09:11	0.036
736	03/27/2010	05:10:11	0.030
737	03/27/2010	05:11:11	0.027
738	03/27/2010	05:12:11	0.030
739	03/27/2010	05:13:11	0.031
740	03/27/2010	05:14:11	0.026
741	03/27/2010	05:15:11	0.028
742	03/27/2010	05:16:11	0.027
743	03/27/2010	05:17:11	0.039
744	03/27/2010	05:18:11	0.029
745	03/27/2010	05:19:11	0.025
746	03/27/2010	05:20:11	0.024
747	03/27/2010	05:21:11	0.022
748	03/27/2010	05:22:11	0.023
749	03/27/2010	05:23:11	0.021
750	03/27/2010	05:24:11	0.021
751	03/27/2010	05:25:11	0.020
752	03/27/2010	05:26:11	0.019
753	03/27/2010	05:27:11	0.018
754	03/27/2010	05:28:11	0.024
755	03/27/2010	05:29:11	0.019
756	03/27/2010	05:30:11	0.020
757	03/27/2010	05:31:11	0.024
758	03/27/2010	05:32:11	0.019
759	03/27/2010	05:33:11	0.020
760	03/27/2010	05:34:11	0.021
761	03/27/2010	05:35:11	0.019
762	03/27/2010	05:36:11	0.019
763	03/27/2010	05:37:11	0.021
764	03/27/2010	05:38:11	0.020
765	03/27/2010	05:39:11	0.018
766	03/27/2010	05:40:11	0.018
767	03/27/2010	05:41:11	0.020
768	03/27/2010	05:42:11	0.020
769	03/27/2010	05:43:11	0.019
770	03/27/2010	05:44:11	0.019

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
771	03/27/2010	05:45:11	0.017
772	03/27/2010	05:46:11	0.020
773	03/27/2010	05:47:11	0.019
774	03/27/2010	05:48:11	0.018
775	03/27/2010	05:49:11	0.018
776	03/27/2010	05:50:11	0.017
777	03/27/2010	05:51:11	0.017
778	03/27/2010	05:52:11	0.017
779	03/27/2010	05:53:11	0.018
780	03/27/2010	05:54:11	0.020
781	03/27/2010	05:55:11	0.016
782	03/27/2010	05:56:11	0.018
783	03/27/2010	05:57:11	0.017
784	03/27/2010	05:58:11	0.018
785	03/27/2010	05:59:11	0.017
786	03/27/2010	06:00:11	0.018
787	03/27/2010	06:01:11	0.015
788	03/27/2010	06:02:11	0.018
789	03/27/2010	06:03:11	0.018
790	03/27/2010	06:04:11	0.021
791	03/27/2010	06:05:11	0.018
792	03/27/2010	06:06:11	0.020
793	03/27/2010	06:07:11	0.017
794	03/27/2010	06:08:11	0.017
795	03/27/2010	06:09:11	0.019
796	03/27/2010	06:10:11	0.021
797	03/27/2010	06:11:11	0.018
798	03/27/2010	06:12:11	0.021
799	03/27/2010	06:13:11	0.019
800	03/27/2010	06:14:11	0.021
801	03/27/2010	06:15:11	0.021
802	03/27/2010	06:16:11	0.022
803	03/27/2010	06:17:11	0.019
804	03/27/2010	06:18:11	0.019
805	03/27/2010	06:19:11	0.017
806	03/27/2010	06:20:11	0.017
807	03/27/2010	06:21:11	0.018
808	03/27/2010	06:22:11	0.018
809	03/27/2010	06:23:11	0.017
810	03/27/2010	06:24:11	0.017
811	03/27/2010	06:25:11	0.020
812	03/27/2010	06:26:11	0.029
813	03/27/2010	06:27:11	0.022
814	03/27/2010	06:28:11	0.019
815	03/27/2010	06:29:11	0.020
816	03/27/2010	06:30:11	0.022

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
817	03/27/2010	06:31:11	0.020
818	03/27/2010	06:32:11	0.019
819	03/27/2010	06:33:11	0.021
820	03/27/2010	06:34:11	0.022
821	03/27/2010	06:35:11	0.021
822	03/27/2010	06:36:11	0.018
823	03/27/2010	06:37:11	0.019
824	03/27/2010	06:38:11	0.021
825	03/27/2010	06:39:11	0.031
826	03/27/2010	06:40:11	0.024
827	03/27/2010	06:41:11	0.022
828	03/27/2010	06:42:11	0.023
829	03/27/2010	06:43:11	0.020
830	03/27/2010	06:44:11	0.023
831	03/27/2010	06:45:11	0.021
832	03/27/2010	06:46:11	0.021
833	03/27/2010	06:47:11	0.027
834	03/27/2010	06:48:11	0.027
835	03/27/2010	06:49:11	0.022
836	03/27/2010	06:50:11	0.021
837	03/27/2010	06:51:11	0.020
838	03/27/2010	06:52:11	0.020
839	03/27/2010	06:53:11	0.022
840	03/27/2010	06:54:11	0.019
841	03/27/2010	06:55:11	0.018
842	03/27/2010	06:56:11	0.021
843	03/27/2010	06:57:11	0.019
844	03/27/2010	06:58:11	0.021
845	03/27/2010	06:59:11	0.021
846	03/27/2010	07:00:11	0.022
847	03/27/2010	07:01:11	0.022
848	03/27/2010	07:02:11	0.022
849	03/27/2010	07:03:11	0.022
850	03/27/2010	07:04:11	0.023
851	03/27/2010	07:05:11	0.022
852	03/27/2010	07:06:11	0.022
853	03/27/2010	07:07:11	0.020
854	03/27/2010	07:08:11	0.020
855	03/27/2010	07:09:11	0.020
856	03/27/2010	07:10:11	0.020
857	03/27/2010	07:11:11	0.022
858	03/27/2010	07:12:11	0.020
859	03/27/2010	07:13:11	0.021
860	03/27/2010	07:14:11	0.021
861	03/27/2010	07:15:11	0.022
862	03/27/2010	07:16:11	0.021

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
863	03/27/2010	07:17:11	0.020
864	03/27/2010	07:18:11	0.020
865	03/27/2010	07:19:11	0.019
866	03/27/2010	07:20:11	0.021
867	03/27/2010	07:21:11	0.017
868	03/27/2010	07:22:11	0.023
869	03/27/2010	07:23:11	0.020
870	03/27/2010	07:24:11	0.021
871	03/27/2010	07:25:11	0.020
872	03/27/2010	07:26:11	0.020
873	03/27/2010	07:27:11	0.020
874	03/27/2010	07:28:11	0.021
875	03/27/2010	07:29:11	0.025
876	03/27/2010	07:30:11	0.022
877	03/27/2010	07:31:11	0.021
878	03/27/2010	07:32:11	0.018
879	03/27/2010	07:33:11	0.024
880	03/27/2010	07:34:11	0.022
881	03/27/2010	07:35:11	0.019
882	03/27/2010	07:36:11	0.018
883	03/27/2010	07:37:11	0.017
884	03/27/2010	07:38:11	0.018
885	03/27/2010	07:39:11	0.019
886	03/27/2010	07:40:11	0.022
887	03/27/2010	07:41:11	0.020
888	03/27/2010	07:42:11	0.020
889	03/27/2010	07:43:11	0.017
890	03/27/2010	07:44:11	0.023
891	03/27/2010	07:45:11	0.019
892	03/27/2010	07:46:11	0.029
893	03/27/2010	07:47:11	0.023
894	03/27/2010	07:48:11	0.019
895	03/27/2010	07:49:11	0.019
896	03/27/2010	07:50:11	0.019
897	03/27/2010	07:51:11	0.025
898	03/27/2010	07:52:11	0.020
899	03/27/2010	07:53:11	0.019
900	03/27/2010	07:54:11	0.020
901	03/27/2010	07:55:11	0.020
902	03/27/2010	07:56:11	0.018
903	03/27/2010	07:57:11	0.020
904	03/27/2010	07:58:11	0.019
905	03/27/2010	07:59:11	0.017
906	03/27/2010	08:00:11	0.015
907	03/27/2010	08:01:11	0.017
908	03/27/2010	08:02:11	0.024

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
909	03/27/2010	08:03:11	0.023
910	03/27/2010	08:04:11	0.019
911	03/27/2010	08:05:11	0.016
912	03/27/2010	08:06:11	0.020
913	03/27/2010	08:07:11	0.023
914	03/27/2010	08:08:11	0.020
915	03/27/2010	08:09:11	0.024
916	03/27/2010	08:10:11	0.020
917	03/27/2010	08:11:11	0.021
918	03/27/2010	08:12:11	0.017
919	03/27/2010	08:13:11	0.016
920	03/27/2010	08:14:11	0.014
921	03/27/2010	08:15:11	0.014
922	03/27/2010	08:16:11	0.015
923	03/27/2010	08:17:11	0.016
924	03/27/2010	08:18:11	0.018
925	03/27/2010	08:19:11	0.018
926	03/27/2010	08:20:11	0.019
927	03/27/2010	08:21:11	0.017
928	03/27/2010	08:22:11	0.019
929	03/27/2010	08:23:11	0.015
930	03/27/2010	08:24:11	0.015
931	03/27/2010	08:25:11	0.014
932	03/27/2010	08:26:11	0.014
933	03/27/2010	08:27:11	0.013
934	03/27/2010	08:28:11	0.012
935	03/27/2010	08:29:11	0.012
936	03/27/2010	08:30:11	0.012
937	03/27/2010	08:31:11	0.016
938	03/27/2010	08:32:11	0.015
939	03/27/2010	08:33:11	0.013
940	03/27/2010	08:34:11	0.012
941	03/27/2010	08:35:11	0.012
942	03/27/2010	08:36:11	0.013
943	03/27/2010	08:37:11	0.010
944	03/27/2010	08:38:11	0.012
945	03/27/2010	08:39:11	0.013
946	03/27/2010	08:40:11	0.015
947	03/27/2010	08:41:11	0.012
948	03/27/2010	08:42:11	0.013
949	03/27/2010	08:43:11	0.014
950	03/27/2010	08:44:11	0.011
951	03/27/2010	08:45:11	0.015
952	03/27/2010	08:46:11	0.017
953	03/27/2010	08:47:11	0.012
954	03/27/2010	08:48:11	0.012

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
955	03/27/2010	08:49:11	0.011
956	03/27/2010	08:50:11	0.012
957	03/27/2010	08:51:11	0.016
958	03/27/2010	08:52:11	0.027
959	03/27/2010	08:53:11	0.016
960	03/27/2010	08:54:11	0.012
961	03/27/2010	08:55:11	0.012
962	03/27/2010	08:56:11	0.012
963	03/27/2010	08:57:11	0.014
964	03/27/2010	08:58:11	0.012
965	03/27/2010	08:59:11	0.012
966	03/27/2010	09:00:11	0.012
967	03/27/2010	09:01:11	0.014
968	03/27/2010	09:02:11	0.019
969	03/27/2010	09:03:11	0.014
970	03/27/2010	09:04:11	0.014
971	03/27/2010	09:05:11	0.013
972	03/27/2010	09:06:11	0.015
973	03/27/2010	09:07:11	0.016
974	03/27/2010	09:08:11	0.014
975	03/27/2010	09:09:11	0.017
976	03/27/2010	09:10:11	0.018
977	03/27/2010	09:11:11	0.013
978	03/27/2010	09:12:11	0.014
979	03/27/2010	09:13:11	0.021
980	03/27/2010	09:14:11	0.017
981	03/27/2010	09:15:11	0.019
982	03/27/2010	09:16:11	0.020
983	03/27/2010	09:17:11	0.018
984	03/27/2010	09:18:11	0.023
985	03/27/2010	09:19:11	0.021
986	03/27/2010	09:20:11	0.020
987	03/27/2010	09:21:11	0.018
988	03/27/2010	09:22:11	0.015
989	03/27/2010	09:23:11	0.015
990	03/27/2010	09:24:11	0.016
991	03/27/2010	09:25:11	0.017
992	03/27/2010	09:26:11	0.017
993	03/27/2010	09:27:11	0.019
994	03/27/2010	09:28:11	0.014
995	03/27/2010	09:29:11	0.014
996	03/27/2010	09:30:11	0.015
997	03/27/2010	09:31:11	0.013
998	03/27/2010	09:32:11	0.014
999	03/27/2010	09:33:11	0.012
1000	03/27/2010	09:34:11	0.012

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1001	03/27/2010	09:35:11	0.016
1002	03/27/2010	09:36:11	0.015
1003	03/27/2010	09:37:11	0.012
1004	03/27/2010	09:38:11	0.017
1005	03/27/2010	09:39:11	0.013
1006	03/27/2010	09:40:11	0.013
1007	03/27/2010	09:41:11	0.013
1008	03/27/2010	09:42:11	0.012
1009	03/27/2010	09:43:11	0.013
1010	03/27/2010	09:44:11	0.013
1011	03/27/2010	09:45:11	0.014
1012	03/27/2010	09:46:11	0.013
1013	03/27/2010	09:47:11	0.013
1014	03/27/2010	09:48:11	0.014
1015	03/27/2010	09:49:11	0.015
1016	03/27/2010	09:50:11	0.014
1017	03/27/2010	09:51:11	0.016
1018	03/27/2010	09:52:11	0.015
1019	03/27/2010	09:53:11	0.015
1020	03/27/2010	09:54:11	0.016
1021	03/27/2010	09:55:11	0.013
1022	03/27/2010	09:56:11	0.017
1023	03/27/2010	09:57:11	0.022
1024	03/27/2010	09:58:11	0.028
1025	03/27/2010	09:59:11	0.016
1026	03/27/2010	10:00:11	0.014
1027	03/27/2010	10:01:11	0.013
1028	03/27/2010	10:02:11	0.012
1029	03/27/2010	10:03:11	0.013
1030	03/27/2010	10:04:11	0.015
1031	03/27/2010	10:05:11	0.013
1032	03/27/2010	10:06:11	0.016
1033	03/27/2010	10:07:11	0.015
1034	03/27/2010	10:08:11	0.014
1035	03/27/2010	10:09:11	0.015
1036	03/27/2010	10:10:11	0.013
1037	03/27/2010	10:11:11	0.014
1038	03/27/2010	10:12:11	0.015
1039	03/27/2010	10:13:11	0.015
1040	03/27/2010	10:14:11	0.017
1041	03/27/2010	10:15:11	0.014
1042	03/27/2010	10:16:11	0.014
1043	03/27/2010	10:17:11	0.014
1044	03/27/2010	10:18:11	0.015
1045	03/27/2010	10:19:11	0.015
1046	03/27/2010	10:20:11	0.015

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1047	03/27/2010	10:21:11	0.016
1048	03/27/2010	10:22:11	0.014
1049	03/27/2010	10:23:11	0.014
1050	03/27/2010	10:24:11	0.014
1051	03/27/2010	10:25:11	0.017
1052	03/27/2010	10:26:11	0.016
1053	03/27/2010	10:27:11	0.029
1054	03/27/2010	10:28:11	0.014
1055	03/27/2010	10:29:11	0.015
1056	03/27/2010	10:30:11	0.015
1057	03/27/2010	10:31:11	0.016
1058	03/27/2010	10:32:11	0.015
1059	03/27/2010	10:33:11	0.015
1060	03/27/2010	10:34:11	0.015
1061	03/27/2010	10:35:11	0.017
1062	03/27/2010	10:36:11	0.017
1063	03/27/2010	10:37:11	0.016
1064	03/27/2010	10:38:11	0.018
1065	03/27/2010	10:39:11	0.015
1066	03/27/2010	10:40:11	0.018
1067	03/27/2010	10:41:11	0.017
1068	03/27/2010	10:42:11	0.017
1069	03/27/2010	10:43:11	0.017
1070	03/27/2010	10:44:11	0.019
1071	03/27/2010	10:45:11	0.018
1072	03/27/2010	10:46:11	0.021
1073	03/27/2010	10:47:11	0.018
1074	03/27/2010	10:48:11	0.018
1075	03/27/2010	10:49:11	0.017
1076	03/27/2010	10:50:11	0.018
1077	03/27/2010	10:51:11	0.083
1078	03/27/2010	10:52:11	0.022
1079	03/27/2010	10:53:11	0.017
1080	03/27/2010	10:54:11	0.017
1081	03/27/2010	10:55:11	0.018
1082	03/27/2010	10:56:11	0.017
1083	03/27/2010	10:57:11	0.018
1084	03/27/2010	10:58:11	0.018
1085	03/27/2010	10:59:11	0.021
1086	03/27/2010	11:00:11	0.019
1087	03/27/2010	11:01:11	0.016
1088	03/27/2010	11:02:11	0.015
1089	03/27/2010	11:03:11	0.017
1090	03/27/2010	11:04:11	0.020
1091	03/27/2010	11:05:11	0.018
1092	03/27/2010	11:06:11	0.019

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1093	03/27/2010	11:07:11	0.019
1094	03/27/2010	11:08:11	0.020
1095	03/27/2010	11:09:11	0.020
1096	03/27/2010	11:10:11	0.019
1097	03/27/2010	11:11:11	0.019
1098	03/27/2010	11:12:11	0.020
1099	03/27/2010	11:13:11	0.018
1100	03/27/2010	11:14:11	0.017
1101	03/27/2010	11:15:11	0.018
1102	03/27/2010	11:16:11	0.018
1103	03/27/2010	11:17:11	0.020
1104	03/27/2010	11:18:11	0.020
1105	03/27/2010	11:19:11	0.018
1106	03/27/2010	11:20:11	0.019
1107	03/27/2010	11:21:11	0.018
1108	03/27/2010	11:22:11	0.017
1109	03/27/2010	11:23:11	0.019
1110	03/27/2010	11:24:11	0.026
1111	03/27/2010	11:25:11	0.023
1112	03/27/2010	11:26:11	0.019
1113	03/27/2010	11:27:11	0.019
1114	03/27/2010	11:28:11	0.020
1115	03/27/2010	11:29:11	0.017
1116	03/27/2010	11:30:11	0.016
1117	03/27/2010	11:31:11	0.017
1118	03/27/2010	11:32:11	0.020
1119	03/27/2010	11:33:11	0.019
1120	03/27/2010	11:34:11	0.017
1121	03/27/2010	11:35:11	0.018
1122	03/27/2010	11:36:11	0.018
1123	03/27/2010	11:37:11	0.018
1124	03/27/2010	11:38:11	0.021
1125	03/27/2010	11:39:11	0.020
1126	03/27/2010	11:40:11	0.020
1127	03/27/2010	11:41:11	0.020
1128	03/27/2010	11:42:11	0.022
1129	03/27/2010	11:43:11	0.020
1130	03/27/2010	11:44:11	0.020
1131	03/27/2010	11:45:11	0.020
1132	03/27/2010	11:46:11	0.022
1133	03/27/2010	11:47:11	0.019
1134	03/27/2010	11:48:11	0.022
1135	03/27/2010	11:49:11	0.023
1136	03/27/2010	11:50:11	0.022
1137	03/27/2010	11:51:11	0.022
1138	03/27/2010	11:52:11	0.022

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1139	03/27/2010	11:53:11	0.021
1140	03/27/2010	11:54:11	0.020
1141	03/27/2010	11:55:11	0.020
1142	03/27/2010	11:56:11	0.021
1143	03/27/2010	11:57:11	0.020
1144	03/27/2010	11:58:11	0.023
1145	03/27/2010	11:59:11	0.023
1146	03/27/2010	12:00:11	0.022
1147	03/27/2010	12:01:11	0.022
1148	03/27/2010	12:02:11	0.022
1149	03/27/2010	12:03:11	0.020
1150	03/27/2010	12:04:11	0.019
1151	03/27/2010	12:05:11	0.018
1152	03/27/2010	12:06:11	0.020
1153	03/27/2010	12:07:11	0.018
1154	03/27/2010	12:08:11	0.019
1155	03/27/2010	12:09:11	0.018
1156	03/27/2010	12:10:11	0.018
1157	03/27/2010	12:11:11	0.021
1158	03/27/2010	12:12:11	0.020
1159	03/27/2010	12:13:11	0.020
1160	03/27/2010	12:14:11	0.022
1161	03/27/2010	12:15:11	0.020
1162	03/27/2010	12:16:11	0.018
1163	03/27/2010	12:17:11	0.022
1164	03/27/2010	12:18:11	0.021
1165	03/27/2010	12:19:11	0.021
1166	03/27/2010	12:20:11	0.018
1167	03/27/2010	12:21:11	0.024
1168	03/27/2010	12:22:11	0.023
1169	03/27/2010	12:23:11	0.020
1170	03/27/2010	12:24:11	0.019
1171	03/27/2010	12:25:11	0.018
1172	03/27/2010	12:26:11	0.017
1173	03/27/2010	12:27:11	0.019
1174	03/27/2010	12:28:11	0.027
1175	03/27/2010	12:29:11	0.015
1176	03/27/2010	12:30:11	0.018
1177	03/27/2010	12:31:11	0.018
1178	03/27/2010	12:32:11	0.022
1179	03/27/2010	12:33:11	0.022
1180	03/27/2010	12:34:11	0.018
1181	03/27/2010	12:35:11	0.019
1182	03/27/2010	12:36:11	0.020
1183	03/27/2010	12:37:11	0.023
1184	03/27/2010	12:38:11	0.023

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1185	03/27/2010	12:39:11	0.022
1186	03/27/2010	12:40:11	0.021
1187	03/27/2010	12:41:11	0.024
1188	03/27/2010	12:42:11	0.021
1189	03/27/2010	12:43:11	0.020
1190	03/27/2010	12:44:11	0.022
1191	03/27/2010	12:45:11	0.021
1192	03/27/2010	12:46:11	0.021
1193	03/27/2010	12:47:11	0.020
1194	03/27/2010	12:48:11	0.019
1195	03/27/2010	12:49:11	0.019
1196	03/27/2010	12:50:11	0.020
1197	03/27/2010	12:51:11	0.022
1198	03/27/2010	12:52:11	0.019
1199	03/27/2010	12:53:11	0.019
1200	03/27/2010	12:54:11	0.020
1201	03/27/2010	12:55:11	0.019
1202	03/27/2010	12:56:11	0.019
1203	03/27/2010	12:57:11	0.019
1204	03/27/2010	12:58:11	0.019
1205	03/27/2010	12:59:11	0.019
1206	03/27/2010	13:00:11	0.021
1207	03/27/2010	13:01:11	0.020
1208	03/27/2010	13:02:11	0.022
1209	03/27/2010	13:03:11	0.021
1210	03/27/2010	13:04:11	0.028
1211	03/27/2010	13:05:11	0.021
1212	03/27/2010	13:06:11	0.023
1213	03/27/2010	13:07:11	0.024
1214	03/27/2010	13:08:11	0.019
1215	03/27/2010	13:09:11	0.019
1216	03/27/2010	13:10:11	0.021
1217	03/27/2010	13:11:11	0.021
1218	03/27/2010	13:12:11	0.021
1219	03/27/2010	13:13:11	0.022
1220	03/27/2010	13:14:11	0.021
1221	03/27/2010	13:15:11	0.020
1222	03/27/2010	13:16:11	0.022
1223	03/27/2010	13:17:11	0.022
1224	03/27/2010	13:18:11	0.023
1225	03/27/2010	13:19:11	0.023
1226	03/27/2010	13:20:11	0.021
1227	03/27/2010	13:21:11	0.018
1228	03/27/2010	13:22:11	0.022
1229	03/27/2010	13:23:11	0.026
1230	03/27/2010	13:24:11	0.037

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1231	03/27/2010	13:25:11	0.034
1232	03/27/2010	13:26:11	0.031
1233	03/27/2010	13:27:11	0.026
1234	03/27/2010	13:28:11	0.024
1235	03/27/2010	13:29:11	0.023
1236	03/27/2010	13:30:11	0.022
1237	03/27/2010	13:31:11	0.021
1238	03/27/2010	13:32:11	0.018
1239	03/27/2010	13:33:11	0.017
1240	03/27/2010	13:34:11	0.018
1241	03/27/2010	13:35:11	0.018
1242	03/27/2010	13:36:11	0.021
1243	03/27/2010	13:37:11	0.021
1244	03/27/2010	13:38:11	0.022
1245	03/27/2010	13:39:11	0.018
1246	03/27/2010	13:40:11	0.018
1247	03/27/2010	13:41:11	0.017
1248	03/27/2010	13:42:11	0.017
1249	03/27/2010	13:43:11	0.033
1250	03/27/2010	13:44:11	0.021
1251	03/27/2010	13:45:11	0.019
1252	03/27/2010	13:46:11	0.021
1253	03/27/2010	13:47:11	0.022
1254	03/27/2010	13:48:11	0.023
1255	03/27/2010	13:49:11	0.020
1256	03/27/2010	13:50:11	0.018
1257	03/27/2010	13:51:11	0.018
1258	03/27/2010	13:52:11	0.021
1259	03/27/2010	13:53:11	0.018
1260	03/27/2010	13:54:11	0.018
1261	03/27/2010	13:55:11	0.021
1262	03/27/2010	13:56:11	0.022
1263	03/27/2010	13:57:11	0.020
1264	03/27/2010	13:58:11	0.018
1265	03/27/2010	13:59:11	0.018
1266	03/27/2010	14:00:11	0.019
1267	03/27/2010	14:01:11	0.019
1268	03/27/2010	14:02:11	0.019
1269	03/27/2010	14:03:11	0.018
1270	03/27/2010	14:04:11	0.019
1271	03/27/2010	14:05:11	0.017
1272	03/27/2010	14:06:11	0.019
1273	03/27/2010	14:07:11	0.030
1274	03/27/2010	14:08:11	0.020
1275	03/27/2010	14:09:11	0.019
1276	03/27/2010	14:10:11	0.017

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1277	03/27/2010	14:11:11	0.018
1278	03/27/2010	14:12:11	0.019
1279	03/27/2010	14:13:11	0.026
1280	03/27/2010	14:14:11	0.026
1281	03/27/2010	14:15:11	0.019
1282	03/27/2010	14:16:11	0.018
1283	03/27/2010	14:17:11	0.017
1284	03/27/2010	14:18:11	0.019
1285	03/27/2010	14:19:11	0.019
1286	03/27/2010	14:20:11	0.020
1287	03/27/2010	14:21:11	0.019
1288	03/27/2010	14:22:11	0.020
1289	03/27/2010	14:23:11	0.020
1290	03/27/2010	14:24:11	0.023
1291	03/27/2010	14:25:11	0.024
1292	03/27/2010	14:26:11	0.019
1293	03/27/2010	14:27:11	0.021
1294	03/27/2010	14:28:11	0.022
1295	03/27/2010	14:29:11	0.023
1296	03/27/2010	14:30:11	0.026
1297	03/27/2010	14:31:11	0.023
1298	03/27/2010	14:32:11	0.021
1299	03/27/2010	14:33:11	0.023
1300	03/27/2010	14:34:11	0.024
1301	03/27/2010	14:35:11	0.024
1302	03/27/2010	14:36:11	0.036
1303	03/27/2010	14:37:11	0.033
1304	03/27/2010	14:38:11	0.031
1305	03/27/2010	14:39:11	0.031
1306	03/27/2010	14:40:11	0.027
1307	03/27/2010	14:41:11	0.025
1308	03/27/2010	14:42:11	0.022
1309	03/27/2010	14:43:11	0.023
1310	03/27/2010	14:44:11	0.028
1311	03/27/2010	14:45:11	0.026
1312	03/27/2010	14:46:11	0.028
1313	03/27/2010	14:47:11	0.026
1314	03/27/2010	14:48:11	0.022
1315	03/27/2010	14:49:11	0.022
1316	03/27/2010	14:50:11	0.024
1317	03/27/2010	14:51:11	0.027
1318	03/27/2010	14:52:11	0.026
1319	03/27/2010	14:53:11	0.028
1320	03/27/2010	14:54:11	0.031
1321	03/27/2010	14:55:11	0.034
1322	03/27/2010	14:56:11	0.037

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1323	03/27/2010	14:57:11	0.037
1324	03/27/2010	14:58:11	0.035
1325	03/27/2010	14:59:11	0.034
1326	03/27/2010	15:00:11	0.034
1327	03/27/2010	15:01:11	0.037
1328	03/27/2010	15:02:11	0.030
1329	03/27/2010	15:03:11	0.031
1330	03/27/2010	15:04:11	0.027
1331	03/27/2010	15:05:11	0.028
1332	03/27/2010	15:06:11	0.030
1333	03/27/2010	15:07:11	0.032
1334	03/27/2010	15:08:11	0.036
1335	03/27/2010	15:09:11	0.034
1336	03/27/2010	15:10:11	0.035
1337	03/27/2010	15:11:11	0.036
1338	03/27/2010	15:12:11	0.037
1339	03/27/2010	15:13:11	0.039
1340	03/27/2010	15:14:11	0.040
1341	03/27/2010	15:15:11	0.039
1342	03/27/2010	15:16:11	0.036
1343	03/27/2010	15:17:11	0.035
1344	03/27/2010	15:18:11	0.032
1345	03/27/2010	15:19:11	0.033
1346	03/27/2010	15:20:11	0.034
1347	03/27/2010	15:21:11	0.035
1348	03/27/2010	15:22:11	0.035
1349	03/27/2010	15:23:11	0.037
1350	03/27/2010	15:24:11	0.035
1351	03/27/2010	15:25:11	0.038
1352	03/27/2010	15:26:11	0.036
1353	03/27/2010	15:27:11	0.035
1354	03/27/2010	15:28:11	0.035
1355	03/27/2010	15:29:11	0.031
1356	03/27/2010	15:30:11	0.031
1357	03/27/2010	15:31:11	0.029
1358	03/27/2010	15:32:11	0.031
1359	03/27/2010	15:33:11	0.028
1360	03/27/2010	15:34:11	0.025
1361	03/27/2010	15:35:11	0.028
1362	03/27/2010	15:36:11	0.029
1363	03/27/2010	15:37:11	0.032
1364	03/27/2010	15:38:11	0.033
1365	03/27/2010	15:39:11	0.033
1366	03/27/2010	15:40:11	0.031
1367	03/27/2010	15:41:11	0.029
1368	03/27/2010	15:42:11	0.027

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1369	03/27/2010	15:43:11	0.029
1370	03/27/2010	15:44:11	0.032
1371	03/27/2010	15:45:11	0.030
1372	03/27/2010	15:46:11	0.033
1373	03/27/2010	15:47:11	0.035
1374	03/27/2010	15:48:11	0.031
1375	03/27/2010	15:49:11	0.032
1376	03/27/2010	15:50:11	0.029
1377	03/27/2010	15:51:11	0.029
1378	03/27/2010	15:52:11	0.030
1379	03/27/2010	15:53:11	0.028
1380	03/27/2010	15:54:11	0.028
1381	03/27/2010	15:55:11	0.032
1382	03/27/2010	15:56:11	0.031
1383	03/27/2010	15:57:11	0.031
1384	03/27/2010	15:58:11	0.027
1385	03/27/2010	15:59:11	0.028
1386	03/27/2010	16:00:11	0.024
1387	03/27/2010	16:01:11	0.028
1388	03/27/2010	16:02:11	0.032
1389	03/27/2010	16:03:11	0.033
1390	03/27/2010	16:04:11	0.034
1391	03/27/2010	16:05:11	0.040
1392	03/27/2010	16:06:11	0.043
1393	03/27/2010	16:07:11	0.041
1394	03/27/2010	16:08:11	0.035
1395	03/27/2010	16:09:11	0.032
1396	03/27/2010	16:10:11	0.032
1397	03/27/2010	16:11:11	0.034
1398	03/27/2010	16:12:11	0.039
1399	03/27/2010	16:13:11	0.039
1400	03/27/2010	16:14:11	0.039
1401	03/27/2010	16:15:11	0.037
1402	03/27/2010	16:16:11	0.035
1403	03/27/2010	16:17:11	0.033
1404	03/27/2010	16:18:11	0.032
1405	03/27/2010	16:19:11	0.034
1406	03/27/2010	16:20:11	0.043
1407	03/27/2010	16:21:11	0.041
1408	03/27/2010	16:22:11	0.040
1409	03/27/2010	16:23:11	0.035
1410	03/27/2010	16:24:11	0.032
1411	03/27/2010	16:25:11	0.035
1412	03/27/2010	16:26:11	0.035
1413	03/27/2010	16:27:11	0.039
1414	03/27/2010	16:28:11	0.035

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1415	03/27/2010	16:29:11	0.034
1416	03/27/2010	16:30:11	0.039
1417	03/27/2010	16:31:11	0.033
1418	03/27/2010	16:32:11	0.035
1419	03/27/2010	16:33:11	0.033
1420	03/27/2010	16:34:11	0.041
1421	03/27/2010	16:35:11	0.035
1422	03/27/2010	16:36:11	0.038
1423	03/27/2010	16:37:11	0.037
1424	03/27/2010	16:38:11	0.035
1425	03/27/2010	16:39:11	0.036
1426	03/27/2010	16:40:11	0.039
1427	03/27/2010	16:41:11	0.042
1428	03/27/2010	16:42:11	0.052
1429	03/27/2010	16:43:11	0.062
1430	03/27/2010	16:44:11	0.058
1431	03/27/2010	16:45:11	0.064
1432	03/27/2010	16:46:11	0.044
1433	03/27/2010	16:47:11	0.044
1434	03/27/2010	16:48:11	0.033
1435	03/27/2010	16:49:11	0.031
1436	03/27/2010	16:50:11	0.033
1437	03/27/2010	16:51:11	0.036
1438	03/27/2010	16:52:11	0.032
1439	03/27/2010	16:53:11	0.033
1440	03/27/2010	16:54:11	0.027
1441	03/27/2010	16:55:11	0.026
1442	03/27/2010	16:56:11	0.028
1443	03/27/2010	16:57:11	0.027
1444	03/27/2010	16:58:11	0.026
1445	03/27/2010	16:59:11	0.029
1446	03/27/2010	17:00:11	0.032
1447	03/27/2010	17:01:11	0.027
1448	03/27/2010	17:02:11	0.030
1449	03/27/2010	17:03:11	0.030
1450	03/27/2010	17:04:11	0.028
1451	03/27/2010	17:05:11	0.030
1452	03/27/2010	17:06:11	0.031
1453	03/27/2010	17:07:11	0.043
1454	03/27/2010	17:08:11	0.029
1455	03/27/2010	17:09:11	0.029
1456	03/27/2010	17:10:11	0.040
1457	03/27/2010	17:11:11	0.026
1458	03/27/2010	17:12:11	0.026
1459	03/27/2010	17:13:11	0.029
1460	03/27/2010	17:14:11	0.031

Test Data			
Data Point	**Date**	**Time**	**Aerosol mg/m^3**
1461	03/27/2010	17:15:11	0.034
1462	03/27/2010	17:16:11	0.033
1463	03/27/2010	17:17:11	0.030
1464	03/27/2010	17:18:11	0.032
1465	03/27/2010	17:19:11	0.035
1466	03/27/2010	17:20:11	0.033
1467	03/27/2010	17:21:11	0.029
1468	03/27/2010	17:22:11	0.031

Test 001

Dumfries Road Residential Area

Instrument		Data Properties	
Model	Dust Trak	Start Date	03/25/2010
Meter S/N	23567	Start Time	15:26:17
		Stop Date	03/26/2010
		Stop Time	15:53:17
		Total Time	1:00:27:00
		Logging Interval	60 seconds

Test Data

Data Point	Date	Time	Aerosol mg/m^3
1	03/25/2010	15:27:17	0.033
2	03/25/2010	15:28:17	0.031
3	03/25/2010	15:29:17	0.035
4	03/25/2010	15:30:17	0.038
5	03/25/2010	15:31:17	0.035
6	03/25/2010	15:32:17	0.031
7	03/25/2010	15:33:17	0.036
8	03/25/2010	15:34:17	0.032
9	03/25/2010	15:35:17	0.033
10	03/25/2010	15:36:17	0.030
11	03/25/2010	15:37:17	0.033
12	03/25/2010	15:38:17	0.035
13	03/25/2010	15:39:17	0.032
14	03/25/2010	15:40:17	0.036
15	03/25/2010	15:41:17	0.031
16	03/25/2010	15:42:17	0.036
17	03/25/2010	15:43:17	0.049
18	03/25/2010	15:44:17	0.037
19	03/25/2010	15:45:17	0.039
20	03/25/2010	15:46:17	0.031
21	03/25/2010	15:47:17	0.032
22	03/25/2010	15:48:17	0.030
23	03/25/2010	15:49:17	0.042
24	03/25/2010	15:50:17	0.031
25	03/25/2010	15:51:17	0.028
26	03/25/2010	15:52:17	0.028
27	03/25/2010	15:53:17	0.028
28	03/25/2010	15:54:17	0.030
29	03/25/2010	15:55:17	0.029
30	03/25/2010	15:56:17	0.030
31	03/25/2010	15:57:17	0.032
32	03/25/2010	15:58:17	0.048
33	03/25/2010	15:59:17	0.035
34	03/25/2010	16:00:17	0.037

Test Data

Data Point	Date	Time	Aerosol mg/m^3
35	03/25/2010	16:01:17	0.034
36	03/25/2010	16:02:17	0.038
37	03/25/2010	16:03:17	0.040
38	03/25/2010	16:04:17	0.038
39	03/25/2010	16:05:17	0.033
40	03/25/2010	16:06:17	0.033
41	03/25/2010	16:07:17	0.039
42	03/25/2010	16:08:17	0.037
43	03/25/2010	16:09:17	0.038
44	03/25/2010	16:10:17	0.037
45	03/25/2010	16:11:17	0.054
46	03/25/2010	16:12:17	0.054
47	03/25/2010	16:13:17	0.039
48	03/25/2010	16:14:17	0.045
49	03/25/2010	16:15:17	0.042
50	03/25/2010	16:16:17	0.063
51	03/25/2010	16:17:17	0.071
52	03/25/2010	16:18:17	0.040
53	03/25/2010	16:19:17	0.040
54	03/25/2010	16:20:17	0.066
55	03/25/2010	16:21:17	0.044
56	03/25/2010	16:22:17	0.041
57	03/25/2010	16:23:17	0.037
58	03/25/2010	16:24:17	0.042
59	03/25/2010	16:25:17	0.035
60	03/25/2010	16:26:17	0.033
61	03/25/2010	16:27:17	0.033
62	03/25/2010	16:28:17	0.039
63	03/25/2010	16:29:17	0.039
64	03/25/2010	16:30:17	0.038
65	03/25/2010	16:31:17	0.036
66	03/25/2010	16:32:17	0.033
67	03/25/2010	16:33:17	0.034
68	03/25/2010	16:34:17	0.038
69	03/25/2010	16:35:17	0.034
70	03/25/2010	16:36:17	0.039
71	03/25/2010	16:37:17	0.067
72	03/25/2010	16:38:17	0.052
73	03/25/2010	16:39:17	0.052
74	03/25/2010	16:40:17	0.072
75	03/25/2010	16:41:17	0.040
76	03/25/2010	16:42:17	0.038
77	03/25/2010	16:43:17	0.040
78	03/25/2010	16:44:17	0.050
79	03/25/2010	16:45:17	0.032
80	03/25/2010	16:46:17	0.052

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
81	03/25/2010	16:47:17	0.035
82	03/25/2010	16:48:17	0.049
83	03/25/2010	16:49:17	0.042
84	03/25/2010	16:50:17	0.042
85	03/25/2010	16:51:17	0.033
86	03/25/2010	16:52:17	0.033
87	03/25/2010	16:53:17	0.041
88	03/25/2010	16:54:17	0.042
89	03/25/2010	16:55:17	0.062
90	03/25/2010	16:56:17	0.068
91	03/25/2010	16:57:17	0.039
92	03/25/2010	16:58:17	0.035
93	03/25/2010	16:59:17	0.051
94	03/25/2010	17:00:17	0.034
95	03/25/2010	17:01:17	0.054
96	03/25/2010	17:02:17	0.034
97	03/25/2010	17:03:17	0.033
98	03/25/2010	17:04:17	0.035
99	03/25/2010	17:05:17	0.032
100	03/25/2010	17:06:17	0.031
101	03/25/2010	17:07:17	0.035
102	03/25/2010	17:08:17	0.035
103	03/25/2010	17:09:17	0.046
104	03/25/2010	17:10:17	0.055
105	03/25/2010	17:11:17	0.046
106	03/25/2010	17:12:17	0.052
107	03/25/2010	17:13:17	0.041
108	03/25/2010	17:14:17	0.041
109	03/25/2010	17:15:17	0.040
110	03/25/2010	17:16:17	0.049
111	03/25/2010	17:17:17	0.039
112	03/25/2010	17:18:17	0.033
113	03/25/2010	17:19:17	0.039
114	03/25/2010	17:20:17	0.035
115	03/25/2010	17:21:17	0.035
116	03/25/2010	17:22:17	0.035
117	03/25/2010	17:23:17	0.034
118	03/25/2010	17:24:17	0.034
119	03/25/2010	17:25:17	0.035
120	03/25/2010	17:26:17	0.036
121	03/25/2010	17:27:17	0.034
122	03/25/2010	17:28:17	0.037
123	03/25/2010	17:29:17	0.046
124	03/25/2010	17:30:17	0.044
125	03/25/2010	17:31:17	0.047
126	03/25/2010	17:32:17	0.035

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
127	03/25/2010	17:33:17	0.036
128	03/25/2010	17:34:17	0.035
129	03/25/2010	17:35:17	0.035
130	03/25/2010	17:36:17	0.032
131	03/25/2010	17:37:17	0.035
132	03/25/2010	17:38:17	0.031
133	03/25/2010	17:39:17	0.032
134	03/25/2010	17:40:17	0.077
135	03/25/2010	17:41:17	0.045
136	03/25/2010	17:42:17	0.036
137	03/25/2010	17:43:17	0.034
138	03/25/2010	17:44:17	0.041
139	03/25/2010	17:45:17	0.043
140	03/25/2010	17:46:17	0.067
141	03/25/2010	17:47:17	0.047
142	03/25/2010	17:48:17	0.042
143	03/25/2010	17:49:17	0.036
144	03/25/2010	17:50:17	0.055
145	03/25/2010	17:51:17	0.034
146	03/25/2010	17:52:17	0.039
147	03/25/2010	17:53:17	0.059
148	03/25/2010	17:54:17	0.070
149	03/25/2010	17:55:17	0.057
150	03/25/2010	17:56:17	0.049
151	03/25/2010	17:57:17	0.103
152	03/25/2010	17:58:17	0.050
153	03/25/2010	17:59:17	0.052
154	03/25/2010	18:00:17	0.051
155	03/25/2010	18:01:17	0.053
156	03/25/2010	18:02:17	0.050
157	03/25/2010	18:03:17	0.057
158	03/25/2010	18:04:17	0.057
159	03/25/2010	18:05:17	0.060
160	03/25/2010	18:06:17	0.055
161	03/25/2010	18:07:17	0.050
162	03/25/2010	18:08:17	0.051
163	03/25/2010	18:09:17	0.070
164	03/25/2010	18:10:17	0.065
165	03/25/2010	18:11:17	0.059
166	03/25/2010	18:12:17	0.066
167	03/25/2010	18:13:17	0.062
168	03/25/2010	18:14:17	0.057
169	03/25/2010	18:15:17	0.057
170	03/25/2010	18:16:17	0.049
171	03/25/2010	18:17:17	0.055
172	03/25/2010	18:18:17	0.053

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
173	03/25/2010	18:19:17	0.055
174	03/25/2010	18:20:17	0.064
175	03/25/2010	18:21:17	0.063
176	03/25/2010	18:22:17	0.055
177	03/25/2010	18:23:17	0.057
178	03/25/2010	18:24:17	0.055
179	03/25/2010	18:25:17	0.059
180	03/25/2010	18:26:17	0.061
181	03/25/2010	18:27:17	0.065
182	03/25/2010	18:28:17	0.065
183	03/25/2010	18:29:17	0.064
184	03/25/2010	18:30:17	0.056
185	03/25/2010	18:31:17	0.055
186	03/25/2010	18:32:17	0.054
187	03/25/2010	18:33:17	0.060
188	03/25/2010	18:34:17	0.060
189	03/25/2010	18:35:17	0.057
190	03/25/2010	18:36:17	0.057
191	03/25/2010	18:37:17	0.054
192	03/25/2010	18:38:17	0.059
193	03/25/2010	18:39:17	0.055
194	03/25/2010	18:40:17	0.055
195	03/25/2010	18:41:17	0.055
196	03/25/2010	18:42:17	0.054
197	03/25/2010	18:43:17	0.053
198	03/25/2010	18:44:17	0.057
199	03/25/2010	18:45:17	0.056
200	03/25/2010	18:46:17	0.064
201	03/25/2010	18:47:17	0.071
202	03/25/2010	18:48:17	0.068
203	03/25/2010	18:49:17	0.059
204	03/25/2010	18:50:17	0.065
205	03/25/2010	18:51:17	0.061
206	03/25/2010	18:52:17	0.069
207	03/25/2010	18:53:17	0.059
208	03/25/2010	18:54:17	0.056
209	03/25/2010	18:55:17	0.050
210	03/25/2010	18:56:17	0.052
211	03/25/2010	18:57:17	0.052
212	03/25/2010	18:58:17	0.060
213	03/25/2010	18:59:17	0.065
214	03/25/2010	19:00:17	0.067
215	03/25/2010	19:01:17	0.062
216	03/25/2010	19:02:17	0.064
217	03/25/2010	19:03:17	0.054
218	03/25/2010	19:04:17	0.056

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
219	03/25/2010	19:05:17	0.063
220	03/25/2010	19:06:17	0.065
221	03/25/2010	19:07:17	0.055
222	03/25/2010	19:08:17	0.059
223	03/25/2010	19:09:17	0.058
224	03/25/2010	19:10:17	0.052
225	03/25/2010	19:11:17	0.055
226	03/25/2010	19:12:17	0.057
227	03/25/2010	19:13:17	0.080
228	03/25/2010	19:14:17	0.058
229	03/25/2010	19:15:17	0.047
230	03/25/2010	19:16:17	0.050
231	03/25/2010	19:17:17	0.064
232	03/25/2010	19:18:17	0.065
233	03/25/2010	19:19:17	0.055
234	03/25/2010	19:20:17	0.051
235	03/25/2010	19:21:17	0.047
236	03/25/2010	19:22:17	0.048
237	03/25/2010	19:23:17	0.052
238	03/25/2010	19:24:17	0.051
239	03/25/2010	19:25:17	0.050
240	03/25/2010	19:26:17	0.057
241	03/25/2010	19:27:17	0.052
242	03/25/2010	19:28:17	0.046
243	03/25/2010	19:29:17	0.052
244	03/25/2010	19:30:17	0.060
245	03/25/2010	19:31:17	0.049
246	03/25/2010	19:32:17	0.050
247	03/25/2010	19:33:17	0.047
248	03/25/2010	19:34:17	0.046
249	03/25/2010	19:35:17	0.049
250	03/25/2010	19:36:17	0.048
251	03/25/2010	19:37:17	0.047
252	03/25/2010	19:38:17	0.045
253	03/25/2010	19:39:17	0.049
254	03/25/2010	19:40:17	0.051
255	03/25/2010	19:41:17	0.054
256	03/25/2010	19:42:17	0.050
257	03/25/2010	19:43:17	0.047
258	03/25/2010	19:44:17	0.051
259	03/25/2010	19:45:17	0.050
260	03/25/2010	19:46:17	0.049
261	03/25/2010	19:47:17	0.050
262	03/25/2010	19:48:17	0.047
263	03/25/2010	19:49:17	0.048
264	03/25/2010	19:50:17	0.050

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
265	03/25/2010	19:51:17	0.049
266	03/25/2010	19:52:17	0.048
267	03/25/2010	19:53:17	0.050
268	03/25/2010	19:54:17	0.055
269	03/25/2010	19:55:17	0.057
270	03/25/2010	19:56:17	0.052
271	03/25/2010	19:57:17	0.055
272	03/25/2010	19:58:17	0.057
273	03/25/2010	19:59:17	0.055
274	03/25/2010	20:00:17	0.064
275	03/25/2010	20:01:17	0.060
276	03/25/2010	20:02:17	0.056
277	03/25/2010	20:03:17	0.057
278	03/25/2010	20:04:17	0.064
279	03/25/2010	20:05:17	0.061
280	03/25/2010	20:06:17	0.057
281	03/25/2010	20:07:17	0.052
282	03/25/2010	20:08:17	0.055
283	03/25/2010	20:09:17	0.054
284	03/25/2010	20:10:17	0.055
285	03/25/2010	20:11:17	0.058
286	03/25/2010	20:12:17	0.057
287	03/25/2010	20:13:17	0.056
288	03/25/2010	20:14:17	0.056
289	03/25/2010	20:15:17	0.055
290	03/25/2010	20:16:17	0.053
291	03/25/2010	20:17:17	0.053
292	03/25/2010	20:18:17	0.055
293	03/25/2010	20:19:17	0.054
294	03/25/2010	20:20:17	0.057
295	03/25/2010	20:21:17	0.055
296	03/25/2010	20:22:17	0.053
297	03/25/2010	20:23:17	0.054
298	03/25/2010	20:24:17	0.055
299	03/25/2010	20:25:17	0.057
300	03/25/2010	20:26:17	0.059
301	03/25/2010	20:27:17	0.060
302	03/25/2010	20:28:17	0.062
303	03/25/2010	20:29:17	0.063
304	03/25/2010	20:30:17	0.062
305	03/25/2010	20:31:17	0.058
306	03/25/2010	20:32:17	0.057
307	03/25/2010	20:33:17	0.061
308	03/25/2010	20:34:17	0.061
309	03/25/2010	20:35:17	0.057
310	03/25/2010	20:36:17	0.061

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
311	03/25/2010	20:37:17	0.059
312	03/25/2010	20:38:17	0.055
313	03/25/2010	20:39:17	0.049
314	03/25/2010	20:40:17	0.052
315	03/25/2010	20:41:17	0.051
316	03/25/2010	20:42:17	0.053
317	03/25/2010	20:43:17	0.054
318	03/25/2010	20:44:17	0.056
319	03/25/2010	20:45:17	0.056
320	03/25/2010	20:46:17	0.054
321	03/25/2010	20:47:17	0.054
322	03/25/2010	20:48:17	0.054
323	03/25/2010	20:49:17	0.053
324	03/25/2010	20:50:17	0.052
325	03/25/2010	20:51:17	0.051
326	03/25/2010	20:52:17	0.054
327	03/25/2010	20:53:17	0.053
328	03/25/2010	20:54:17	0.053
329	03/25/2010	20:55:17	0.051
330	03/25/2010	20:56:17	0.049
331	03/25/2010	20:57:17	0.050
332	03/25/2010	20:58:17	0.050
333	03/25/2010	20:59:17	0.051
334	03/25/2010	21:00:17	0.052
335	03/25/2010	21:01:17	0.046
336	03/25/2010	21:02:17	0.051
337	03/25/2010	21:03:17	0.050
338	03/25/2010	21:04:17	0.049
339	03/25/2010	21:05:17	0.050
340	03/25/2010	21:06:17	0.043
341	03/25/2010	21:07:17	0.044
342	03/25/2010	21:08:17	0.044
343	03/25/2010	21:09:17	0.045
344	03/25/2010	21:10:17	0.040
345	03/25/2010	21:11:17	0.039
346	03/25/2010	21:12:17	0.038
347	03/25/2010	21:13:17	0.040
348	03/25/2010	21:14:17	0.040
349	03/25/2010	21:15:17	0.042
350	03/25/2010	21:16:17	0.041
351	03/25/2010	21:17:17	0.042
352	03/25/2010	21:18:17	0.040
353	03/25/2010	21:19:17	0.045
354	03/25/2010	21:20:17	0.039
355	03/25/2010	21:21:17	0.040
356	03/25/2010	21:22:17	0.040

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
357	03/25/2010	21:23:17	0.041
358	03/25/2010	21:24:17	0.038
359	03/25/2010	21:25:17	0.042
360	03/25/2010	21:26:17	0.038
361	03/25/2010	21:27:17	0.038
362	03/25/2010	21:28:17	0.037
363	03/25/2010	21:29:17	0.037
364	03/25/2010	21:30:17	0.036
365	03/25/2010	21:31:17	0.035
366	03/25/2010	21:32:17	0.037
367	03/25/2010	21:33:17	0.036
368	03/25/2010	21:34:17	0.036
369	03/25/2010	21:35:17	0.038
370	03/25/2010	21:36:17	0.040
371	03/25/2010	21:37:17	0.042
372	03/25/2010	21:38:17	0.039
373	03/25/2010	21:39:17	0.037
374	03/25/2010	21:40:17	0.034
375	03/25/2010	21:41:17	0.038
376	03/25/2010	21:42:17	0.037
377	03/25/2010	21:43:17	0.036
378	03/25/2010	21:44:17	0.035
379	03/25/2010	21:45:17	0.041
380	03/25/2010	21:46:17	0.035
381	03/25/2010	21:47:17	0.037
382	03/25/2010	21:48:17	0.037
383	03/25/2010	21:49:17	0.037
384	03/25/2010	21:50:17	0.036
385	03/25/2010	21:51:17	0.033
386	03/25/2010	21:52:17	0.035
387	03/25/2010	21:53:17	0.035
388	03/25/2010	21:54:17	0.033
389	03/25/2010	21:55:17	0.034
390	03/25/2010	21:56:17	0.033
391	03/25/2010	21:57:17	0.035
392	03/25/2010	21:58:17	0.047
393	03/25/2010	21:59:17	0.039
394	03/25/2010	22:00:17	0.033
395	03/25/2010	22:01:17	0.033
396	03/25/2010	22:02:17	0.032
397	03/25/2010	22:03:17	0.034
398	03/25/2010	22:04:17	0.035
399	03/25/2010	22:05:17	0.032
400	03/25/2010	22:06:17	0.032
401	03/25/2010	22:07:17	0.031
402	03/25/2010	22:08:17	0.032

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
403	03/25/2010	22:09:17	0.032
404	03/25/2010	22:10:17	0.033
405	03/25/2010	22:11:17	0.034
406	03/25/2010	22:12:17	0.035
407	03/25/2010	22:13:17	0.032
408	03/25/2010	22:14:17	0.033
409	03/25/2010	22:15:17	0.031
410	03/25/2010	22:16:17	0.036
411	03/25/2010	22:17:17	0.031
412	03/25/2010	22:18:17	0.033
413	03/25/2010	22:19:17	0.031
414	03/25/2010	22:20:17	0.030
415	03/25/2010	22:21:17	0.028
416	03/25/2010	22:22:17	0.031
417	03/25/2010	22:23:17	0.031
418	03/25/2010	22:24:17	0.031
419	03/25/2010	22:25:17	0.033
420	03/25/2010	22:26:17	0.034
421	03/25/2010	22:27:17	0.038
422	03/25/2010	22:28:17	0.044
423	03/25/2010	22:29:17	0.041
424	03/25/2010	22:30:17	0.038
425	03/25/2010	22:31:17	0.037
426	03/25/2010	22:32:17	0.038
427	03/25/2010	22:33:17	0.037
428	03/25/2010	22:34:17	0.036
429	03/25/2010	22:35:17	0.036
430	03/25/2010	22:36:17	0.039
431	03/25/2010	22:37:17	0.034
432	03/25/2010	22:38:17	0.035
433	03/25/2010	22:39:17	0.035
434	03/25/2010	22:40:17	0.034
435	03/25/2010	22:41:17	0.035
436	03/25/2010	22:42:17	0.035
437	03/25/2010	22:43:17	0.034
438	03/25/2010	22:44:17	0.034
439	03/25/2010	22:45:17	0.033
440	03/25/2010	22:46:17	0.035
441	03/25/2010	22:47:17	0.037
442	03/25/2010	22:48:17	0.037
443	03/25/2010	22:49:17	0.036
444	03/25/2010	22:50:17	0.036
445	03/25/2010	22:51:17	0.034
446	03/25/2010	22:52:17	0.032
447	03/25/2010	22:53:17	0.033
448	03/25/2010	22:54:17	0.031

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
449	03/25/2010	22:55:17	0.030
450	03/25/2010	22:56:17	0.028
451	03/25/2010	22:57:17	0.058
452	03/25/2010	22:58:17	0.047
453	03/25/2010	22:59:17	0.030
454	03/25/2010	23:00:17	0.031
455	03/25/2010	23:01:17	0.033
456	03/25/2010	23:02:17	0.032
457	03/25/2010	23:03:17	0.028
458	03/25/2010	23:04:17	0.031
459	03/25/2010	23:05:17	0.028
460	03/25/2010	23:06:17	0.028
461	03/25/2010	23:07:17	0.028
462	03/25/2010	23:08:17	0.028
463	03/25/2010	23:09:17	0.027
464	03/25/2010	23:10:17	0.028
465	03/25/2010	23:11:17	0.028
466	03/25/2010	23:12:17	0.027
467	03/25/2010	23:13:17	0.026
468	03/25/2010	23:14:17	0.026
469	03/25/2010	23:15:17	0.026
470	03/25/2010	23:16:17	0.029
471	03/25/2010	23:17:17	0.029
472	03/25/2010	23:18:17	0.027
473	03/25/2010	23:19:17	0.028
474	03/25/2010	23:20:17	0.030
475	03/25/2010	23:21:17	0.031
476	03/25/2010	23:22:17	0.028
477	03/25/2010	23:23:17	0.029
478	03/25/2010	23:24:17	0.029
479	03/25/2010	23:25:17	0.032
480	03/25/2010	23:26:17	0.029
481	03/25/2010	23:27:17	0.030
482	03/25/2010	23:28:17	0.030
483	03/25/2010	23:29:17	0.029
484	03/25/2010	23:30:17	0.030
485	03/25/2010	23:31:17	0.029
486	03/25/2010	23:32:17	0.029
487	03/25/2010	23:33:17	0.030
488	03/25/2010	23:34:17	0.030
489	03/25/2010	23:35:17	0.035
490	03/25/2010	23:36:17	0.028
491	03/25/2010	23:37:17	0.031
492	03/25/2010	23:38:17	0.032
493	03/25/2010	23:39:17	0.030
494	03/25/2010	23:40:17	0.034

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
495	03/25/2010	23:41:17	0.030
496	03/25/2010	23:42:17	0.031
497	03/25/2010	23:43:17	0.032
498	03/25/2010	23:44:17	0.033
499	03/25/2010	23:45:17	0.032
500	03/25/2010	23:46:17	0.033
501	03/25/2010	23:47:17	0.033
502	03/25/2010	23:48:17	0.032
503	03/25/2010	23:49:17	0.031
504	03/25/2010	23:50:17	0.034
505	03/25/2010	23:51:17	0.039
506	03/25/2010	23:52:17	0.038
507	03/25/2010	23:53:17	0.036
508	03/25/2010	23:54:17	0.035
509	03/25/2010	23:55:17	0.036
510	03/25/2010	23:56:17	0.036
511	03/25/2010	23:57:17	0.036
512	03/25/2010	23:58:17	0.035
513	03/25/2010	23:59:17	0.036
514	03/26/2010	00:00:17	0.038
515	03/26/2010	00:01:17	0.038
516	03/26/2010	00:02:17	0.039
517	03/26/2010	00:03:17	0.041
518	03/26/2010	00:04:17	0.040
519	03/26/2010	00:05:17	0.040
520	03/26/2010	00:06:17	0.041
521	03/26/2010	00:07:17	0.040
522	03/26/2010	00:08:17	0.041
523	03/26/2010	00:09:17	0.043
524	03/26/2010	00:10:17	0.040
525	03/26/2010	00:11:17	0.039
526	03/26/2010	00:12:17	0.040
527	03/26/2010	00:13:17	0.037
528	03/26/2010	00:14:17	0.035
529	03/26/2010	00:15:17	0.037
530	03/26/2010	00:16:17	0.036
531	03/26/2010	00:17:17	0.037
532	03/26/2010	00:18:17	0.035
533	03/26/2010	00:19:17	0.035
534	03/26/2010	00:20:17	0.036
535	03/26/2010	00:21:17	0.036
536	03/26/2010	00:22:17	0.034
537	03/26/2010	00:23:17	0.036
538	03/26/2010	00:24:17	0.033
539	03/26/2010	00:25:17	0.033
540	03/26/2010	00:26:17	0.034

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
541	03/26/2010	00:27:17	0.031
542	03/26/2010	00:28:17	0.030
543	03/26/2010	00:29:17	0.031
544	03/26/2010	00:30:17	0.032
545	03/26/2010	00:31:17	0.032
546	03/26/2010	00:32:17	0.030
547	03/26/2010	00:33:17	0.030
548	03/26/2010	00:34:17	0.029
549	03/26/2010	00:35:17	0.029
550	03/26/2010	00:36:17	0.030
551	03/26/2010	00:37:17	0.028
552	03/26/2010	00:38:17	0.030
553	03/26/2010	00:39:17	0.028
554	03/26/2010	00:40:17	0.027
555	03/26/2010	00:41:17	0.027
556	03/26/2010	00:42:17	0.027
557	03/26/2010	00:43:17	0.027
558	03/26/2010	00:44:17	0.028
559	03/26/2010	00:45:17	0.027
560	03/26/2010	00:46:17	0.028
561	03/26/2010	00:47:17	0.027
562	03/26/2010	00:48:17	0.027
563	03/26/2010	00:49:17	0.028
564	03/26/2010	00:50:17	0.025
565	03/26/2010	00:51:17	0.025
566	03/26/2010	00:52:17	0.026
567	03/26/2010	00:53:17	0.026
568	03/26/2010	00:54:17	0.027
569	03/26/2010	00:55:17	0.026
570	03/26/2010	00:56:17	0.027
571	03/26/2010	00:57:17	0.026
572	03/26/2010	00:58:17	0.025
573	03/26/2010	00:59:17	0.029
574	03/26/2010	01:00:17	0.026
575	03/26/2010	01:01:17	0.025
576	03/26/2010	01:02:17	0.027
577	03/26/2010	01:03:17	0.024
578	03/26/2010	01:04:17	0.028
579	03/26/2010	01:05:17	0.025
580	03/26/2010	01:06:17	0.024
581	03/26/2010	01:07:17	0.025
582	03/26/2010	01:08:17	0.025
583	03/26/2010	01:09:17	0.028
584	03/26/2010	01:10:17	0.028
585	03/26/2010	01:11:17	0.028
586	03/26/2010	01:12:17	0.026

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
587	03/26/2010	01:13:17	0.023
588	03/26/2010	01:14:17	0.026
589	03/26/2010	01:15:17	0.026
590	03/26/2010	01:16:17	0.025
591	03/26/2010	01:17:17	0.025
592	03/26/2010	01:18:17	0.027
593	03/26/2010	01:19:17	0.029
594	03/26/2010	01:20:17	0.027
595	03/26/2010	01:21:17	0.028
596	03/26/2010	01:22:17	0.027
597	03/26/2010	01:23:17	0.025
598	03/26/2010	01:24:17	0.027
599	03/26/2010	01:25:17	0.028
600	03/26/2010	01:26:17	0.027
601	03/26/2010	01:27:17	0.029
602	03/26/2010	01:28:17	0.026
603	03/26/2010	01:29:17	0.027
604	03/26/2010	01:30:17	0.027
605	03/26/2010	01:31:17	0.026
606	03/26/2010	01:32:17	0.028
607	03/26/2010	01:33:17	0.026
608	03/26/2010	01:34:17	0.027
609	03/26/2010	01:35:17	0.027
610	03/26/2010	01:36:17	0.027
611	03/26/2010	01:37:17	0.027
612	03/26/2010	01:38:17	0.027
613	03/26/2010	01:39:17	0.027
614	03/26/2010	01:40:17	0.027
615	03/26/2010	01:41:17	0.026
616	03/26/2010	01:42:17	0.027
617	03/26/2010	01:43:17	0.028
618	03/26/2010	01:44:17	0.029
619	03/26/2010	01:45:17	0.028
620	03/26/2010	01:46:17	0.029
621	03/26/2010	01:47:17	0.029
622	03/26/2010	01:48:17	0.028
623	03/26/2010	01:49:17	0.028
624	03/26/2010	01:50:17	0.029
625	03/26/2010	01:51:17	0.027
626	03/26/2010	01:52:17	0.027
627	03/26/2010	01:53:17	0.029
628	03/26/2010	01:54:17	0.027
629	03/26/2010	01:55:17	0.028
630	03/26/2010	01:56:17	0.029
631	03/26/2010	01:57:17	0.027
632	03/26/2010	01:58:17	0.027

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
633	03/26/2010	01:59:17	0.027
634	03/26/2010	02:00:17	0.027
635	03/26/2010	02:01:17	0.027
636	03/26/2010	02:02:17	0.027
637	03/26/2010	02:03:17	0.027
638	03/26/2010	02:04:17	0.027
639	03/26/2010	02:05:17	0.027
640	03/26/2010	02:06:17	0.026
641	03/26/2010	02:07:17	0.027
642	03/26/2010	02:08:17	0.027
643	03/26/2010	02:09:17	0.027
644	03/26/2010	02:10:17	0.027
645	03/26/2010	02:11:17	0.027
646	03/26/2010	02:12:17	0.027
647	03/26/2010	02:13:17	0.025
648	03/26/2010	02:14:17	0.028
649	03/26/2010	02:15:17	0.027
650	03/26/2010	02:16:17	0.025
651	03/26/2010	02:17:17	0.026
652	03/26/2010	02:18:17	0.026
653	03/26/2010	02:19:17	0.025
654	03/26/2010	02:20:17	0.027
655	03/26/2010	02:21:17	0.029
656	03/26/2010	02:22:17	0.026
657	03/26/2010	02:23:17	0.026
658	03/26/2010	02:24:17	0.028
659	03/26/2010	02:25:17	0.027
660	03/26/2010	02:26:17	0.026
661	03/26/2010	02:27:17	0.028
662	03/26/2010	02:28:17	0.028
663	03/26/2010	02:29:17	0.027
664	03/26/2010	02:30:17	0.027
665	03/26/2010	02:31:17	0.026
666	03/26/2010	02:32:17	0.027
667	03/26/2010	02:33:17	0.030
668	03/26/2010	02:34:17	0.027
669	03/26/2010	02:35:17	0.027
670	03/26/2010	02:36:17	0.026
671	03/26/2010	02:37:17	0.027
672	03/26/2010	02:38:17	0.027
673	03/26/2010	02:39:17	0.028
674	03/26/2010	02:40:17	0.027
675	03/26/2010	02:41:17	0.027
676	03/26/2010	02:42:17	0.025
677	03/26/2010	02:43:17	0.026
678	03/26/2010	02:44:17	0.026

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
679	03/26/2010	02:45:17	0.028
680	03/26/2010	02:46:17	0.026
681	03/26/2010	02:47:17	0.027
682	03/26/2010	02:48:17	0.027
683	03/26/2010	02:49:17	0.027
684	03/26/2010	02:50:17	0.027
685	03/26/2010	02:51:17	0.026
686	03/26/2010	02:52:17	0.027
687	03/26/2010	02:53:17	0.026
688	03/26/2010	02:54:17	0.026
689	03/26/2010	02:55:17	0.027
690	03/26/2010	02:56:17	0.026
691	03/26/2010	02:57:17	0.025
692	03/26/2010	02:58:17	0.026
693	03/26/2010	02:59:17	0.026
694	03/26/2010	03:00:17	0.026
695	03/26/2010	03:01:17	0.024
696	03/26/2010	03:02:17	0.024
697	03/26/2010	03:03:17	0.027
698	03/26/2010	03:04:17	0.026
699	03/26/2010	03:05:17	0.027
700	03/26/2010	03:06:17	0.026
701	03/26/2010	03:07:17	0.027
702	03/26/2010	03:08:17	0.028
703	03/26/2010	03:09:17	0.026
704	03/26/2010	03:10:17	0.026
705	03/26/2010	03:11:17	0.025
706	03/26/2010	03:12:17	0.026
707	03/26/2010	03:13:17	0.024
708	03/26/2010	03:14:17	0.025
709	03/26/2010	03:15:17	0.025
710	03/26/2010	03:16:17	0.026
711	03/26/2010	03:17:17	0.027
712	03/26/2010	03:18:17	0.026
713	03/26/2010	03:19:17	0.024
714	03/26/2010	03:20:17	0.025
715	03/26/2010	03:21:17	0.027
716	03/26/2010	03:22:17	0.027
717	03/26/2010	03:23:17	0.029
718	03/26/2010	03:24:17	0.028
719	03/26/2010	03:25:17	0.025
720	03/26/2010	03:26:17	0.026
721	03/26/2010	03:27:17	0.029
722	03/26/2010	03:28:17	0.028
723	03/26/2010	03:29:17	0.027
724	03/26/2010	03:30:17	0.026

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
725	03/26/2010	03:31:17	0.028
726	03/26/2010	03:32:17	0.029
727	03/26/2010	03:33:17	0.025
728	03/26/2010	03:34:17	0.024
729	03/26/2010	03:35:17	0.031
730	03/26/2010	03:36:17	0.029
731	03/26/2010	03:37:17	0.028
732	03/26/2010	03:38:17	0.025
733	03/26/2010	03:39:17	0.032
734	03/26/2010	03:40:17	0.028
735	03/26/2010	03:41:17	0.029
736	03/26/2010	03:42:17	0.030
737	03/26/2010	03:43:17	0.030
738	03/26/2010	03:44:17	0.030
739	03/26/2010	03:45:17	0.028
740	03/26/2010	03:46:17	0.031
741	03/26/2010	03:47:17	0.029
742	03/26/2010	03:48:17	0.028
743	03/26/2010	03:49:17	0.031
744	03/26/2010	03:50:17	0.031
745	03/26/2010	03:51:17	0.029
746	03/26/2010	03:52:17	0.030
747	03/26/2010	03:53:17	0.028
748	03/26/2010	03:54:17	0.032
749	03/26/2010	03:55:17	0.028
750	03/26/2010	03:56:17	0.028
751	03/26/2010	03:57:17	0.028
752	03/26/2010	03:58:17	0.028
753	03/26/2010	03:59:17	0.029
754	03/26/2010	04:00:17	0.029
755	03/26/2010	04:01:17	0.029
756	03/26/2010	04:02:17	0.027
757	03/26/2010	04:03:17	0.029
758	03/26/2010	04:04:17	0.029
759	03/26/2010	04:05:17	0.027
760	03/26/2010	04:06:17	0.028
761	03/26/2010	04:07:17	0.029
762	03/26/2010	04:08:17	0.029
763	03/26/2010	04:09:17	0.028
764	03/26/2010	04:10:17	0.027
765	03/26/2010	04:11:17	0.027
766	03/26/2010	04:12:17	0.028
767	03/26/2010	04:13:17	0.027
768	03/26/2010	04:14:17	0.029
769	03/26/2010	04:15:17	0.027
770	03/26/2010	04:16:17	0.027

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
771	03/26/2010	04:17:17	0.028
772	03/26/2010	04:18:17	0.028
773	03/26/2010	04:19:17	0.028
774	03/26/2010	04:20:17	0.026
775	03/26/2010	04:21:17	0.025
776	03/26/2010	04:22:17	0.026
777	03/26/2010	04:23:17	0.024
778	03/26/2010	04:24:17	0.025
779	03/26/2010	04:25:17	0.027
780	03/26/2010	04:26:17	0.025
781	03/26/2010	04:27:17	0.026
782	03/26/2010	04:28:17	0.026
783	03/26/2010	04:29:17	0.025
784	03/26/2010	04:30:17	0.025
785	03/26/2010	04:31:17	0.026
786	03/26/2010	04:32:17	0.026
787	03/26/2010	04:33:17	0.025
788	03/26/2010	04:34:17	0.025
789	03/26/2010	04:35:17	0.025
790	03/26/2010	04:36:17	0.025
791	03/26/2010	04:37:17	0.025
792	03/26/2010	04:38:17	0.026
793	03/26/2010	04:39:17	0.026
794	03/26/2010	04:40:17	0.026
795	03/26/2010	04:41:17	0.026
796	03/26/2010	04:42:17	0.026
797	03/26/2010	04:43:17	0.028
798	03/26/2010	04:44:17	0.026
799	03/26/2010	04:45:17	0.026
800	03/26/2010	04:46:17	0.027
801	03/26/2010	04:47:17	0.026
802	03/26/2010	04:48:17	0.027
803	03/26/2010	04:49:17	0.027
804	03/26/2010	04:50:17	0.029
805	03/26/2010	04:51:17	0.027
806	03/26/2010	04:52:17	0.028
807	03/26/2010	04:53:17	0.028
808	03/26/2010	04:54:17	0.026
809	03/26/2010	04:55:17	0.027
810	03/26/2010	04:56:17	0.024
811	03/26/2010	04:57:17	0.026
812	03/26/2010	04:58:17	0.026
813	03/26/2010	04:59:17	0.025
814	03/26/2010	05:00:17	0.027
815	03/26/2010	05:01:17	0.027
816	03/26/2010	05:02:17	0.026

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
817	03/26/2010	05:03:17	0.025
818	03/26/2010	05:04:17	0.027
819	03/26/2010	05:05:17	0.027
820	03/26/2010	05:06:17	0.026
821	03/26/2010	05:07:17	0.025
822	03/26/2010	05:08:17	0.026
823	03/26/2010	05:09:17	0.026
824	03/26/2010	05:10:17	0.027
825	03/26/2010	05:11:17	0.029
826	03/26/2010	05:12:17	0.029
827	03/26/2010	05:13:17	0.030
828	03/26/2010	05:14:17	0.028
829	03/26/2010	05:15:17	0.031
830	03/26/2010	05:16:17	0.031
831	03/26/2010	05:17:17	0.029
832	03/26/2010	05:18:17	0.035
833	03/26/2010	05:19:17	0.037
834	03/26/2010	05:20:17	0.038
835	03/26/2010	05:21:17	0.032
836	03/26/2010	05:22:17	0.036
837	03/26/2010	05:23:17	0.046
838	03/26/2010	05:24:17	0.035
839	03/26/2010	05:25:17	0.032
840	03/26/2010	05:26:17	0.031
841	03/26/2010	05:27:17	0.031
842	03/26/2010	05:28:17	0.028
843	03/26/2010	05:29:17	0.026
844	03/26/2010	05:30:17	0.025
845	03/26/2010	05:31:17	0.028
846	03/26/2010	05:32:17	0.026
847	03/26/2010	05:33:17	0.027
848	03/26/2010	05:34:17	0.024
849	03/26/2010	05:35:17	0.027
850	03/26/2010	05:36:17	0.027
851	03/26/2010	05:37:17	0.027
852	03/26/2010	05:38:17	0.028
853	03/26/2010	05:39:17	0.027
854	03/26/2010	05:40:17	0.026
855	03/26/2010	05:41:17	0.025
856	03/26/2010	05:42:17	0.026
857	03/26/2010	05:43:17	0.028
858	03/26/2010	05:44:17	0.026
859	03/26/2010	05:45:17	0.027
860	03/26/2010	05:46:17	0.029
861	03/26/2010	05:47:17	0.029
862	03/26/2010	05:48:17	0.029

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
863	03/26/2010	05:49:17	0.028
864	03/26/2010	05:50:17	0.028
865	03/26/2010	05:51:17	0.030
866	03/26/2010	05:52:17	0.028
867	03/26/2010	05:53:17	0.028
868	03/26/2010	05:54:17	0.029
869	03/26/2010	05:55:17	0.028
870	03/26/2010	05:56:17	0.031
871	03/26/2010	05:57:17	0.031
872	03/26/2010	05:58:17	0.032
873	03/26/2010	05:59:17	0.030
874	03/26/2010	06:00:17	0.032
875	03/26/2010	06:01:17	0.030
876	03/26/2010	06:02:17	0.028
877	03/26/2010	06:03:17	0.030
878	03/26/2010	06:04:17	0.028
879	03/26/2010	06:05:17	0.029
880	03/26/2010	06:06:17	0.032
881	03/26/2010	06:07:17	0.036
882	03/26/2010	06:08:17	0.043
883	03/26/2010	06:09:17	0.036
884	03/26/2010	06:10:17	0.035
885	03/26/2010	06:11:17	0.036
886	03/26/2010	06:12:17	0.038
887	03/26/2010	06:13:17	0.035
888	03/26/2010	06:14:17	0.032
889	03/26/2010	06:15:17	0.034
890	03/26/2010	06:16:17	0.032
891	03/26/2010	06:17:17	0.032
892	03/26/2010	06:18:17	0.031
893	03/26/2010	06:19:17	0.034
894	03/26/2010	06:20:17	0.036
895	03/26/2010	06:21:17	0.036
896	03/26/2010	06:22:17	0.036
897	03/26/2010	06:23:17	0.040
898	03/26/2010	06:24:17	0.042
899	03/26/2010	06:25:17	0.042
900	03/26/2010	06:26:17	0.047
901	03/26/2010	06:27:17	0.049
902	03/26/2010	06:28:17	0.052
903	03/26/2010	06:29:17	0.056
904	03/26/2010	06:30:17	0.053
905	03/26/2010	06:31:17	0.053
906	03/26/2010	06:32:17	0.046
907	03/26/2010	06:33:17	0.047
908	03/26/2010	06:34:17	0.042

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
909	03/26/2010	06:35:17	0.041
910	03/26/2010	06:36:17	0.039
911	03/26/2010	06:37:17	0.039
912	03/26/2010	06:38:17	0.038
913	03/26/2010	06:39:17	0.035
914	03/26/2010	06:40:17	0.038
915	03/26/2010	06:41:17	0.037
916	03/26/2010	06:42:17	0.037
917	03/26/2010	06:43:17	0.039
918	03/26/2010	06:44:17	0.038
919	03/26/2010	06:45:17	0.038
920	03/26/2010	06:46:17	0.042
921	03/26/2010	06:47:17	0.041
922	03/26/2010	06:48:17	0.036
923	03/26/2010	06:49:17	0.040
924	03/26/2010	06:50:17	0.039
925	03/26/2010	06:51:17	0.036
926	03/26/2010	06:52:17	0.035
927	03/26/2010	06:53:17	0.036
928	03/26/2010	06:54:17	0.042
929	03/26/2010	06:55:17	0.035
930	03/26/2010	06:56:17	0.036
931	03/26/2010	06:57:17	0.035
932	03/26/2010	06:58:17	0.035
933	03/26/2010	06:59:17	0.035
934	03/26/2010	07:00:17	0.037
935	03/26/2010	07:01:17	0.039
936	03/26/2010	07:02:17	0.041
937	03/26/2010	07:03:17	0.041
938	03/26/2010	07:04:17	0.042
939	03/26/2010	07:05:17	0.043
940	03/26/2010	07:06:17	0.046
941	03/26/2010	07:07:17	0.047
942	03/26/2010	07:08:17	0.046
943	03/26/2010	07:09:17	0.043
944	03/26/2010	07:10:17	0.043
945	03/26/2010	07:11:17	0.044
946	03/26/2010	07:12:17	0.050
947	03/26/2010	07:13:17	0.079
948	03/26/2010	07:14:17	0.062
949	03/26/2010	07:15:17	0.039
950	03/26/2010	07:16:17	0.039
951	03/26/2010	07:17:17	0.040
952	03/26/2010	07:18:17	0.040
953	03/26/2010	07:19:17	0.049
954	03/26/2010	07:20:17	0.046

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
955	03/26/2010	07:21:17	0.047
956	03/26/2010	07:22:17	0.046
957	03/26/2010	07:23:17	0.046
958	03/26/2010	07:24:17	0.048
959	03/26/2010	07:25:17	0.045
960	03/26/2010	07:26:17	0.048
961	03/26/2010	07:27:17	0.048
962	03/26/2010	07:28:17	0.059
963	03/26/2010	07:29:17	0.058
964	03/26/2010	07:30:17	0.053
965	03/26/2010	07:31:17	0.052
966	03/26/2010	07:32:17	0.041
967	03/26/2010	07:33:17	0.037
968	03/26/2010	07:34:17	0.037
969	03/26/2010	07:35:17	0.040
970	03/26/2010	07:36:17	0.037
971	03/26/2010	07:37:17	0.039
972	03/26/2010	07:38:17	0.065
973	03/26/2010	07:39:17	0.043
974	03/26/2010	07:40:17	0.043
975	03/26/2010	07:41:17	0.038
976	03/26/2010	07:42:17	0.036
977	03/26/2010	07:43:17	0.037
978	03/26/2010	07:44:17	0.039
979	03/26/2010	07:45:17	0.039
980	03/26/2010	07:46:17	0.037
981	03/26/2010	07:47:17	0.039
982	03/26/2010	07:48:17	0.038
983	03/26/2010	07:49:17	0.039
984	03/26/2010	07:50:17	0.039
985	03/26/2010	07:51:17	0.038
986	03/26/2010	07:52:17	0.037
987	03/26/2010	07:53:17	0.040
988	03/26/2010	07:54:17	0.037
989	03/26/2010	07:55:17	0.055
990	03/26/2010	07:56:17	0.053
991	03/26/2010	07:57:17	0.047
992	03/26/2010	07:58:17	0.045
993	03/26/2010	07:59:17	0.058
994	03/26/2010	08:00:17	0.051
995	03/26/2010	08:01:17	0.044
996	03/26/2010	08:02:17	0.042
997	03/26/2010	08:03:17	0.044
998	03/26/2010	08:04:17	0.043
999	03/26/2010	08:05:17	0.041
1000	03/26/2010	08:06:17	0.040

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1001	03/26/2010	08:07:17	0.041
1002	03/26/2010	08:08:17	0.041
1003	03/26/2010	08:09:17	0.037
1004	03/26/2010	08:10:17	0.038
1005	03/26/2010	08:11:17	0.039
1006	03/26/2010	08:12:17	0.041
1007	03/26/2010	08:13:17	0.049
1008	03/26/2010	08:14:17	0.040
1009	03/26/2010	08:15:17	0.042
1010	03/26/2010	08:16:17	0.040
1011	03/26/2010	08:17:17	0.041
1012	03/26/2010	08:18:17	0.040
1013	03/26/2010	08:19:17	0.039
1014	03/26/2010	08:20:17	0.041
1015	03/26/2010	08:21:17	0.039
1016	03/26/2010	08:22:17	0.037
1017	03/26/2010	08:23:17	0.035
1018	03/26/2010	08:24:17	0.038
1019	03/26/2010	08:25:17	0.038
1020	03/26/2010	08:26:17	0.033
1021	03/26/2010	08:27:17	0.032
1022	03/26/2010	08:28:17	0.035
1023	03/26/2010	08:29:17	0.036
1024	03/26/2010	08:30:17	0.031
1025	03/26/2010	08:31:17	0.028
1026	03/26/2010	08:32:17	0.029
1027	03/26/2010	08:33:17	0.030
1028	03/26/2010	08:34:17	0.055
1029	03/26/2010	08:35:17	0.039
1030	03/26/2010	08:36:17	0.036
1031	03/26/2010	08:37:17	0.030
1032	03/26/2010	08:38:17	0.028
1033	03/26/2010	08:39:17	0.030
1034	03/26/2010	08:40:17	0.033
1035	03/26/2010	08:41:17	0.033
1036	03/26/2010	08:42:17	0.029
1037	03/26/2010	08:43:17	0.030
1038	03/26/2010	08:44:17	0.027
1039	03/26/2010	08:45:17	0.032
1040	03/26/2010	08:46:17	0.027
1041	03/26/2010	08:47:17	0.026
1042	03/26/2010	08:48:17	0.024
1043	03/26/2010	08:49:17	0.025
1044	03/26/2010	08:50:17	0.024
1045	03/26/2010	08:51:17	0.024
1046	03/26/2010	08:52:17	0.025

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1047	03/26/2010	08:53:17	0.035
1048	03/26/2010	08:54:17	0.065
1049	03/26/2010	08:55:17	0.032
1050	03/26/2010	08:56:17	0.025
1051	03/26/2010	08:57:17	0.031
1052	03/26/2010	08:58:17	0.026
1053	03/26/2010	08:59:17	0.027
1054	03/26/2010	09:00:17	0.027
1055	03/26/2010	09:01:17	0.027
1056	03/26/2010	09:02:17	0.032
1057	03/26/2010	09:03:17	0.028
1058	03/26/2010	09:04:17	0.024
1059	03/26/2010	09:05:17	0.023
1060	03/26/2010	09:06:17	0.027
1061	03/26/2010	09:07:17	0.026
1062	03/26/2010	09:08:17	0.022
1063	03/26/2010	09:09:17	0.024
1064	03/26/2010	09:10:17	0.023
1065	03/26/2010	09:11:17	0.048
1066	03/26/2010	09:12:17	0.025
1067	03/26/2010	09:13:17	0.026
1068	03/26/2010	09:14:17	0.025
1069	03/26/2010	09:15:17	0.025
1070	03/26/2010	09:16:17	0.022
1071	03/26/2010	09:17:17	0.031
1072	03/26/2010	09:18:17	0.034
1073	03/26/2010	09:19:17	0.027
1074	03/26/2010	09:20:17	0.078
1075	03/26/2010	09:21:17	0.060
1076	03/26/2010	09:22:17	0.038
1077	03/26/2010	09:23:17	0.030
1078	03/26/2010	09:24:17	0.031
1079	03/26/2010	09:25:17	0.030
1080	03/26/2010	09:26:17	0.033
1081	03/26/2010	09:27:17	0.027
1082	03/26/2010	09:28:17	0.025
1083	03/26/2010	09:29:17	0.025
1084	03/26/2010	09:30:17	0.035
1085	03/26/2010	09:31:17	0.054
1086	03/26/2010	09:32:17	0.032
1087	03/26/2010	09:33:17	0.026
1088	03/26/2010	09:34:17	0.031
1089	03/26/2010	09:35:17	0.027
1090	03/26/2010	09:36:17	0.032
1091	03/26/2010	09:37:17	0.029
1092	03/26/2010	09:38:17	0.027

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1093	03/26/2010	09:39:17	0.028
1094	03/26/2010	09:40:17	0.025
1095	03/26/2010	09:41:17	0.028
1096	03/26/2010	09:42:17	0.024
1097	03/26/2010	09:43:17	0.028
1098	03/26/2010	09:44:17	0.034
1099	03/26/2010	09:45:17	0.029
1100	03/26/2010	09:46:17	0.031
1101	03/26/2010	09:47:17	0.029
1102	03/26/2010	09:48:17	0.027
1103	03/26/2010	09:49:17	0.029
1104	03/26/2010	09:50:17	0.028
1105	03/26/2010	09:51:17	0.030
1106	03/26/2010	09:52:17	0.029
1107	03/26/2010	09:53:17	0.028
1108	03/26/2010	09:54:17	0.040
1109	03/26/2010	09:55:17	0.026
1110	03/26/2010	09:56:17	0.045
1111	03/26/2010	09:57:17	0.034
1112	03/26/2010	09:58:17	0.024
1113	03/26/2010	09:59:17	0.023
1114	03/26/2010	10:00:17	0.023
1115	03/26/2010	10:01:17	0.024
1116	03/26/2010	10:02:17	0.026
1117	03/26/2010	10:03:17	0.026
1118	03/26/2010	10:04:17	0.028
1119	03/26/2010	10:05:17	0.041
1120	03/26/2010	10:06:17	0.030
1121	03/26/2010	10:07:17	0.028
1122	03/26/2010	10:08:17	0.025
1123	03/26/2010	10:09:17	0.030
1124	03/26/2010	10:10:17	0.043
1125	03/26/2010	10:11:17	0.029
1126	03/26/2010	10:12:17	0.025
1127	03/26/2010	10:13:17	0.030
1128	03/26/2010	10:14:17	0.028
1129	03/26/2010	10:15:17	0.028
1130	03/26/2010	10:16:17	0.026
1131	03/26/2010	10:17:17	0.027
1132	03/26/2010	10:18:17	0.032
1133	03/26/2010	10:19:17	0.034
1134	03/26/2010	10:20:17	0.033
1135	03/26/2010	10:21:17	0.040
1136	03/26/2010	10:22:17	0.028
1137	03/26/2010	10:23:17	0.028
1138	03/26/2010	10:24:17	0.029

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1139	03/26/2010	10:25:17	0.031
1140	03/26/2010	10:26:17	0.044
1141	03/26/2010	10:27:17	0.038
1142	03/26/2010	10:28:17	0.031
1143	03/26/2010	10:29:17	0.028
1144	03/26/2010	10:30:17	0.031
1145	03/26/2010	10:31:17	0.028
1146	03/26/2010	10:32:17	0.030
1147	03/26/2010	10:33:17	0.030
1148	03/26/2010	10:34:17	0.032
1149	03/26/2010	10:35:17	0.042
1150	03/26/2010	10:36:17	0.031
1151	03/26/2010	10:37:17	0.028
1152	03/26/2010	10:38:17	0.031
1153	03/26/2010	10:39:17	0.038
1154	03/26/2010	10:40:17	0.028
1155	03/26/2010	10:41:17	0.034
1156	03/26/2010	10:42:17	0.035
1157	03/26/2010	10:43:17	0.034
1158	03/26/2010	10:44:17	0.029
1159	03/26/2010	10:45:17	0.028
1160	03/26/2010	10:46:17	0.029
1161	03/26/2010	10:47:17	0.025
1162	03/26/2010	10:48:17	0.027
1163	03/26/2010	10:49:17	0.027
1164	03/26/2010	10:50:17	0.030
1165	03/26/2010	10:51:17	0.027
1166	03/26/2010	10:52:17	0.030
1167	03/26/2010	10:53:17	0.027
1168	03/26/2010	10:54:17	0.025
1169	03/26/2010	10:55:17	0.031
1170	03/26/2010	10:56:17	0.041
1171	03/26/2010	10:57:17	0.028
1172	03/26/2010	10:58:17	0.029
1173	03/26/2010	10:59:17	0.029
1174	03/26/2010	11:00:17	0.026
1175	03/26/2010	11:01:17	0.027
1176	03/26/2010	11:02:17	0.027
1177	03/26/2010	11:03:17	0.022
1178	03/26/2010	11:04:17	0.031
1179	03/26/2010	11:05:17	0.028
1180	03/26/2010	11:06:17	0.029
1181	03/26/2010	11:07:17	0.028
1182	03/26/2010	11:08:17	0.028
1183	03/26/2010	11:09:17	0.028
1184	03/26/2010	11:10:17	0.025

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1185	03/26/2010	11:11:17	0.027
1186	03/26/2010	11:12:17	0.023
1187	03/26/2010	11:13:17	0.025
1188	03/26/2010	11:14:17	0.031
1189	03/26/2010	11:15:17	0.025
1190	03/26/2010	11:16:17	0.022
1191	03/26/2010	11:17:17	0.025
1192	03/26/2010	11:18:17	0.030
1193	03/26/2010	11:19:17	0.024
1194	03/26/2010	11:20:17	0.028
1195	03/26/2010	11:21:17	0.027
1196	03/26/2010	11:22:17	0.028
1197	03/26/2010	11:23:17	0.024
1198	03/26/2010	11:24:17	0.026
1199	03/26/2010	11:25:17	0.026
1200	03/26/2010	11:26:17	0.024
1201	03/26/2010	11:27:17	0.026
1202	03/26/2010	11:28:17	0.024
1203	03/26/2010	11:29:17	0.025
1204	03/26/2010	11:30:17	0.025
1205	03/26/2010	11:31:17	0.023
1206	03/26/2010	11:32:17	0.024
1207	03/26/2010	11:33:17	0.022
1208	03/26/2010	11:34:17	0.024
1209	03/26/2010	11:35:17	0.025
1210	03/26/2010	11:36:17	0.021
1211	03/26/2010	11:37:17	0.026
1212	03/26/2010	11:38:17	0.021
1213	03/26/2010	11:39:17	0.021
1214	03/26/2010	11:40:17	0.022
1215	03/26/2010	11:41:17	0.023
1216	03/26/2010	11:42:17	0.024
1217	03/26/2010	11:43:17	0.025
1218	03/26/2010	11:44:17	0.026
1219	03/26/2010	11:45:17	0.027
1220	03/26/2010	11:46:17	0.026
1221	03/26/2010	11:47:17	0.025
1222	03/26/2010	11:48:17	0.022
1223	03/26/2010	11:49:17	0.025
1224	03/26/2010	11:50:17	0.024
1225	03/26/2010	11:51:17	0.024
1226	03/26/2010	11:52:17	0.028
1227	03/26/2010	11:53:17	0.025
1228	03/26/2010	11:54:17	0.025
1229	03/26/2010	11:55:17	0.024
1230	03/26/2010	11:56:17	0.024

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1231	03/26/2010	11:57:17	0.026
1232	03/26/2010	11:58:17	0.027
1233	03/26/2010	11:59:17	0.026
1234	03/26/2010	12:00:17	0.027
1235	03/26/2010	12:01:17	0.025
1236	03/26/2010	12:02:17	0.023
1237	03/26/2010	12:03:17	0.037
1238	03/26/2010	12:04:17	0.039
1239	03/26/2010	12:05:17	0.033
1240	03/26/2010	12:06:17	0.026
1241	03/26/2010	12:07:17	0.025
1242	03/26/2010	12:08:17	0.027
1243	03/26/2010	12:09:17	0.025
1244	03/26/2010	12:10:17	0.024
1245	03/26/2010	12:11:17	0.026
1246	03/26/2010	12:12:17	0.028
1247	03/26/2010	12:13:17	0.036
1248	03/26/2010	12:14:17	0.028
1249	03/26/2010	12:15:17	0.025
1250	03/26/2010	12:16:17	0.023
1251	03/26/2010	12:17:17	0.024
1252	03/26/2010	12:18:17	0.027
1253	03/26/2010	12:19:17	0.025
1254	03/26/2010	12:20:17	0.023
1255	03/26/2010	12:21:17	0.029
1256	03/26/2010	12:22:17	0.029
1257	03/26/2010	12:23:17	0.025
1258	03/26/2010	12:24:17	0.026
1259	03/26/2010	12:25:17	0.029
1260	03/26/2010	12:26:17	0.025
1261	03/26/2010	12:27:17	0.023
1262	03/26/2010	12:28:17	0.024
1263	03/26/2010	12:29:17	0.025
1264	03/26/2010	12:30:17	0.023
1265	03/26/2010	12:31:17	0.023
1266	03/26/2010	12:32:17	0.027
1267	03/26/2010	12:33:17	0.025
1268	03/26/2010	12:34:17	0.028
1269	03/26/2010	12:35:17	0.025
1270	03/26/2010	12:36:17	0.028
1271	03/26/2010	12:37:17	0.048
1272	03/26/2010	12:38:17	0.025
1273	03/26/2010	12:39:17	0.024
1274	03/26/2010	12:40:17	0.021
1275	03/26/2010	12:41:17	0.032
1276	03/26/2010	12:42:17	0.024

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1277	03/26/2010	12:43:17	0.026
1278	03/26/2010	12:44:17	0.026
1279	03/26/2010	12:45:17	0.025
1280	03/26/2010	12:46:17	0.026
1281	03/26/2010	12:47:17	0.026
1282	03/26/2010	12:48:17	0.025
1283	03/26/2010	12:49:17	0.024
1284	03/26/2010	12:50:17	0.024
1285	03/26/2010	12:51:17	0.024
1286	03/26/2010	12:52:17	0.025
1287	03/26/2010	12:53:17	0.039
1288	03/26/2010	12:54:17	0.024
1289	03/26/2010	12:55:17	0.025
1290	03/26/2010	12:56:17	0.026
1291	03/26/2010	12:57:17	0.031
1292	03/26/2010	12:58:17	0.028
1293	03/26/2010	12:59:17	0.025
1294	03/26/2010	13:00:17	0.024
1295	03/26/2010	13:01:17	0.026
1296	03/26/2010	13:02:17	0.025
1297	03/26/2010	13:03:17	0.026
1298	03/26/2010	13:04:17	0.023
1299	03/26/2010	13:05:17	0.027
1300	03/26/2010	13:06:17	0.033
1301	03/26/2010	13:07:17	0.029
1302	03/26/2010	13:08:17	0.031
1303	03/26/2010	13:09:17	0.030
1304	03/26/2010	13:10:17	0.029
1305	03/26/2010	13:11:17	0.027
1306	03/26/2010	13:12:17	0.034
1307	03/26/2010	13:13:17	0.038
1308	03/26/2010	13:14:17	0.030
1309	03/26/2010	13:15:17	0.031
1310	03/26/2010	13:16:17	0.027
1311	03/26/2010	13:17:17	0.027
1312	03/26/2010	13:18:17	0.031
1313	03/26/2010	13:19:17	0.028
1314	03/26/2010	13:20:17	0.028
1315	03/26/2010	13:21:17	0.031
1316	03/26/2010	13:22:17	0.028
1317	03/26/2010	13:23:17	0.029
1318	03/26/2010	13:24:17	0.028
1319	03/26/2010	13:25:17	0.028
1320	03/26/2010	13:26:17	0.025
1321	03/26/2010	13:27:17	0.029
1322	03/26/2010	13:28:17	0.028

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1323	03/26/2010	13:29:17	0.025
1324	03/26/2010	13:30:17	0.026
1325	03/26/2010	13:31:17	0.024
1326	03/26/2010	13:32:17	0.029
1327	03/26/2010	13:33:17	0.029
1328	03/26/2010	13:34:17	0.027
1329	03/26/2010	13:35:17	0.034
1330	03/26/2010	13:36:17	0.033
1331	03/26/2010	13:37:17	0.029
1332	03/26/2010	13:38:17	0.029
1333	03/26/2010	13:39:17	0.025
1334	03/26/2010	13:40:17	0.024
1335	03/26/2010	13:41:17	0.026
1336	03/26/2010	13:42:17	0.028
1337	03/26/2010	13:43:17	0.031
1338	03/26/2010	13:44:17	0.024
1339	03/26/2010	13:45:17	0.026
1340	03/26/2010	13:46:17	0.024
1341	03/26/2010	13:47:17	0.025
1342	03/26/2010	13:48:17	0.025
1343	03/26/2010	13:49:17	0.029
1344	03/26/2010	13:50:17	0.028
1345	03/26/2010	13:51:17	0.047
1346	03/26/2010	13:52:17	0.026
1347	03/26/2010	13:53:17	0.028
1348	03/26/2010	13:54:17	0.030
1349	03/26/2010	13:55:17	0.025
1350	03/26/2010	13:56:17	0.026
1351	03/26/2010	13:57:17	0.036
1352	03/26/2010	13:58:17	0.026
1353	03/26/2010	13:59:17	0.026
1354	03/26/2010	14:00:17	0.025
1355	03/26/2010	14:01:17	0.025
1356	03/26/2010	14:02:17	0.026
1357	03/26/2010	14:03:17	0.033
1358	03/26/2010	14:04:17	0.028
1359	03/26/2010	14:05:17	0.035
1360	03/26/2010	14:06:17	0.035
1361	03/26/2010	14:07:17	0.027
1362	03/26/2010	14:08:17	0.025
1363	03/26/2010	14:09:17	0.024
1364	03/26/2010	14:10:17	0.027
1365	03/26/2010	14:11:17	0.028
1366	03/26/2010	14:12:17	0.024
1367	03/26/2010	14:13:17	0.023
1368	03/26/2010	14:14:17	0.025

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1369	03/26/2010	14:15:17	0.023
1370	03/26/2010	14:16:17	0.024
1371	03/26/2010	14:17:17	0.025
1372	03/26/2010	14:18:17	0.028
1373	03/26/2010	14:19:17	0.028
1374	03/26/2010	14:20:17	0.025
1375	03/26/2010	14:21:17	0.028
1376	03/26/2010	14:22:17	0.028
1377	03/26/2010	14:23:17	0.026
1378	03/26/2010	14:24:17	0.027
1379	03/26/2010	14:25:17	0.026
1380	03/26/2010	14:26:17	0.026
1381	03/26/2010	14:27:17	0.025
1382	03/26/2010	14:28:17	0.024
1383	03/26/2010	14:29:17	0.024
1384	03/26/2010	14:30:17	0.024
1385	03/26/2010	14:31:17	0.027
1386	03/26/2010	14:32:17	0.024
1387	03/26/2010	14:33:17	0.025
1388	03/26/2010	14:34:17	0.024
1389	03/26/2010	14:35:17	0.025
1390	03/26/2010	14:36:17	0.029
1391	03/26/2010	14:37:17	0.027
1392	03/26/2010	14:38:17	0.026
1393	03/26/2010	14:39:17	0.025
1394	03/26/2010	14:40:17	0.026
1395	03/26/2010	14:41:17	0.024
1396	03/26/2010	14:42:17	0.043
1397	03/26/2010	14:43:17	0.040
1398	03/26/2010	14:44:17	0.030
1399	03/26/2010	14:45:17	0.029
1400	03/26/2010	14:46:17	0.026
1401	03/26/2010	14:47:17	0.025
1402	03/26/2010	14:48:17	0.028
1403	03/26/2010	14:49:17	0.025
1404	03/26/2010	14:50:17	0.025
1405	03/26/2010	14:51:17	0.032
1406	03/26/2010	14:52:17	0.025
1407	03/26/2010	14:53:17	0.025
1408	03/26/2010	14:54:17	0.025
1409	03/26/2010	14:55:17	0.029
1410	03/26/2010	14:56:17	0.026
1411	03/26/2010	14:57:17	0.028
1412	03/26/2010	14:58:17	0.029
1413	03/26/2010	14:59:17	0.028
1414	03/26/2010	15:00:17	0.025

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1415	03/26/2010	15:01:17	0.024
1416	03/26/2010	15:02:17	0.025
1417	03/26/2010	15:03:17	0.027
1418	03/26/2010	15:04:17	0.026
1419	03/26/2010	15:05:17	0.026
1420	03/26/2010	15:06:17	0.027
1421	03/26/2010	15:07:17	0.027
1422	03/26/2010	15:08:17	0.027
1423	03/26/2010	15:09:17	0.025
1424	03/26/2010	15:10:17	0.025
1425	03/26/2010	15:11:17	0.026
1426	03/26/2010	15:12:17	0.025
1427	03/26/2010	15:13:17	0.024
1428	03/26/2010	15:14:17	0.023
1429	03/26/2010	15:15:17	0.023
1430	03/26/2010	15:16:17	0.026
1431	03/26/2010	15:17:17	0.027
1432	03/26/2010	15:18:17	0.026
1433	03/26/2010	15:19:17	0.025
1434	03/26/2010	15:20:17	0.025
1435	03/26/2010	15:21:17	0.023
1436	03/26/2010	15:22:17	0.026
1437	03/26/2010	15:23:17	0.025
1438	03/26/2010	15:24:17	0.026
1439	03/26/2010	15:25:17	0.028
1440	03/26/2010	15:26:17	0.027
1441	03/26/2010	15:27:17	0.027
1442	03/26/2010	15:28:17	0.027
1443	03/26/2010	15:29:17	0.025
1444	03/26/2010	15:30:17	0.030
1445	03/26/2010	15:31:17	0.024
1446	03/26/2010	15:32:17	0.025
1447	03/26/2010	15:33:17	0.027
1448	03/26/2010	15:34:17	0.022
1449	03/26/2010	15:35:17	0.030
1450	03/26/2010	15:36:17	0.027
1451	03/26/2010	15:37:17	0.025
1452	03/26/2010	15:38:17	0.034
1453	03/26/2010	15:39:17	0.037
1454	03/26/2010	15:40:17	0.035
1455	03/26/2010	15:41:17	0.036
1456	03/26/2010	15:42:17	0.057
1457	03/26/2010	15:43:17	0.047
1458	03/26/2010	15:44:17	0.040
1459	03/26/2010	15:45:17	0.043
1460	03/26/2010	15:46:17	0.028

Test Data			
Data Point	Date	Time	Aerosol mg/m^3
1461	03/26/2010	15:47:17	0.029
1462	03/26/2010	15:48:17	0.026
1463	03/26/2010	15:49:17	0.029
1464	03/26/2010	15:50:17	0.034
1465	03/26/2010	15:51:17	0.030
1466	03/26/2010	15:52:17	0.036
1467	03/26/2010	15:53:17	0.047

R.O.S.E ENVIRONMENTAL LTD.

TEST CERTIFICATE
7119

Date: 15th April, 2010

Client: AECom

Your ref.: Rental

Type of Equipment: TSI Dust Trak with Environmental enclosure.

This is to certify that the following Equipment have been Tested and Calibrated and is permitted for use as specified by the manufacturer.

TEST DATE	EQUIPMENT DESCRIPTION	SERIAL NUMBER	TEST/SERVICE PROVIDED
15-Apr-10	TSI Dust Trak	85202707	CALIBRATION

NOTE: The TSI Dust Trak meter flow rate was set to 1.7 LPM and zeroed with the zero filter provided by TSI Incorporated.

Service Technician

Verified By

Authorized Signature

Solutions for a healthy environment

Unit #7, Lot 2C Chootoo Road,
El Socorro, San Juan
Tel: 868-638-1640, 638-7673, 675-1094
Fax:868-675-1988
email: solutions@roseenvironmental.net

R.O.S.E ENVIRONMENTAL LTD.

TEST CERTIFICATE
7118

DATE: April 15th, 2010

COMPANY: **AECOM**

YOUR REF.: **Rental** **You Ref: DN# 10369/RA/TA/NRS**

TYPE OF EQUIPMENT: Particulate Samplers

This is to certify that the following Equipment have been Tested and is permitted for use as specified by the manufacturer.

TEST DATE	EQUIPMENT DESCRIPTION	SERIAL #	TEST/SERVICE PROVIDED
15 Apr 2010	MiniVol Particulate Sampler	4678	TEST
15 Apr 2010	MiniVol Particulate Sampler	4144	TEST

NOTE: 1. Each unit's flowrate was checked and verified at 5.0Lpm

Service Technician

Verified By

Authorized Signature

Solutions for a healthy environment

Unit #7, Lot 2C Chootoo Road,
El Socorro, San Juan
Tel: 868-638-1640, 638-7673, 675-1094
Fax:868-675-1988
email: solutions@roseenvironmental.net

R.O.S.E
ENVIRONMENTAL LTD.

TEST CERTIFICATE
7050

DATE: March 17th, 2010

COMPANY: **AECOM**

YOUR REF.: **Rental** **You Ref: DN# 9894/MR/TA/CD**

TYPE OF EQUIPMENT: Particulate Samplers

....

This is to certify that the following Equipment have been Tested and is permitted for use as specified by the manufacturer.

TEST DATE	EQUIPMENT DESCRIPTION	SERIAL #	TEST/SERVICE PROVIDED
17 Mar 2010	MiniVol Particulate Sampler	4678	TEST
17 Mar 2010	MiniVol Particulate Sampler	4144	TEST

NOTE: 1. Each unit's flowrate was checked and verified at 5.0Lpm

....
Service Technician

....
Verified By

....
Authorized Signature

Solutions for a healthy environment

Unit #7, Lot 2C Chootoo Road,
El Socorro, San Juan
Tel: 868-638-1640, 638-7673, 675-1094
Fax:868-675-1988
email: solutions@roseenvironmental.net

R.O.S.E ENVIRONMENTAL LTD.

TEST CERTIFICATE
7052

Date: 17th March, 2010

Client: AECom

Your ref.: Rental

Type of Equipment: TSI Dust Trak with Environmental enclosure.

This is to certify that the following Equipment have been Tested and Calibrated and is permitted for use as specified by the manufacturer.

TEST DATE	EQUIPMENT DESCRIPTION	SERIAL NUMBER	TEST/SERVICE PROVIDED
17-Mar-10	TSI Dust Trak	23567	CALIBRATION

NOTE: The TSI Dust Trak meter flow rate was set to 1.7 LPM and zeroed with the zero filter provided by TSI Incorporated.

M. Ramberan.

Service Technician

Verified By

Authorized Signature

Solutions for a healthy environment

Unit #7, Lot 2C Chootoo Road,
El Socorro, San Juan
Tel: 868-638-1640, 638-7673, 675-1094
Fax:868-675-1988
email: solutions@roseenvironmental.net

Appendix E

Socio-Economic Baseline Data

Appendix E

Socio-Economic Baseline Data

E.1 Key Concepts and Definitions of CSO 2000 Census

Appendix E.1 Key Concepts and Definition of CSO 2000 Census

Dwelling Unit

A dwelling unit is any building, or separate and independent part of a building, in which a person or group of persons (private household) is living at the time of census enumeration. The essential features of a dwelling unit are “separateness” and “independence”.

An enclose is separate if surrounded by walls or some form of partitioning, covered by a roof so that a person or group of persons can isolate himself/themselves from other persons for purposes of sleeping and preparing and sharing meals.

A dwelling unit is independent when it has direct access from the street or common landing, staircase, passage or gallery, i.e. when occupants can come in and go out without passing through anyone else’s living quarters.

Examples of dwelling units are:

i. Separate Houses

ii. Flats/Apartments/Condominiums

iii. Townhouses

iv. Double Houses/Duplexes

v. Part of Commercial/Industrial Buildings

vi. Barracks

vii. Out-rooms

viii. Other Private Dwellings

ix. Group Dwellings (institution, hotel, youth development apprenticeship centre and boarding house)

x. WAFDA

Vacant Dwelling Unit

A vacant dwelling unit is defined as living quarters, which is habitable, but no one live there during the enumeration.

Closed Dwelling Unit

A closed dwelling unit is defined as living quarters, which is occupied, but during the enumeration period, the occupants are temporarily away, that is, away for less than six (6) months.

Private Dwelling

Private-type dwellings are those in which private households reside. Examples are single houses, flats, apartments, part of commercial buildings. Boarding houses catering for **less than six (6) persons** are also included under private dwelling

Non-Private Dwellings/Group Dwellings/Institutions

An institution is defined as living quarters in which the occupants live collectively for disciplinary, health, educational, religious, military, work or other reasons

These institutions have been divided into two major groups:

Group A - includes institutions such as hotels and large boarding houses, (hostels, military, barracks, etc.) which cater for six (6) or more paying guests, the inhabitants of which, like the general non-institutional population, may engage in normal economic activity. National Youth Development Apprenticeship Centres (Youth Camps) and juvenile correctional facilities are also included under Group A.

Group B - includes hospitals and nursing homes, prisons, geriatric homes, orphanages and such institutions where inmates, during the period in the institution, will in general not take part in any normal economic activity.

Inmates in institutions categorised in Group B are included in the household if as at Census Day, they were living in the institutions for less than six months.

Appendix E

Socio-Economic Baseline Data

E.2 List of Communities, Municipalities and Subcatchments

Appendix E.2 List of Communities, Municipalities and Subcatchments

Administrative Area/Municipality	Community	Subcatchment
San Fernando City Corporation	Mon Repos	San Fernando South
	Navet Village	
	Les Efforts East	
	Lower Hillshide	
	Paradise	
	Les Efforts West	
	Green Acres	Green Acres
	Gulf View	Bel Air-Gulf View
	St. Joseph Village	Vistabella
	Maraj Lands	
	Vistabella	
	Paradise	
	Broadway	
	Embacadere	
	City Proper	
	Marabella	Marabella
	Union Park	
	Union Village	
	Tarouba	Tarouba-Cocoyea
	Cocoyea Village	
	Cocoyea Village	Cocoyea South
	Pleasantville	Pleasantville-Corinth
	Victoria Village	
Penal/Debe Regional Corporation	La Romain	La Romain South
	Rambert Village	La Romain North
	Canaan Village/Palmiste	
	Palmiste	
	La Romain	La Romain Central
	Palmiste	Palmiste South

	Phillipine	
	Diamond	
	Hermitage Village	
	Picton	Picton
	Duncan Village	Duncan Village
	Esperance Village	Union Hall
	Golconda	
Princes Town Regional Corporation	Golconda	Retrench-Golconda
	Corinth	Ste. Madeline
	Ste. Madeline	

Appendix E

Socio-Economic Baseline Data

E.3 List of Schools within San Fernando Wastewater Catchment

Appendix E.3 List of Schools within San Fernando Wastewater Catchment Area

Name of Institution	Contact/Address	Type of Institution
Anstey Memorial Girls' AC Primary School	652-4331/#29 Drayton Street, San Fernando	Primary School
Bien Venue Presbyterian Primary School	657-3179/La Plaisance Road, La Romain	Primary School
Bonne Aventure Presbyterian Primary School	650-0649/School Road, Bonne Aventure, via Gasparillo	Primary School
Canaan Presbyterian Primary School	652-7733/Siparia Erin Road, Duncan Village via San Fernando	Primary School
Caratal RC Primary School	650-2827/Gasparillo Road, Gasparillo	Primary School
Cipero RC Primary School	653-1940/Church Street, Rabert Village, La Romaine	Primary School
Cocoyea Government Primary School	653-4520/Forress Avenue, Cocoyea Village via San Fernando	Primary School
Coffee Street Boys AC Primary School	653-2093/#29 Cooper Street, San Fernando	Primary School
Debe Hindu Primary School	647-5827/San Fernando-Siparia Main Road, Debe Post Office	Primary School
Debe Presbyterian Primary School	647-7684/#1 Periwinkle Drive, Wellington Road, Debe	Primary School
Gasparillo Government Primary School	650-1022/Bonne Avenue Road, Gasparillo	Primary School
Grant Memorial Presbyterian Primary School	652-4023/#1a Carib Street, San Fernando	Primary School
Happy Hill Hindu Primary School	650-2220/Bonne Aventure Road, Gasparillo	Primary School
Harmony Hall Presbyterian Primary School	658-2082/Union Road, Marabella	Primary School
Hermitage Presbyterian Primary School	653-9877/Dumfries Road, Hermitage Village via San Fernando	Primary School
La Romain Government Primary School	652-0678/Church Street, La Romain	Primary School
La Romain RC Primary School	657-3194/Victoria Street Ext., La Romain	Primary School
Marabella Government Primary School	658-4295/Fahey Avenue, Union Park East, Gopaul Lands, Marabella	Primary School

Marabella Boys AC Primary School	653-9807/Southern Main Road, Marabella	Primary School
Marabella Girls AC Primary School	Southern Main Road, Marabella	Primary School
Mon Repos RC Primary School	Torrance Street, San Fernando	Primary School
Picton Presbyterian Primary School	652-8634/Papouri Road, Diamond Village P.O. via San Fernando	Primary School
Pleasantville Government Primary School	657-6343/Prince Albert Street, Pleasantville	Primary School
Pointe-a-Pierre Government Primary School	#68 Station Road, Pointe-a-Pierre	Primary School
Reform Hindu Primary School	650-5700/#1 Railway Road, Reform Village	Primary School
Reform Presbyterian Primary School	Reform Village, Guaracara-Tabaquite Road, Gasparillo	Primary School
San Fernando Methodist Primary School	652-4784/#34-36 Mon Chagrin Street, San Fernando	Primary School
San Fernando ASJA Primary School	Park Street, San Fernando	Primary School
San Fernando Boys Government Primary School	657-1093/#29 Crichlow Street, San Fernando	Primary School
San Fernando Boys RC Primary School	657-9464/#22 Harris Promenade, San Fernando	Primary School
San Fernando Girls Government Primary School	657-8353/#84 Rushworth Street, San Fernando	Primary School
San Fernando Girls AC Primary School	657-7567/Pouchet Avenue, San Fernando	Primary School
San Fernando SDA Primary School	652-5777/Pouchet Street, San Fernando	Primary School
San Fernando TML Primary School	652-3238/#27 Farah Street, Les Efforts West, San Fernando	Primary School
St Joseph Terrace	657-9711/#97 Circular Road, San Fernando	Primary School
St. Peter's Private School	658-2019/Bonne Aventure Park, Pointe-a-Pierre	Primary School
St. Clement's Vedic Primary School	102 Naparima/Mayaro Road, St. Clement Junction, San Fernando	Primary School
St. Gabriel's Girls RC Primary School	652-4611/Lord Street, San Fernando	Primary School
St. John's AC Primary School	St. John's Village, Cipero Road via San Fernando	Primary School
St. Paul's AC Primary School	657-7178/Harris Street, San Fernando	Primary School
Ste. Madeline Government	Manahambre Road, Ste. Madeline	Primary School

Primary School		
Vistabella Presbyterian Primary School	652-9389/#1-3 Cane Street, Vistabella via San Fernando	Primary School
Vos Government Primary School	650-3628/Charles Street, Gasparillo	Primary School
ASJA Boys College, San Fernando	657-8373/657-8378/#19-21 Park Street, San Fernando	Secondary School
ASJA Girls College, San Fernando	657-8402/#33-35 Park Street, San Fernando	Secondary School
Corinth Teachers Training College 6th Form	652-4445/652-3646/Corinth Village, Cocoyea Village, San Fernando	Secondary School
Debe High School	647-2405/M2 Ring Road, Debe	Secondary School
Gasparillo Composite	650-2657/Rahaman Drive, Bonne Aventure Road, Happy Hill Village, Gasparillo	Secondary School
La Romain High School	697-0579/352-5462/Church Street, La Romain	Secondary School
Marabella Juinor Secondary	658-3772/Cor. Tagore Avenue & Gopaul Lands, Marabella	Secondary School
Marabella Senior Comprehensive	658-5774/659-3225/#1 1/4mm Guracara Tabaquite Road	Secondary School
Modern Business College, San Fernando	653-9795/High Street, San Fernando	Secondary School
Naparima Boys College	652-2415/Paradise Pasture, Independence Avenue, San Fernando	Secondary School
Naparima Girsl High School	652-2049/#4 La Pique Road, San Fernando	Secondary School
Open Bible High School	657-1120/7449/#20-24 Ruth Avenue, Marabella	Secondary School
Parvatie Girls Hindu College	647-0007/Debe Main Road, Southern Main Road, Debe	Secondary School
Pleasantville Senior Comprehensice	657-9070/#200 Collector Road, Pleasantville, San Fernando East	Secondary School
Presentation College, San Fernando	652-2311/653-4395/#32-34 Coffee Street, San Fernando	Secondary School
San Fernando East Junior Secondary	657-7384/Pleasantville 200, San Fernando East	Secondary School
San Fernando Government Secondary	657-7169/Todd Street, San Fernando	Secondary School
San Fernando Secondary Comprehensive	657-8356/Farah Street, San Fernando	Secondary School
Southern Academy of SDA	657-8012/Pouchet Street, San	Secondary School

	Fernando	
Southern Community College	652-6521/Carib Street, San Fernando	Secondary School
St. Benedict's College	657-7006 /Southern Main Road, La Romain	Secondary School
St. Joseph's Convent, San Fernando	652-3301/City Square, Harris Promenade, San Fernando	Secondary School
St. Kevin's College	657-2753/1055/#23-25 Prince of Wales Street, San Fernando	Secondary School
Ste. Madeline Secondary	652-3056/Corinth Road, Ste. Madeline	Secondary School
UWI Sixth Form, San Fernando	653-5996/#7-9 Padmore Street, San Fernando	Secondary School
Daniel's Educational Institute	652-8446/#100 Cooper Street, San Fernando	Secondary School
St. George's Academy	653-7280/#38 Royal Road, San Fernando	Secondary School
UTT Corinth Campus	Corinth	Tertiary
School of Accounting and Management	653-9488/1064/#17-25 Blanche Fraser Street, San Fernando	Tertiary
School of Philosophy	652-5340/628-6668/#16-26 Hubert Rance Street, Vistabella	Tertiary
Academy of Engineering Technicians	653-0915/#1 Mc Dougal Street, San Fernando	Tertiary
COSTAATT	652-5482/Pointe-a-Pierre Road, Vistabella	Tertiary
College of Health, Environment & Safety	657-7806/#26 Crichlow Street, San Fernando	Tertiary
College of Science, Tech & Applied Arts	653-4884/#154 Pointe-a-Pierre Road, Vistabella	Tertiary
Higher Education & Consultancy Services	657-8384/5131/#18 Rushworth Street, San Fernando	Tertiary
Institute of Tertiary Tutors	653-3945/652-9726/#4-6 Chancery Lane, San Fernando	Tertiary
Omardeen School of Accountancy	657-9919/#167-169 Cipero Street, San Fernando	Tertiary
Professional School of Accountancy	657-6528/#54 Riverside Drive, San Fernando	Tertiary
Student's Accountancy Centre	653-7278/#14A Coffee Street, San Fernando	Tertiary
University of Trinidad and Tobago	653-4451-3/San Fernando	Tertiary
P&R Learning Centre	652-9113/St. James Street, San Fernando	Tertiary

School of Practical Accounting & Accounting Services	652-0716/#127 Coffee Street, San Fernando	Tertiary
Caribbean Institute of Language & International Business	#129 Coffee Street, San Fernando	Tertiary
National Centre for persons with disabilities	652-4880/#7-21 New Street, San Fernando	Tertiary
Automation Technology College	652-4122#/6 Johnstone Street, San Fernando	Tertiary
Pal Institute of Health Safety & Environmental Services Limited	652-4725/#78-82 Gooding Village, San Fernando	Tertiary

Appendix E

Socio-Economic Baseline Data

E.4 Population Growth Rates

Appendix E.4 Population Calculations using Housing Count

Year	Growth Rate	Population
2009	0.57	90200
2010	0.58	90723.16
2011	0.58	91249.35
2012	0.58	91778.6
2013	0.58	92310.92
2014	0.58	92846.32
2015	0.58	93384.83
2016	0.53	93879.77
2017	0.53	94377.33
2018	0.53	94877.53
2019	0.53	95380.38
2020	0.53	95885.9
2021	0.45	96317.38
2022	0.45	96750.81
2023	0.45	97186.19
2024	0.45	97623.53
2025	0.45	98062.83
2026	0.35	98406.05
2027	0.35	98750.48
2028	0.35	99096.1
2029	0.35	99442.94
2030	0.35	99790.99
2031	0.28	100070.4
2032	0.28	100350.6
2033	0.28	100631.6
2034	0.28	100913.4
2035	0.28	101195.9

Appendix E.4 Population Calculations using CSO 2000 Census Data

Year	Growth Rate	Population
2000	0.61	89015.00
2001	0.61	89557.99
2002	0.61	90104.30
2003	0.61	90653.93
2004	0.61	91206.92
2005	0.61	91763.28
2006	0.57	92286.33
2007	0.57	92812.37
2008	0.57	93341.40
2009	0.57	93873.44
2010	0.58	94417.91
2011	0.58	94965.53
2012	0.58	95516.33
2013	0.58	96070.33
2014	0.58	96627.53
2015	0.58	97187.97
2016	0.53	97703.07
2017	0.53	98220.90
2018	0.53	98741.47
2019	0.53	99264.80
2020	0.53	99790.90
2021	0.45	100239.96
2022	0.45	100691.04
2023	0.45	101144.15
2024	0.45	101599.30
2025	0.45	102056.49
2026	0.35	102413.69
2027	0.35	102772.14
2028	0.35	103131.84
2029	0.35	103492.80
2030	0.35	103855.03
2031	0.28	104145.82
2032	0.28	104437.43
2033	0.28	104729.86

2034	0.28	105023.10
2035	0.28	105317.16

Appendix E

Socio-Economic Baseline Data

E.5 Socio-Economic Classification

Appendix E.5 Socio-Economic Point Classification

% SES	SES	% pt range out of 51 pts
24%	low	.05 - .25
34%	middle low	.26-.46
22%	middle	.47-.67
16%	middle high	.68-.93
5%	high	.94-1.0

Appendix E.5 Socio-Economic Point Scheme

Occupation	Points
Sales worker	2
Service Worker	2
Farming	1
Skilled worker	2
Unskilled worker	1
Professional	5
Technical	4
Self employed	3
Administrative	4
Unemployed	1
Housewife	2
Retired	2
Don't Know	1
Refused	1
No response	0
Education	
Primary	1
Secondary 3/5	2
Secondary 6th	3
Technical / Vocational	4
College / University	5
No formal education	1
Refused/Don't Know	1
No response	0
Items in home	
CD Player	1
DVD Player	1
Television	1
Telephone	1
Home PC	3
Motor Vehicle	2
Hot Water (in taps)	2
Clothes dryer	3
Cable TV	1
Direct TV	1
Satellite TV	1
Air conditioning unit	2

International credit card	3
Maid (Hired Help)	4
Internet Access	3
Home is Rented	1
Home is Owned	4
Live in Home by arrangement	1

Appendix E

Socio-Economic Baseline Data

E.6 Social Survey (2009)

FINAL REPORT
ON
ENVIRONMENTAL IMPACT ASSESSMENT STUDY
San Fernando

Prepared for:
AECOM
18 Alcazar Street,
St. Clair

Prepared by:
Market Facts & Opinions (2000) Ltd.
16-18 Tragarete Road
Port of Spain
January 15, 2010

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Background

AECOM is in the process of designing and establishing a sewerage processing plant to service the needs of San Fernando.

As such, this study was conducted to determine residents' perception of the project and its potential impact on the community. The survey also seeks to determine the current baseline conditions, i.e. the socio-economic conditions of each community in the area.

Background

MARKET FACTS & OPINIONS

The scope of this assessment will be to determine the extent of environmental and social impacts arising from the proposed development, the management of identified significant negative impacts through mitigation, in addition to monitoring plans to gauge the effectiveness of the adopted mitigation measures. The areas likely to be affected and those which were part of the study are as follows:

- Marabella
- Tarouba
- Cocoyea – Cocoyea South
- Ste Madeline
- Pleasantville – Corinth
- San Fernando Central
- Green Acres
- Union Hall
- Gulf View – La Romaine
- Retrench – Golconda
- Picton – Diamond
- Palmiste including Les Efforts East and West
- La Romaine
- Hermitage
- Duncan Village

Research Methodology

- One-on-one interviews were conducted with the person in the household who is responsible for paying the utility bills
- Households were selected in the locations which would be affected by the project
- Fieldwork was conducted by four teams. Each team consisted of four interviewers and one supervisor. Fieldwork was conducted between the 10:00 – 18:00 hrs from December 4^{th} to 17^{th} excluding Sunday 6^{th} & 13^{th}. Every second house was selected to be interviewed.
- The main questionnaire was developed by Market Facts & Opinions (2000) Limited in collaboration with the client, AECOM

Research Methodology

MARKET FACTS & OPINIONS

Who:	1002 households
How:	Face to Face Interviews
When:	4th – 17th December, 2009
Where:	Marabella Tarouba Cocoyea – Cocoyea South Ste Madeline Pleasantville – Corinth San Fernando Central Green Acres Union Hall Gulf View – La Romaine Retrench – Golconda Picton – Diamond Palmiste including Les Efforts East and West La Romain Hermitage Duncan Village

Executive Summary

Demographics

The average resident in San Fernando tends to be from a middle income household. Residents generally have been living in the area for more than 20 years (54%). Moreover, they are more likely to be employed with a company than to be self-employed.

Community Awareness

There is a low level of awareness (22%) of the proposed Wastewater Collection Treatment and Disposal Facility for the San Fernando area. In addition, awareness for the project is fairly recent, as just about three of every four respondents have heard about the project within the last six months. The media (60%) is the main channel through which aware residents have gained information about this proposed project.

A positive outcome is more likely to be anticipated by residents both for themselves and their community from the proposed project rather than a negative one. A cleaner, healthier environment, and a regular supply of water are the main anticipated benefits common to both individuals and the community. Residents who perceived that the proposed project would have negative repercussions for them mainly cite an increase in their utility (water) bill (51%).

Executive Summary

MARKET FACTS & OPINIONS

Perceived Impact on the Environment

While the wastewater system is expected to have both positive and negative impacts on the environment, the sector of the environment most likely to be affected is human beings (94%). Oceans, rivers and drains (78%) and roads (64%) round off the top three areas that respondents perceive are most likely to be affected.

Community Concerns and Involvement

The three main concerns for residents are an irregular water supply (40%), bad roads (23%) and crime (18%).

Virtually the entire sample is not involved in any village council, non-governmental or community based organization (92%). Those who are involved cite a host of groups to which they belong, mainly community groups in their neighbourhood. Gulf View, Retrench – Golconda and Hermitage residents are more likely to be involved in such community based groups.

The same proportion of respondents who are aware of their community leaders (30%) is also satisfied with their performance (29%). Poor visibility (27%) and representation (23%) in the communities drive the negative sentiment of those respondents who are not satisfied with their community leaders.

Executive Summary

MARKET FACTS & OPINIONS

Impact of Industrial Development in San Fernando

Approximately one of every four respondents expressed that they were affected either positively or negatively by business and industrial development in San Fernando over the past 10 years. Respondents are more likely to have been negatively affected (68%) during this period.

The main negative effect of industrial development experienced is the increase in traffic (52%), while an increase in the number of shopping and business payment centres (50%) as well as more business opportunities (36%) have been identified as the main benefits in the past 10 years.

69% of the residents experience nuisances in their communities. The top three nuisances are traffic (30%), odour (28%) and crime (26%), with traffic and odour affecting residents on a daily basis, while crime, although a nuisance, affecting them less often than once every two weeks.

Executive Summary

MARKET FACTS & OPINIONS

Characteristics of the Household

- 86% of the households interviewed spend $500 or less on their water bills quarterly
- 49% of the residents do not have a sewer system, while 36% have this cost included in their rent/mortgage; 11% pay between $51 - $100 quarterly
- 25% of respondents are unwilling to pay an increased rate for their sewer service; 49% are willing to pay ≤ $45
- 58% of the households interviewed have internal water closets
- 98% of the households interviewed have water piped directly to their house by WASA
- 99% of the households interviewed have a direct T&TEC connection
- 80% of the households interviewed live in houses built with concrete and bricks
- 39% of the sample usually access the San Fernando General Hospital
- 78% of employed persons work on a full time basis – 40+ hours weekly

Awareness of and Satisfaction with Public Facilities

- 70% of the residents are satisfied with the service that they receive from the nearest police station
- 90% of the residents are satisfied with the service that they receive from the nearest fire station
- 47% of the households interviewed use the recreational grounds in their communities

Conclusions and Recommendations

MARKET FACTS & OPINIONS

The proposed wastewater project for the San Fernando area has not been a topic of much discussion among respondents, as there is a low level of awareness (22%) of the project. In addition to this low awareness level, information on the project has only been recently generated – as recent as within the last six months. While residents are not particularly aware of the project, they foresee positive changes as a result of the implementation. These positive changes, namely a cleaner, healthier environment hold true for themselves and their communities.

Public education on the proposed project is crucial. In addition to having an increase in their utility bill, residents also perceive that illness would ensue as a result of consuming wastewater that is not properly treated. They also perceive that marine life and lands would be damaged because of leaks and spills from pipelines. Informing the public about the pros and cons of the proposed project is necessary to remove any misconceptions that currently exist.

Most respondents are either unwilling to pay any additional cost for a sewer system or are prepared to pay the minimum. Furthermore approximately three of every five respondents are not currently connected to a public sewer system and therefore do not pay for this service presently. Therefore it is important in the communication about the proposed plan that the environmental benefits and advantages of using a sewer system be emphasized so that the value of this project is accepted by the community.

DETAILED FINDINGS

Demographics

Location

The following table shows the sample distribution of the locations surveyed within the catchment area of the proposed Wastewater Collection Treatment and Disposal Facility.

Marabella	15%	Retrench – Golconda	5%
La Romain	10%	Ste Madeline	5%
Pleasantville – Corinth	9%	Duncan Village	5%
Palmiste – including Les Efforts East and West	7%	Gulf View – La Romain	5%
Cocoyea – Cocoyea South	7%	Vistabella	5%
San Fernando Central	6%	Green Acres	4%
Picton/Diamond	6%	Union Hall	4%
Tarouba	5%	Hermitage	4%
BASE	1002	BASE	1002

Length of Residence

Just over half of the sample (54%) has been living in their respective communities for more than 20 years.

Less than 2 years	4%
2-5 years	11%
6-10 years	12%
11-20 years	19%
More than 20 years	54%
BASE	1002

Socio-Economic Status

Points were attributed to the different occupations, levels of education and items in home in order to determine the socio-economic status of the persons interviewed in the study. The lowest number of points possible was three and the highest was twenty five. The ranges were as follows:

Low socio-economic status: 3 – 7 points
Middle socio-economic status: 8 – 17 points
High socio-economic status: 18 – 25 points

Socio-Economic Status

The following table shows the socio-economic status of the persons interviewed in the study.

	OVERALL	Marabella	La Romain	Pleasantville	Palmiste	Cocoyea South	San F'do Central
Low	35%	22%	13%	36%	45%	44%	36%
Middle	57%	64%	55%	62%	48%	53%	60%
High	8%	14%	32%	2%	7%	3%	4%
BASE	1002	149	47	86	74	66	58

	OVERALL	Picton	Vistabella	Tarouba	Ste Madeline	Gulf View	Duncan Village
Low	35%	45%	18%	36%	45%	13%	37%
Middle	57%	48%	67%	58%	47%	55%	57%
High	8%	7%	15%	6%	8%	32%	6%
BASE	1002	56	54	52	51	47	46

	OVERALL	Retrench	Green Acres	Hermitage	Union Hall
Low	35%	51%	22%	44%	22%
Middle	57%	40%	67%	51%	67%
High	8%	9%	11%	5%	11%
BASE	1002	45	40	39	36

Industries employed within

Members of households in San Fernando are more likely to be employed by someone else rather than being owners of a business. The service industry is the main sector in which they are employed.

	Employed	Self-Employed
Agriculture	1%	--
Service	72%	18%
Oil and Gas	11%	--
Other Industry	13%	1%
None	4%	--
BASE	1002	

*Total exceeds 100% due to multiple responses. Instances of more than one person in the household employed.

MARKET FACTS & OPINIONS

Community Awareness of the Wastewater Collection Treatment and Disposal Facility

Community Awareness

The awareness level for the proposed Wastewater Collection and Treatment facility for the San Fernando area is low. Just about one of every five respondents (22%) claims to have heard of the proposed facility. In terms of the period of awareness, for most (74%), it is as recent as within the last six months.

YES	22%
NO	78%
BASE	1002

LENGTH OF AWARENESS		
1 to 3 months	59%	74%
3 to 6 months	15%	
6 months to 1 year		12%
1 to 3 years		2%
3 to 5 years		1%
More than 5 years		11%
BASE		217

Community Awareness

MARKET FACTS & OPINIONS

The media (60%) serves as the main informant for generating awareness about the proposed project.

	Information Channel
Media	**60%**
Word of Mouth	33%
Neighbours	4%
Members of Parliament	1%
Public Meetings/Workshops	1%
Community Leaders	1%
Employed at WASA/relative employed at WASA	1%
Flyers	1%
WASA	1%
BASE	217

***Total exceeds 100% due to multiple responses**

Personal Impact

Respondents were asked to state the ways in which they would be affected by the project. Respondents are twice as likely to perceive that there would be a positive benefit for them (78%) rather than a negative one (37%).

Positive	78%
Negative	37%
BASE	1002

*Total exceeds 100% due to multiple responses

MARKET FACTS & OPINIONS

Personal Impact – Positive

A cleaner/healthier environment (39%), followed by a more efficient disposal of wastewater (19%), a regular supply of water (17%) and no air pollution (15%) are the main perceived benefits.

Cleaner/healthier environment	39%
More efficient sewer system/efficient disposal of waste	19%
Would get a regular supply of water	17%
No air pollution	15%
Better wastewater disposal	10%
No need to pay to clean septic tanks	10%
Less flooding	5%
Wastewater would be recycled	5%
Land would not be polluted with run off	3%
A large amount of wastewater would be accommodated from the community	1%
Other	1%
BASE	777

***Total exceeds 100% due to multiple responses**

Personal Impact – Negative

Half of the respondents who felt that they would be affected negatively by the proposed project cited an economic reason – a perceived increase in their WASA bill (51%).

Higher cost/increased costs for water/increase in WASA bill	51%
Untreated/unhealthy water would be re-used	14%
Roads will be damaged	12%
Air will be polluted	6%
Traffic will be increased	6%
Reduced water supply	5%
Burst or leaking pipes/overflows	5%
Bad odours	3%
Noise pollution	2%
Property will be dug up	2%
Can't say/don't know	2%
Other	6%
BASE	373

***Total exceeds 100% due to multiple responses**

Benefit to the Community

Respondents were further asked whether they believe the project would be of any benefit to the community. There is a greater likelihood to foresee a benefit (85%) to the community rather than not to. Similarities can be noted between the main personal and community benefits. A cleaner, healthier environment (50%), a regular/increased water supply (19%) and increased employment (16%) are the main community benefits.

YES	85%
NO	15%
BASE	1002

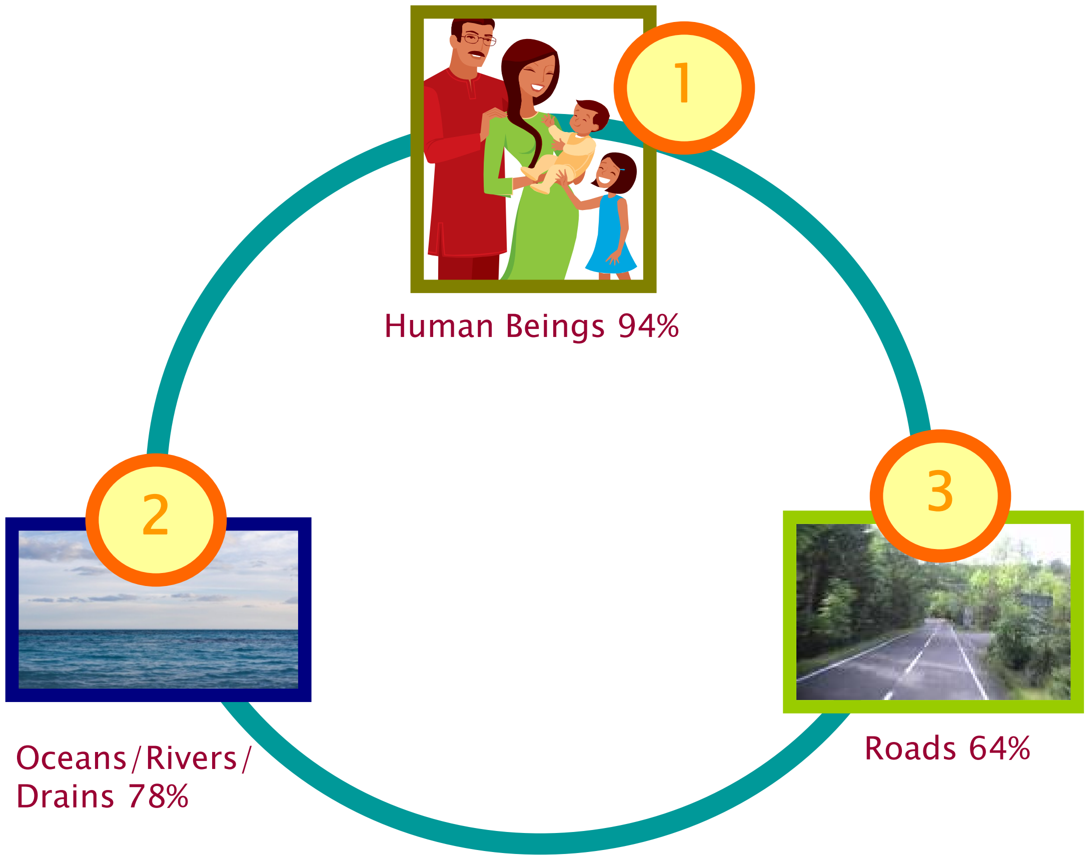
	Benefit to the Community
Cleaner and healthier environment	50%
Regular/increased water supply	19%
Increased employment	16%
Proper disposal of wastewater/modern up-to-date disposal	14%
Better drainage	6%
No need for a septic tank	5%
Cheaper/no need to pay to clean septic tank	5%
Less flooding	5%
Recycled water would be available for use in the community	3%
Water would be cleaner	2%
Other	3%
BASE	849

*Total exceeds 100% due to multiple responses

Perceived Impact on the Environment

Impact on the Environment

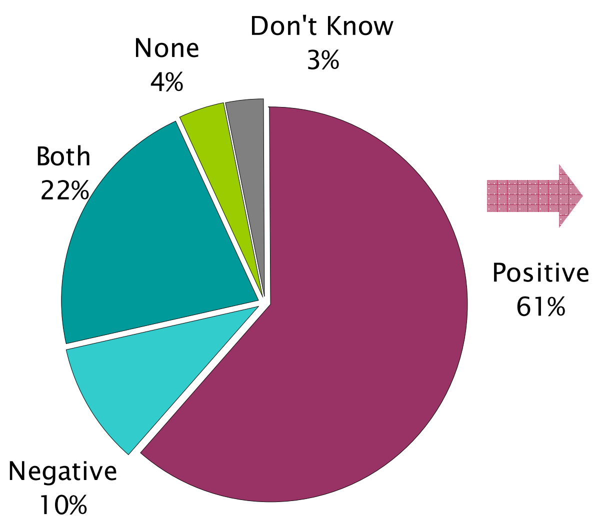
Residents were asked to state whether the proposed project would have positive or negative impacts on specific sectors of the environment. Human beings (94%) are the ones who it is felt would be most affected. The top three affected sectors are highlighted in the chart below.



Base:1002

Impact on Human Beings – Positive

As far as the impact that the proposed project will have on human beings, respondents are more likely to be of the opinion that there would be a positive (83%) than a negative impact (32%). Consistent with the community and personal benefits, a cleaner, healthier environment (47%) and to some extent a regular water supply (15%) and a more efficient disposal of waste (14%) are the main benefits humans are expected to receive.



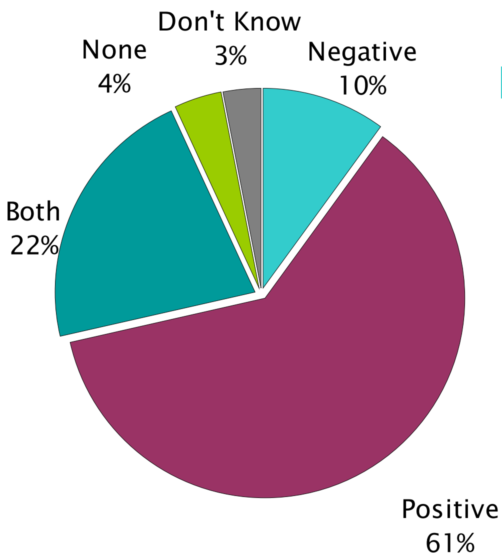
Base:1002

	Positive
Environment would be healthier/cleaner	47%
More water for the area/regular water supply	15%
Better/more efficient disposal of waste	14%
More employment for the area	10%
Air would be healthier/fresher air	9%
Reduction in exposure to diseases because of underground pipelines	8%
Less air pollution/safe from air borne diseases	6%
Reduced flooding/no overflow from the sewers	6%
No longer have to worry about cleaning septic tanks	6%
Cleaner water supply	3%
Other	2%
BASE	844

*Total exceeds 100% due to multiple responses

Impact on Human Beings – Negative

Those who anticipate a negative impact on human beings cite an increase in their WASA bill (46%) and to a lesser degree an increase in traffic congestion due to road works (20%) as the main negative consequences for humans.



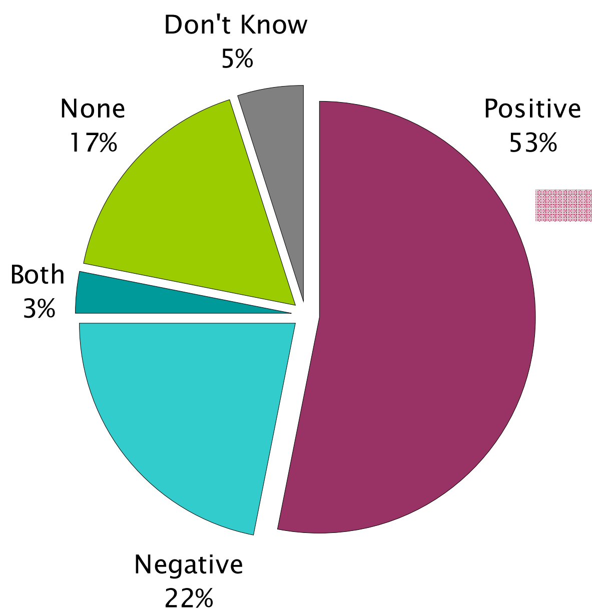
Base:1002

	Negative
Cost would increase/increase in WASA bill	46%
Increased traffic/traffic congestion	20%
Improper treatment of wastewater would result in diseases being contracted	16%
Chemicals used would be harmful to humans	9%
Sickness due to drinking/using unsafe water	5%
Illness caused by inhalation of polluted air	4%
Roads would be dug up	3%
Bad odour/smell from pollution	3%
Air pollution due to chemical use	2%
Persons would be displaced	2%
Other	5%
BASE	320

*Total exceeds 100% due to multiple responses

Impact on the Oceans/Rivers/Drains – Positive

Approximately three of every five respondents (56%) perceive that the proposed project would have a positive impact on marine life, while one quarter foresee negative repercussions. Cleaner rivers, oceans, drains due to less contamination by waste water (93%) is the main basis of this positive opinion.



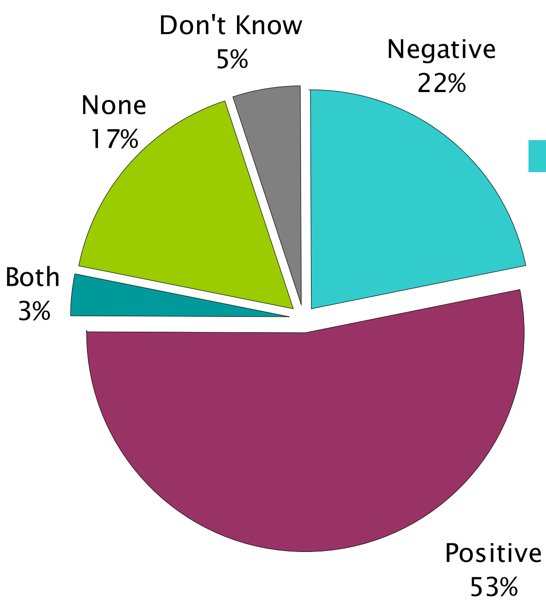
Base:1002

	Positive
Cleaner rivers, oceans and drains/no waste water to do harm	93%
Better/more efficient disposal of waste	5%
Reduced flooding/no overflow from the sewers	3%
Environment will be cleaner/healthier	1%
Other	1%
BASE	559

*Total exceeds 100% due to multiple responses

Impact on the Oceans/Rivers/Drains – Negative

For the one quarter who perceive that marine life would be negatively affected, the dumping/spills of waste (51%) and destruction of marine life because of contamination (45%) are their main drivers of this sentiment.



Base:1002

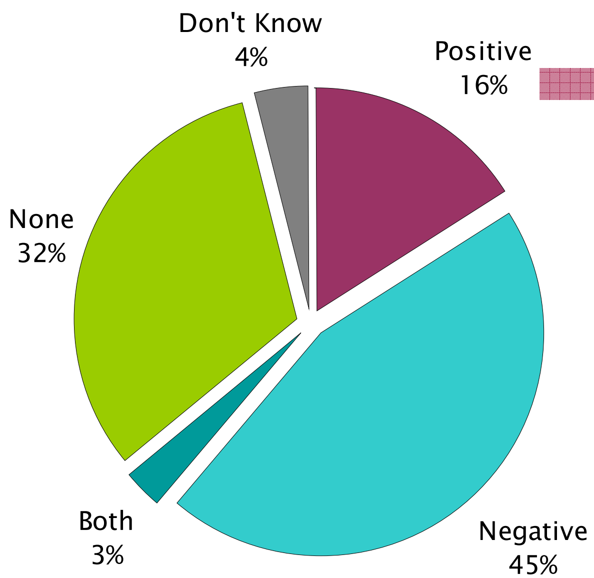
	Negative
Dumping/spills of waste/chemicals polluting the rivers	51%
Marine life will be destroyed due to contamination	45%
Chemicals getting into the river will destroy marine life	19%
Untreated waste will get into rivers	1%
Other	3%
BASE	249

*Total exceeds 100% due to multiple responses

MARKET FACTS & OPINIONS

Impact on Roads – Positive

Just under half of sample anticipate that the implementation of the proposed treatment plant will have a negative impact on the area roads. A lower proportion (19%) indicated that positive outcomes would result, namely a reduction in flooding (62%) and regular maintenance of roads (42%). It is also noteworthy that for one third of the respondents, no impact is anticipated.



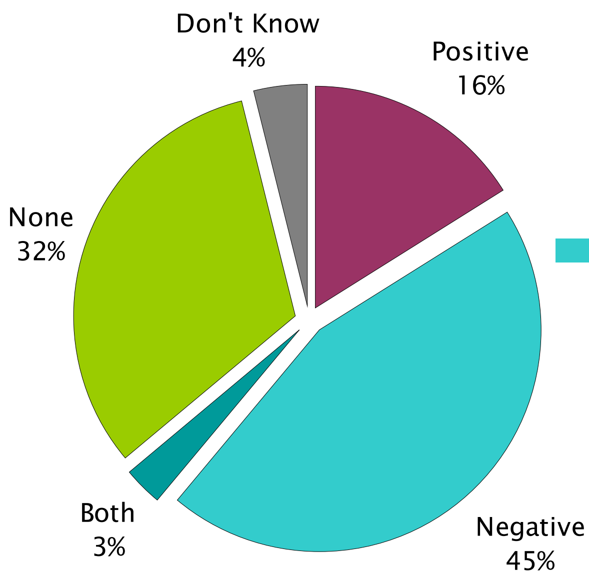
Base:1002

	Positive
Flooding on roads would be reduced	62%
Roads will be regularly maintained	42%
Better/more efficient disposal of wastewater	3%
Other	5%
BASE	192

*Total exceeds 100% due to multiple responses

Impact on Roads – Negative

Virtually all of the respondents who perceive that roads would be negatively affected cite the damage that would be caused to them as a result of the excavation (98%). No other reason is as noteworthy.



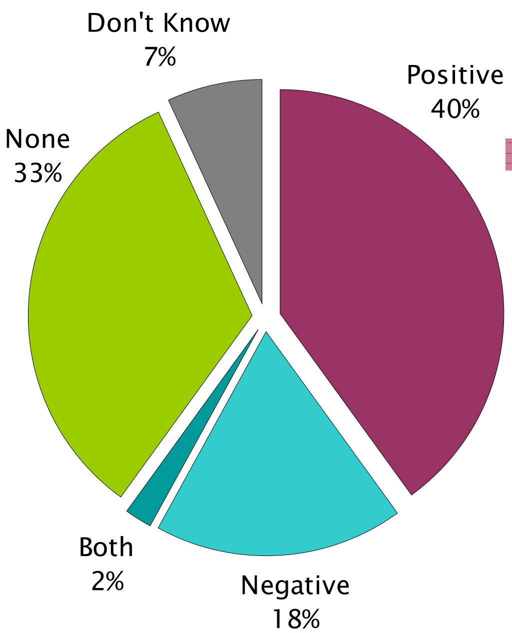
Base:1002

	Negative
Roads will be damaged	98%
Traffic will be increased	5%
Other	1%
BASE	482

*Total exceeds 100% due to multiple responses

Impact on the Air – Positive

Twice as many respondents are hopeful that there would be a positive impact on the air (42%) as opposed to a negative one. Overwhelmingly, unpolluted air/healthier air (100%) is the basis for their opinion. One third of the respondents do not foresee any impact on the air.



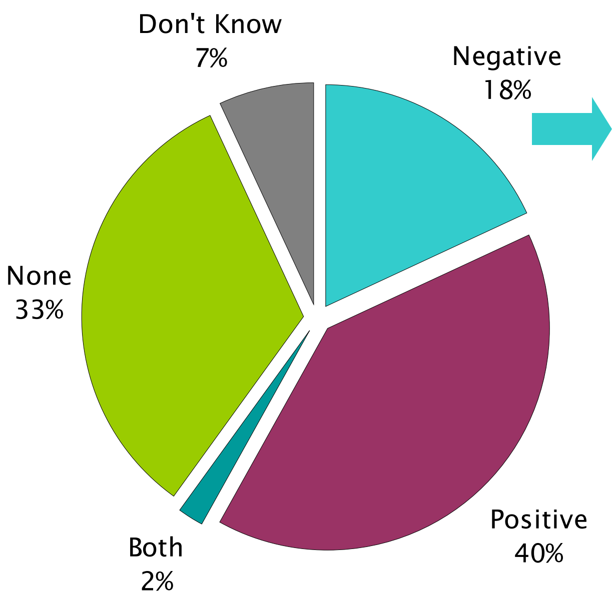
Base:1002

	Positive
Air would be healthier/unpolluted/ safe from airborne diseases	100%
Better/more efficient disposal of wastewater/no foul scents	3%
Cleaner and healthier environment	1%
Other	1%
BASE	423

*Total exceeds 100% due to multiple responses

Impact on the Air – Negative

Those respondents who perceive that the project would have a negative impact on the air attribute this mainly to the chemicals used (55%).



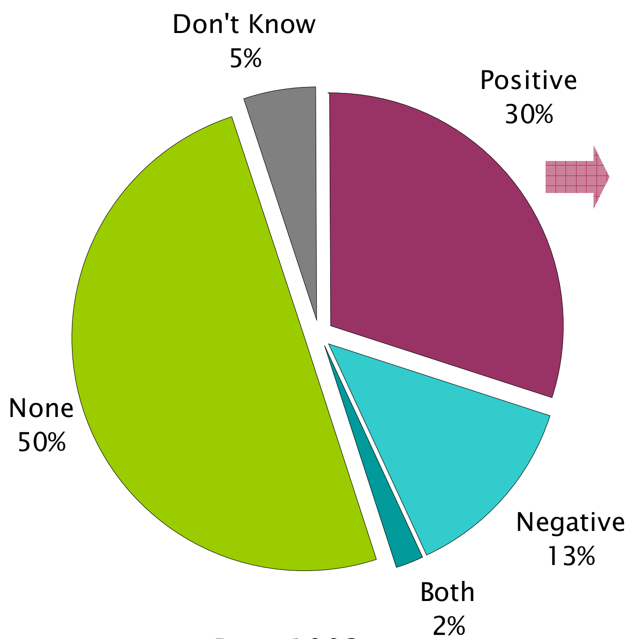
	Negative
Air pollution due to chemical use	55%
Bad odours will emanate from the plant	27%
Dust pollution	19%
Fumes/toxins will cause illness	7%
Other	2%
BASE	204

*Total exceeds 100% due to multiple responses

Base:1002

Impact on Animals/Plants – Positive

While half of the sample believes that there would be no impact on plants and animals, there is a 2:1 ratio in favour of there being a positive rather than a negative impact. Plants and animals having access to cleaner water is mentioned as the main reason by 60% of these respondents.



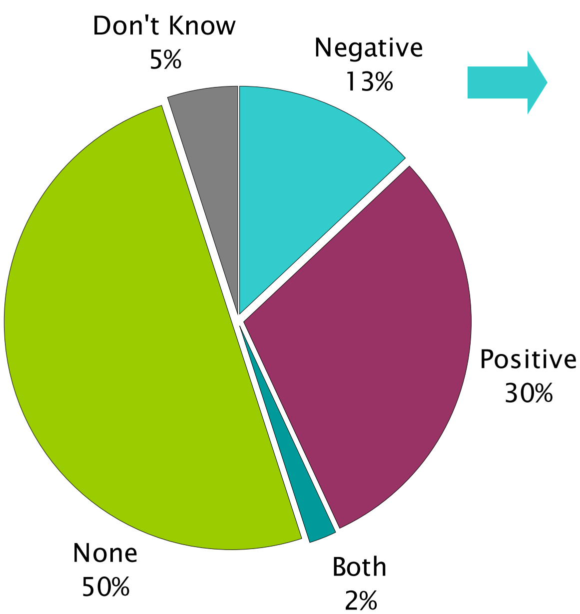
Base:1002

	Positive
Plants/animals would have access to cleaner water	60%
Environment would be cleaner/healthier	32%
Lands for food cultivation would be healthier	7%
Regular/more water for the area	6%
Land would not be polluted	3%
Better/more efficient disposal of waste	1%
Reduced flooding/no overflow from the sewers	1%
Other	2%
BASE	322

*Total exceeds 100% due to multiple responses

Impact on Animals/Plants – Negative

Death of plants and animals because of contaminated water is the main drawback cited.



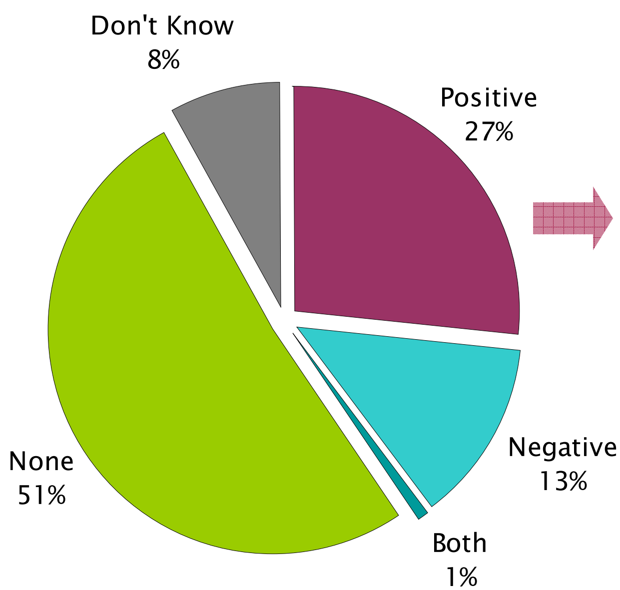
Base:1002

	Negative
Plants/animals would die due to pollution in the water	64%
Vegetation for animals would be destroyed	11%
Contaminated land/contaminated feeding grounds	11%
Water source used by animals would be polluted	9%
Other	17%
BASE	153

*Total exceeds 100% due to multiple responses

Impact on the Land – Positive

Interestingly, the degree of the impact that is perceived to affect the land closely mirrors that perceived to impact animals and plants. Half of all respondents do not believe that the land would be impacted, while a 2:1 ratio in favour of a positive outcome is anticipated. Having less erosion (41%) and no pollution of lands (34%) top the list of positive impacts.



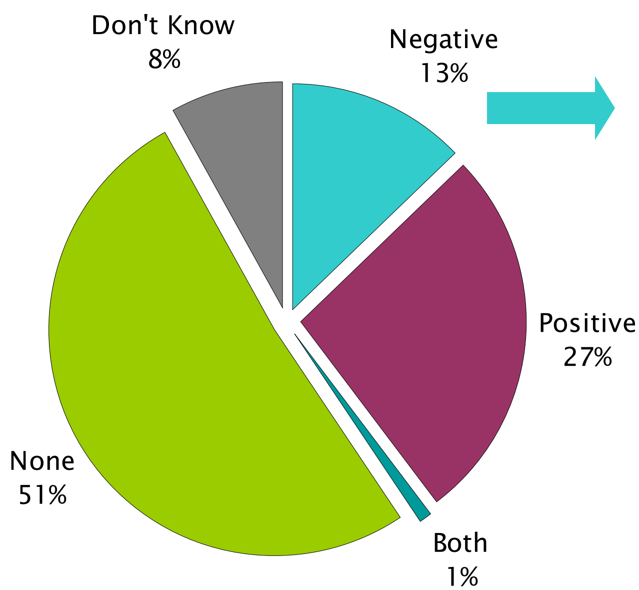
Base:1002

	Positive
Less erosion as water would be channeled into a particular course	41%
Lands would not be polluted	34%
Reduced flooding/no overflow from the sewers	16%
Land for cultivation and animal rearing would be healthier	7%
Land would no longer be damaged by untreated wastewater	7%
Cleaner and healthier environment	2%
Better/more efficient disposal of wastewater	1%
Other	3%
BASE	283

*Total exceeds 100% due to multiple responses

Impact on the Land – Negative

Conversely, land erosion (32%) is also named as the main negative impact. To a lesser extent, damage caused to the soil due to lack of fertilization (21%), toxicity of the soil (19%) and an effect of the landscape (19%) are also perceived to occur.



Base:1002

	Negative
Land erosion	32%
Soil would be damaged because of lack of fertilization	21%
Land/soil would become toxic because of chemicals used	19%
Landscape would be affected due to digging of trenches	19%
Land would be affected because of chemicals used	9%
Run off would affect the land/flooding after rainfall	6%
Soil in the area would be too weak	4%
Food crops would die because of land contamination	2%
Contaminated land/contaminated feeding grounds	1%
Other	7%
BASE	139

*Total exceeds 100% due to multiple responses

Community Concerns and Involvement

Concerns in the Community

MARKET FACTS & OPINIONS

Irregularity in the supply of water (40%) and bad roads (23%) top the list of community concerns in San Fernando area.

Irregular water supply	40%
Bad roads	23%
Crime	18%
The environment	15%
Lack of proper drainage	15%
Traffic congestion	10%
Pollution	9%
Health	5%
Flooding	7%
BASE	1002

Employment	4%
Lack of transportation	3%
Educational/vocational training	2%
No/irregular garbage collection	2%
Housing	2%
No sporting/recreational facilities/community centre	2%
^Other	9%
No concerns	16%
BASE	1002

*Total exceeds 100% due to multiple responses
^ Other represents % < 2%

Concerns in the Community – by Location

The following table shows by location the concerns in the individual communities. Residents in several sub-catchments were more likely to highlight a particular concern than the other several sub-catchment areas.

	Overall	Marabella	La Romain	Pleasantville	Palmiste	Cocoyea South	San F'do Central	Picton	Vistabella
Irregular water supply	40%	**61%**	**46%**	23%	31%	26%	43%	**66%**	**54%**
Bad roads	23%	13%	**56%**	5%	7%	6%	9%	**61%**	13%
Crime	18%	**27%**	13%	14%	15%	14%	**35%**	14%	22%
BASE	**1002**	**149**	**103**	**86**	**74**	**66**	**58**	**56**	**54**

	Overall	Tarouba	Ste Madeline	Gulf View	Duncan Village	Retrench	Green Acres	Hermitage	Union Hall
Irregular water supply	40%	39%	28%	30%	30%	24%	33%	44%	22%
Bad roads	23%	8%	14%	13%	**33%**	**29%**	**35%**	**51%**	**42%**
Crime	18%	**25%**	**26%**	**26%**	2%	20%	3%	5%	11%
BASE	**1002**	**52**	**51**	**47**	**46**	**45**	**40**	**39**	**36**

Concerns are highlighted in particular sub-catchments were the proportion of residents who identified the concern is 5% or more higher than that of the overall sample

Involvement in Community Groups

The majority of respondents (92%) are not involved in any village council, non-governmental organization, community-based organization or local government group. The following table identifies the groups with which residents are involved.

Yes	8%
No	92%
BASE	1002

	Community Groups
Union Hall Village Council	7%
Village Council (unspecified)	7%
Gulf View Residents' Association	6%
Political Group	5%
Tarouba Heights Community Group	4%
Rambert Village Council	4%
La Romain Land Tenants Association	4%
Marabella Community Village Council	4%
Scouts Association	4%
Religious Organizations	4%
Other community based groups	21%
BASE	81

Involvement in Community Groups cont'd

MARKET FACTS & OPINIONS

Community Groups – 3% Each	Community Groups – 1% Each
– Cocoyea Village Council – Diamond Village Council – Vistabella Village Council – Golconda Village Council – Ste Madeline Village Council – Pleasantville Improvement – 3M Youths	– Tarouba Heights Youth Group – La Romain Village Council – Health Need – Cocoyea Community Organization – South Cocoyea Residents' Association – Searchers' Club – Mon Repos Village Council – National Centre for Persons with Disabilities – Ste Madeline Dance School – Pleasantville Village Council – Rotary Club – Siparia Ballroom Dance Class – Palmiste Residents United – Hermitage Village Council
BASE – 81	

*Total exceeds 100% due to multiple responses

Involvement in Community Groups– by Location

The following table shows by location the involvement in community groups by the individual communities. Residents from Gulf View, Retrench – Golconda and Hermitage are those who tend to be involved in community groups.

	Overall	Marabella including Union Park	La Romain	Pleasantville – Corinth	Palmiste – Les Efforts East/West	Cocoyea South	San Fernando Central	Picton/ Diamond	Vistabella
Yes	8%	4%	8%	9%	1%	9%	10%	5%	11%
No	92%	96%	92%	91%	99%	91%	90%	95%	89%
BASE	1002	149	103	86	74	66	58	56	54

	Overall	Tarouba	Ste Madeline	Gulf View – La Romain	Duncan Village	Retrench – Golconda	Green Acres	Hermitage	Union Hall
Yes	8%	10%	8%	17%	9%	13%	3%	13%	11%
No	92%	90%	92%	83%	91%	87%	97%	87%	89%
BASE	1002	52	51	47	46	45	40	39	36

Gulf View – La Romain, Retrench – Golconda and Hermitage are highlighted since the proportion of residents who are involved in community groups is 5% or more higher than that of the overall sample

MARKET FACTS & OPINIONS

Community Leaders

Three of every ten respondents are aware of their community leaders' names (30%). The table below shows the main ones mentioned. Junia Regrello (14%) and Jennifer Marryshaw (12%) are the main community leaders mentioned.

Yes	30%
No	69%
No community leader	1%
BASE	1002

Main Community Leaders	
Junia Regrello	14%
Jennifer Marryshaw	12%
Patrick Manning	7%
Roodal Moonilal	6%
Leslie Lynch	6%
Sonnylal Manwah	6%
Mikela Panday	4%
Christine Kangaloo	3%
BASE	300

*Multiple Community Leaders were mentioned

Satisfaction with Community Leaders

Satisfaction with the community leader's performance is low, as only three of every ten respondents (29%) are satisfied with the performance of his/her community leader (s). Those who are not satisfied cite a lack of visibility (27%) and poor representation (23%) as the main areas of dissatisfaction.

Yes	29%
No	41%
Unaware if there is a leader	29%
Not applicable	1%
BASE	1002

	Why Not?
They do not visit the area/have never seen him/her	27%
Poor representation/not doing enough/anything	23%
Nothing has been done about the bad roads	16%
Nothing has been done about the poor drainage	12%
Nothing has been done to represent the community	12%
Nothing has been done about the insufficient water supply	8%
Concerns are not dealt with efficiently	5%
There is no communication with persons in the village	4%
Drains/streets are not cleaned often	3%
Nothing is being done to assist the youth in the community	3%
There is a lack of sporting/recreational facilities in the area	3%
Other	3%
BASE	410

*Total exceeds 100% due to multiple responses

MARKET FACTS & OPINIONS

Satisfaction with Community Leaders cont'd

Why Not – 1% – 2%	< 1%
– Crime situation is not being addressed – No meetings are held – There is no garbage collection – Health issues in area are not being addressed – There is a lack of street lights in the area – There are no community centres – No streets signs in the area	– The lack of housing in the area is not being addressed – No response
BASE – 410	

*Total exceeds 100% due to multiple responses

Satisfaction with Community Leaders – by Location

MARKET FACTS & OPINIONS

Residents from Marabella, Pleasantville – Corinth, Palmiste – Les Efforts East/West, Cocoyea South, Gulf View, Hermitage and Union Hall tend to be most satisfied with their community leaders. The proportion of residents in this community who are satisfied with their community leaders is 5% or more than that of the overall sample.

	Yes	No	Don't know if there is a leader	Not applicable	BASE
Marabella including Union Park	35%	28%	34%	3%	149
La Romain	18%	66%	15%	1%	103
Pleasantville – Corinth	41%	24%	34%	1%	86
Palmiste – Les Efforts East/West	34%	32%	32%	1%	74
Cocoyea South	41%	46%	14%	--	66
San Fernando Central	14%	41%	45%	--	58
Picton/Diamond	29%	64%	7%	--	56
Vistabella	15%	30%	56%	--	54
Tarouba	23%	64%	14%	--	52
Ste Madeline	22%	59%	20%	--	51
Gulf View – La Romain	34%	28%	38%	--	47
Duncan Village	17%	48%	35%	--	46
Retrench – Golconda	29%	33%	36%	2%	45
Green Acres	15%	43%	43%	--	40
Hermitage	41%	36%	23%	--	39
Union Hall	47%	14%	39%	--	36

Changes in the Community

MARKET FACTS & OPINIONS

Residents who expressed satisfaction with their community leaders are mainly pleased by their ability to improve the infrastructure in the communities (40%).

Yes	86%
No	14%
Cannot say	^
BASE	289

^ less than 1%

Improved infrastructure (roads, drainage, pavements)	40%
Improved recreation/sporting facilities/community centre	14%
Did social work	10%
Provided street lights/lights in recreation grounds	9%
Organized activities for youths such as sport etc.	9%
Helped to provide jobs	9%
Improved services (transport/bus, street cleaning, day care, elderly home)	7%
Workshops/motivation for youths	6%
Community beautification	6%
Improved water supply	3%
Improved garbage disposal	3%
Introduced social programmes	2%
Organized activities in the community (family day, Christmas parties)	2%
Other	10%
BASE	247

*Total % exceeds 100% due to multiple responses

Involvement with Other Community Groups

Apart from village councils, non-governmental organizations, community-based organizations and local government groups, one quarter of the residents belong to other community groups.

Yes	25%
No	75%
BASE	1002

Distribute hampers for the needy	32%
Sports	15%
Social activities eg. Family day	13%
Holding fund raising events	12%
Religious activities	8%
Counsel families	6%
Youth programmes	5%
Visit children's hospitals/homes	4%
Tutor children and adults	2%
Health fairs (free testing for Diabetes, AIDS etc)	2%
Assisting homeless/abused in the area	2%
Courses (drapery making etc)	1%
Other	10%
None/nothing	25%
BASE	253

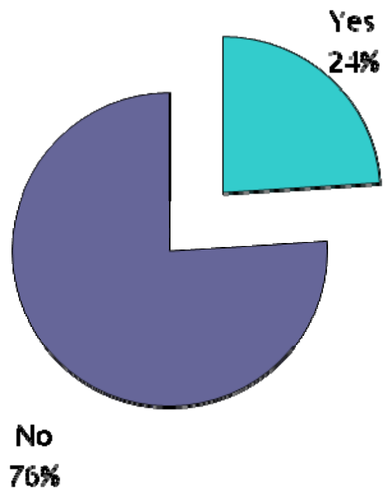
Total % exceeds 100% due to multiple responses

MARKET FACTS & OPINIONS

Impact of Industrial Development in San Fernando

Impact of Industrial Development

One quarter of the sample (24%) has been affected either positively or negatively by the business and industrial developments in San Fernando over the past 10 years. The impact tends to be a more negative one (68%) than positive (46%).



Base: 1002

Positive	46%
Negative	68%
BASE	241

Total % exceeds 100% due to multiple responses

Impact of Industrial Development – by Location

The following table shows by location those locations most impacted by industrial development in San Fernando.

	Overall	Marabella	La Romain	Pleasntville	Palmiste	Cocoyea South	San F'do Central	Picton	Vistabella
Yes	24%	**34%**	12%	26%	12%	20%	26%	25%	**37%**
No	76%	66%	88%	74%	88%	80%	74%	75%	63%
BASE	**1002**	**149**	**103**	**86**	**74**	**66**	**58**	**56**	**54**

	Overall	Tarouba	Ste Madeline	Gulf View	Duncan Village	Retrench	Green Acres	Hermitage	Union Hall
Yes	24%	**39%**	20%	**40%**	20%	20%	13%	13%	25%
No	76%	61%	80%	60%	80%	80%	87%	87%	75%
BASE	**1002**	**52**	**51**	**47**	**46**	**45**	**40**	**39**	**36**

Marabella, Visatabella, Tarouba and Gulf View are highlighted since the proportion of residents who stated that they were impacted by industrial development is 5% or more higher than that of the overall sample

Impact of Industrial Development – Positive

Those persons who are positively affected by business and industrial developments stated that they have increased access to shopping and business facilities (50%) as well as more employment opportunities (36%).

	Positive
A lot of shopping and business (including payment centres) in the area	50%
More employment opportunities	36%
Business has improved/more investment opportunities	12%
Infrastructural development (highway being lit)	2%
Cleaner environment	1%
Water taxi eliminating traffic jams	1%
Able to study closer to home (tertiary education)	1%
Other	9%
BASE	111

Total % exceeds 100% due to multiple responses

Impact of Industrial Development – Negative

MARKET FACTS & OPINIONS

Many residents complained that the business and industrial developments in San Fernando have mainly contributed to an increase in traffic (52%).

	Negative
Increase in traffic	52%
Air pollution/toxins in the air	15%
Noise	10%
High cost of living/high foodstuff prices	7%
Pollution of the environment	6%
Dust causing illnesses	5%
Lack of employment	4%
Damage to roads	4%
Insufficient public parking facilities	3%
Increase in crime	2%
Bad odour from processing plants in area	2%
*Other	12%
BASE	164

Total % exceeds 100% due to multiple responses;
*** Other represents < 2%**

MARKET FACTS & OPINIONS

Community Nuisances

Community Nuisances

Seven of every ten residents experience nuisances within their communities. Traffic (30%), odour (28%) and crime (26%) are the main nuisances. Traffic and odour affect residents primarily on a daily basis, while crime tends to affect them less often than once every two weeks.

		Daily	3-5 times a week	1-2 times a week	Fortnightly	Less often than once every 2 weeks	BASE
Traffic	30%	91%	3%	3%	1%	1%	302
Odour	28%	39%	15%	17%	5%	23%	277
Crime	26%	18%	9%	16%	14%	43%	258
Noise	24%	49%	13%	20%	4%	14%	241
Dust	17%	70%	9%	8%	2%	12%	173
Untreated sewerage	11%	50%	16%	9%	5%	20%	107
None	31%						
Other	2%						
BASE	1002						

Total % exceeds 100% due to multiple responses

Community Nuisances by Location

MARKET FACTS & OPINIONS

Communities affected by traffic tend to be:

- Vistabella
- Gulf View
- La Romain
- Duncan Village

Communities affected by odour tend to be:

- Marabella
- Tarouba
- Ste. Madeline
- Gulf View
- Union Hall

Communities affected by crime tend to be:

- Marabella
- San Fernando Central
- Tarouba
- Ste. Madeline
- Gulf View

Communities affected by noise tend to be:

- San Fernando Central
- Gulf View
- Duncan Village
- Green Acres
- Hermitage
- Palmiste

Communities affected by dust tend to be:

- Marabella
- San Fernando Central
- Gulf View
- Retrench/Golconda
- Tarouba

Communities affected by untreated sewerage tend to be:

- La Romain
- Picton
- Duncan Village
- Green Acres
- Hermitage

Community Nuisances – by Location Cont'd

The following tables show the community nuisances by location.

	Overall	Marabella	La Romain	Pleasantville	Palmiste	Cocoyea South	San F'do Central	Picton	Vistabella
Traffic	**30%**	28%	**35%**	21%	34%	26%	33%	30%	**39%**
Odour	28%	**38%**	20%	20%	16%	17%	29%	29%	20%
Crime	26%	**43%**	21%	26%	19%	15%	**41%**	13%	24%
Noise	24%	20%	18%	12%	**31%**	21%	**36%**	5%	26%
Dust	17%	**22%**	21%	15%	15%	8%	**22%**	13%	13%
Untreated sewerage	11%	8%	**18%**	6%	10%	5%	12%	**16%**	4%
BASE	**1002**	**149**	**103**	**86**	**74**	**66**	**58**	**56**	**54**

Specific community nuisances are highlighted in the different sub-catchment areas since the proportion of residents who stated that they were affected by the community nuisances is 5% or more higher than that of the overall sample

Community Nuisances – by Location

MARKET FACTS & OPINIONS

The following tables show the community nuisances by location.

	Overall	Tarouba	Ste Madeline	Gulf View	Duncan Village	Retrench	Green Acres	Hermitage	Union Hall
Traffic	30%	31%	18%	55%	39%	33%	23%	13%	28%
Odour	28%	44%	35%	51%	20%	29%	28%	13%	33%
Crime	26%	31%	35%	38%	9%	24%	13%	13%	14%
Noise	24%	21%	20%	53%	41%	27%	33%	36%	8%
Dust	17%	25%	10%	45%	9%	27%	13%	3%	6%
Untreated sewerage	11%	12%	2%	11%	28%	7%	18%	18%	6%
BASE	1002	52	51	47	46	45	40	39	36

Characteristics of the Household

Current Water Bill Expenditure – Quarterly

MARKET FACTS & OPINIONS

The quarterly water bill for most residents is less than $500, with a rate of $101 – $300 being standard for the quarter.

$0 –$100	22%
$101 –$300	41%
$301 –$500	23%
$501 –$1,000	1%
Cost included in rent	11%
Don’t Know	2%
Refused	1%
BASE	1002

Current Sewer Bill Expenditure – Quarterly

Interestingly, just about half of the sample are not connected to a public sewer system. For the remainder, 36% collectively have the bill included in their water bill (26%) or rent/mortgage (10%). Although marginal, the few respondents (11%) who specified an amount mainly pay between $51-$100 per quarter for their sewer service.

≤$50	1%
$51 -$100	11%
$101 – $500	2%
Cost included in rent/mortgage	10%
Don't Know	2%
Refused	1%
Cost is included in water bill	26%
Don't have a sewer	**49%**
BASE	1002

^ Represents less than 1%

Preferred Price for Sewer Service – Quarterly

The minimal amount suggested – between $1 – $45 is what half of the sample would be prepared to pay for an improved sewer service. One quarter of them are unwilling to pay an increase for this service.

$1 – $45	49%
$46 – $65	8%
$66 – $85	5%
$86 – $104	9%
$105 or more	3%
Nothing/unwilling for increase	25%
Refused	^
Don't Know	1%
BASE	1002

^ Represents less than 1%

Type of Toilet Facilities

MARKET FACTS & OPINIONS

There is a 3:2 ratio for persons who have water closets with a septic tank versus those who are connected to a public sewer.

Water Closet with septic tank	58%
Water closet with public sewer	40%
Pit Latrine	1%
BASE	1002

Number of Toilets	Septic Tank	Public Sewer	Pit Latrine
1	56%	54%	100%
2	31%	32%	
3	10%	11%	
4	3%	3%	
5	--	1%	
BASE	585	403	15*

* Analysis should be viewed with caution where bases are smalll

Domestic Source of Water

More often than not, the domestic source of water is piped directly to the house by WASA (98%).

WASA piped to house/yard	**98%**
Truck borne	1%
Standpipe	1%
BASE	1002

Energy (Lighting and Cooking) Source

The entire sample has a direct T&TEC connection and 95% use LPG for cooking.

Direct T&TEC	**99%**
Indirect T&TEC	1%
LPG	95%
BASE	1002

Total % exceeds 100% due to multiple responses

Type of Housing Material

About eight of every ten households visited live in houses which are constructed with concrete and bricks.

Concrete and Bricks	**80%**
Wood and Concrete	14%
Concrete, bricks and wood	4%
Wood	3%
BASE	1002

Schools Attend

51% of the households do not have any member of the household attending school. The following tables show the *main* schools attended by the students in San Fernando.

	Primary
San Fernando Boys R.C Primary School	7%
Grant Memorial Presbyterian Primary School	4%
St. Gabriel’s Girls’ R.C. School	4%
Vistabella Presbyterian Primary School	4%
San Fernando Boys’ Primary School	3%
St. Paul’s A.C. Primary School	3%
Picton Presbyterian Primary School	2%
Canaan Presbyterian Primary School	2%
Pleasantville Government Primary School	2%
San Fernando Girls Government Primary School	2%
San Fernando Girls A.C. Primary School	2%
San Fernando SDA Primary School	2%
BASE	489

Schools Attend – Primary Schools

	Primary – 1% Each
– Anstey Memorial Girls' A.C. Primary School	– San Fernando Methodist Primary School
– Bien Venue Presbyterian School	– San Fernando Methodist Primary School
– Cipero R.C. Primary School	– San Fernando A.S.J.A Primary School
– Harmony Hall Presbyterian Primary School	– St Clements Vedic Primary School
– Hermitage Presbyterian Primary School	– Marabella Anglican Boys and Girls School
– La Romaine R.C. Primary School	– Marabella Government Primary School
– Mon Repos R.C. Primary School	– Jordan Hill Presbyterian School
BASE – 489	

	Primary – <1% Each
– Cocoyea Government Primary School	–Carapichaima R.C. School
– Coffee Street Boys A.C. Primary School	–Cedar Grove Primary
– Dayanand Memorial Vedic Primary School	– St Joseph Primary School
– Debe Hindu Primary School	– Princes Town Presbyterian School
– La Romain Government Primary School	– Point Fortin Anglican
– San Fernando T.M.L Primary School	– Other Primary Schools (4%)
– San Francique Presbyterian Primary School	
BASE – 489	

Schools Attend – Secondary

	Secondary
Pleasantville Senior Comprehensive	5%
Debe High School	4%
St. Benedict's College	4%
Marabella Senior Comprehensive	3%
Presentation College, San Fernando	3%
San Fernando Government Secondary	3%
St Joseph Convent, San Fernando	3%
St Madeline Secondary	3%
San Fernando Secondary Comprehensive	2%
Gasparillo Composite	2%
Holy Faith Convent, Penal	2%
A.S.J.A Girls' College, San Fernando	2%
Pravarti Girls' Hindu School	2%
BASE	489

Schools Attend – Secondary

	Secondary – 1% Each
– A.S.J.A Boys' College, San Fernando	– San Fernando East Secondary
– La Romain High School	– Shiva Boys' Hindu School
– Marabella Junior Secondary	– Southern Academy of S.D.A
– Naparima Boys College	– Pleasantville East Secondary
– Naparima Girls' High School	– St Stephen's College
– Open Bible High School	– Servol Life Centre
BASE – 489	

	Secondary – <1% Each
– Iere High School	– St Michael Academy
– St. Kevin's College	– Miracle Ministries High School
– Barrackpore East Secondary	– Princes Town North Secondary
– Barrackpore West Secondary	– Cowen Hamilton Secondary School
– Fyzabad Composite	– Holy Faith Convent, Couva
– Williamsville Secondary School	– Other Secondary (1%)
BASE – 489	

Schools Attend – Tertiary

	Tertiary
U.W.I.	9%
UTT	5%
SBCS	3%
C.O.S.T.A.A.T.T.	1%
S.A.M	1%
University of the Southern Caribbean	1%
Modern Business Studies	1%
Other – Tertiary	1%
BASE	489

Total % exceeds 100% due to multiple responses

Public Medical Facility

The main public medical facility accessed is the San Fernando General Hospital (39%). One quarter of those surveyed do not visit any public medical facility.

San Fernando General Hospital	39%
La Romain Health Centre	10%
Marabella Health Centre	9%
Pleasantville Health Centre	8%
Ste Madeline Health Centre	4%
Debe Health Centre	4%
Roy Joseph Health Centre	2%
Other	2%
None	24%
BASE	1002

Total % exceeds 100% due to multiple responses

Awareness of and Satisfaction with Public Facilities

Nearest Police Station

Respondents are generally satisfied with the service received by these police stations.

San Fernando Police Station	43%
Marabella Police Station	24%
Mon Repos Police Station	20%
Ste Madeline Police Station	9%
Debe Police Post	4%
BASE	1002

	Satisfaction with Service
Yes	70%
No	29%
Can't say	1%
BASE	1002

Nearest Fire Station

The San Fernando Bye Pass has been identified as the closest fire station to virtually all respondents. Similar to their level of satisfaction with the police stations in their vicinity, residents in San Fernando are also pleased with the service they receive at their neighbourhood fire station.

San Fernando Bye Pass	91%
Lady Hailes Avenue	9%
BASE	1002

	Satisfaction with Service
Yes	90%
No	8%
Can't say	2%
BASE	1002

Nearest Recreational Ground

MARKET FACTS & OPINIONS

47% of the households use the recreational grounds in their communities.

	Use
Yes	47%
No	53%
BASE	1002

Skinner Park	32%
Mannie Ramjohn Stadium	13%
Cocoyea Recreational Facilities	8%
Palmiste Recreational Ground	5%
Parks, basketball ground etc	5%
Chapman Park	4%
Ste. Madeline Recreational Ground	3%
Kennedy Park Recreation Ground	3%
Irvin Park	3%
BASE	467*

* Main recreational grounds shown

Additional Demographics

Ethnicity	
African	41%
East Indian	44%
Mixed/Other	15%
Gender	
Male	45%
Female	55%
Marital Status	
Single	22%
Married/living as married	60%
Divorced/separated	9%
Widowed	10%
BASE	1002

Respondent Occupation	
Sales worker	1%
Service worker	13%
Farming/agriculture	*
Skilled labourer	6%
Unskilled labourer	6%
Professional	3%
Technical/support services	11%
Self employed	5%
Administrative	5%
Unemployed	6%
Housewife/student	16%
Retired/pensioner	29%
BASE	1002

Employment Status (Base 489)	
Work full time – (40+ hours per week)	78%
Work part time – (20-39 hours per week)	17%
Work part time – (< 20 hours per week)	5%
Respondent Highest Level of Education	
Primary	29%
Secondary up to 3rd form	5%
Secondary up to 5th form	28%
Secondary up to 6th form	5%
Vocational/Technical	19%
University First Degree/ACCA	11%
Post Graduate Degree	3%
No formal education	1%
Refused	1%
BASE	1002

Age Composition of Household	
0 to 1 years	8%
2 to 5 years	19%
6 to 11 years	22%
12 to 19 years	31%
20 to 44 years	74%
45 to 65 years	69%
65 years and over	33%
BASE	1002

* Totals exceed 100% due to multiple responses

Total Number of Persons in Household	
1	7%
2	18%
3	17%
4	24%
5	14%
6	8%
7	5%
8	4%
9	1%
10	1%
More than 10 persons	1%
Mean	4
BASE	1002

Appendix F

Key Stakeholder and Public Consultations

Appendix F

Key Stakeholder and Public Consultations

F.1 Key Stakeholder Meeting

EIA for Construction of a Regional Wastewater Treatment Plant and Collection System for San Fernando and Environs

Stakeholder Meeting

September 30, 2009

Agenda

- Introduction
- Purpose of Meeting
- Project Area and Existing Situation
- Proposed Project Description
  - Collection System
  - WWTP
- EIA Baseline Parameters
- Discussion

Introduction

- Speakers
  - Denise Lee Sing Pereira – Project Manager WASA
  - Jim Marx – Project Manager AECOM
  - Matt McTaggart – Project Director AECOM

Purpose of Meeting

- The Water and Sewerage Authority proposes to construct an integrated wastewater collection, and treatment system for the San Fernando Area and Environs
- This meeting will provide
  - information to key Stakeholders at the early stages of design
  - a forum for dialogue and feedback prior to implementation

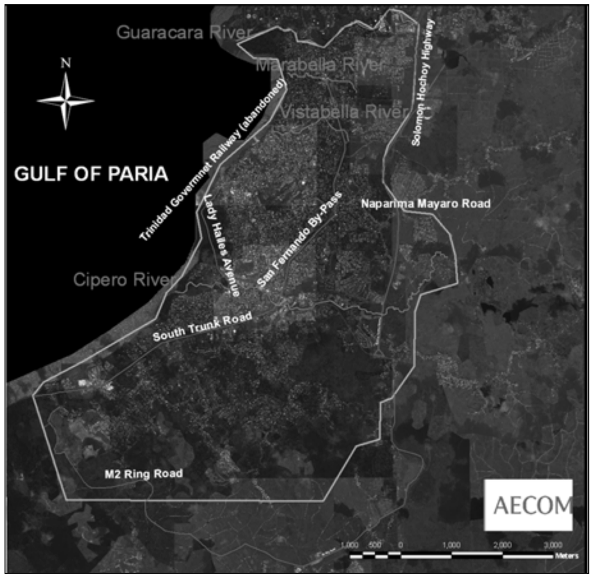
Purpose of Meeting

- Project includes:
  - Construction of a network of new pipelines and lift stations in unsewered areas and the integration of existing wastewater systems into one combined centralized collection system
  - Construction of a single wastewater treatment plant at the existing San Fernando Wastewater Treatment Plant (WWTP) site
  - Preparation of EIA as part of requirement to obtain CEC

Project Area

- The project area is approx. 42 km^2 and is defined by:
  - Guaracara River (North)
  - Gulf of Paria (West)
  - Solomon Hochoy Highway (East) including Ste. Madeline
  - M2 Ring Road (South)

Project Boundaries



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Existing Situation

- Approximately 30% of the project area is sewered
- Consisting of several wastewater treatment plants and collection systems
  - Existing WASA plants at San Fernando and Harmony Hall
  - Other WWTPs are mostly privately owned
  - Most non-functioning

Existing Situation

- Approximately 70% of the project area has on-lot disposal systems
- Consisting of pit latrines, septic tanks, soak-aways
- Grey water connections to surface drains

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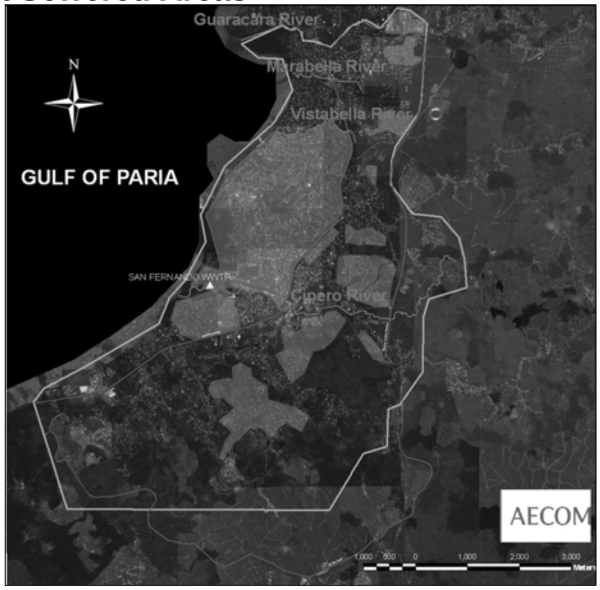
Existing Situation

- Raw and partially treated wastewater is entering environment (rivers, streams, water bodies)
- Health hazards to local population
- Environmental concerns

San Fernando Wastewater Project. EIA Stakeholder Meeting. 30 September 2009

Current Sewered Areas



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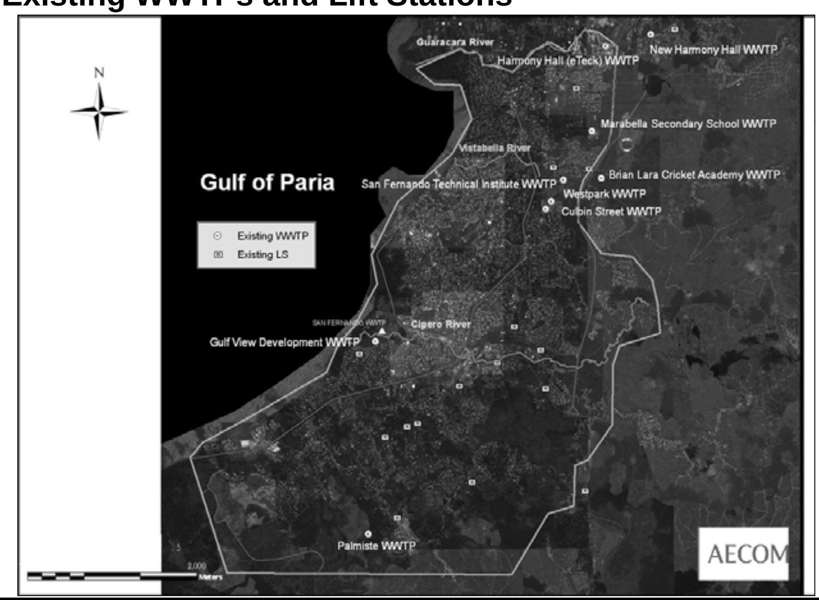
Existing WWTPs and Lift Stations



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Project Benefits

- Properly collected and treated wastewater before discharged to environment
  - Health benefits to public
  - Clean up rivers, streams and surrounding environment
  - Meet EMA Water Pollution Rules (WPR 2006)
- One functional WWTP for entire project area
  - Cost savings
  - Easier to maintain

Collection System Design Criteria

- Provide service to all customers
  - Residential, commercial, institutional and light industrial customers
- Replace existing sewers where necessary
- Minimize disturbance to existing utilities to degree possible
  - Requires accurate as-built information and co-operation from utility agencies
- Minimize disruption to traffic during construction
  - Utilize Trenchless Techniques to degree possible

San Fernando Wastewater Project. EIA Stakeholder Meeting. 30 September 2009

Collection System Design Criteria

- Project area is divided into sub-catchments for construction phasing
- Gravity system with minimal number of pumping stations
- Smaller collector sewers drain into larger trunk mains along:
  - Marabella River
  - Vistabella River
  - Gulf of Paria
  - Cipero River

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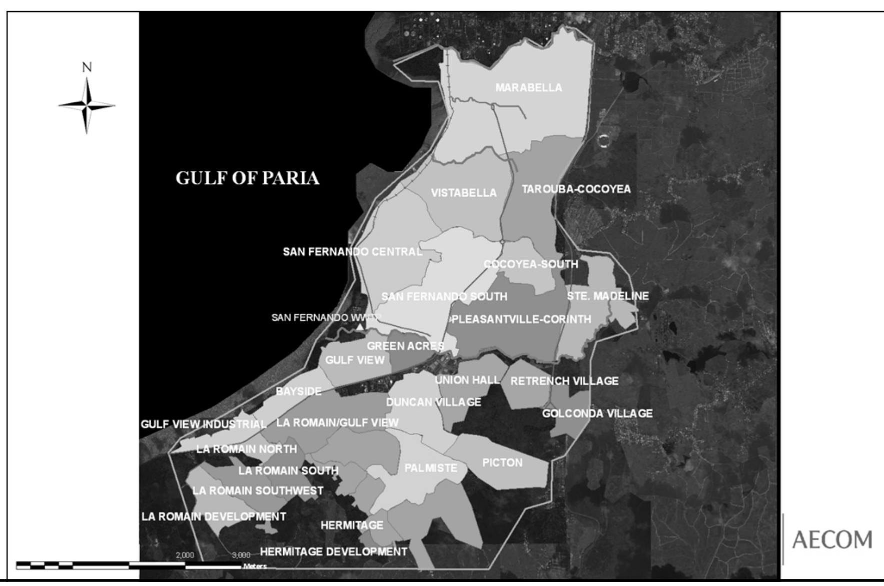
Collection System Subcatchments



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Collection System
Proposed Trunk Sewer Layout

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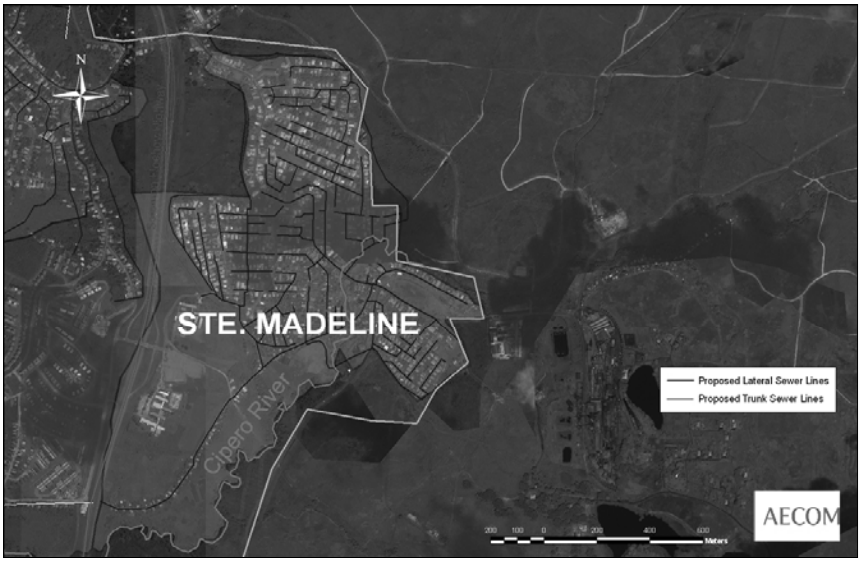
San Fernando Wastewater Project. EIA Stakeholder Meeting. 30 September 2009

Collection System Design
Proposed Sewer Layout - Marabella

San Fernando Wastewater Project. EIA Stakeholder Meeting. 30 September 2009

Collection System Design
Proposed Sewer Layout – Ste. Madeline



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Collection System Design
Proposed Sewer Layout – Tarouba- Cocoyea

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Collection System Design
Proposed Sewer Layout – Cocoyea South

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Collection System Design
Proposed Sewer Layout – Pleasantville Corinth

2

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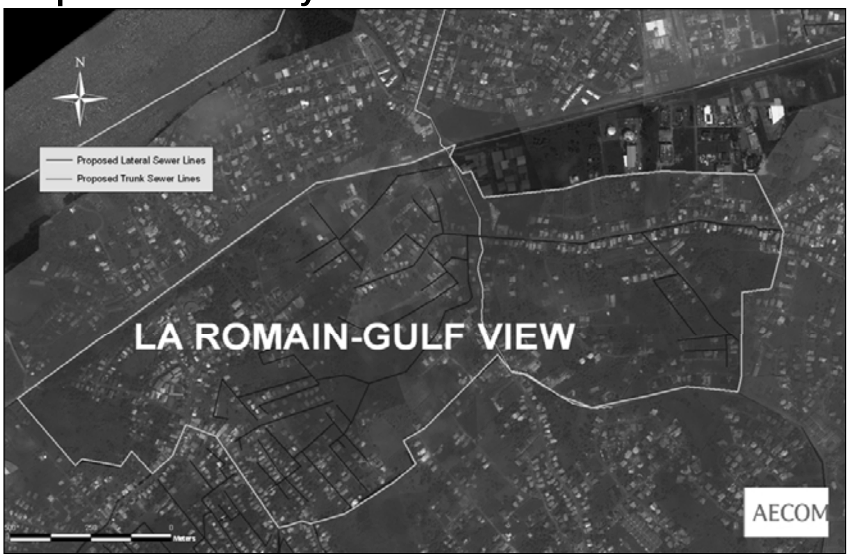
Collection System Design
Proposed Sewer Layout – La Romain Gulf View



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Collection System Design
Proposed Sewer Layout – La Romain South

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Collection System Design
Proposed Sewer Layout – Green Acres

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San Fernando Wastewater Project. EIA Stakeholder Meeting. 30 September 2009

Collection System
Traffic Management

- Traffic Management Plan to be approved by WASA before construction begins
- Minimize dust and mud
- Try to maintain one lane of traffic on major roads
- Provide detours where road must be closed
- Provide pedestrian traffic alternatives
- Provide access to businesses during working hours
- Trenchless technology will be studied at major road and river crossings and for deeper trunk sewers
- Staggered construction schedule

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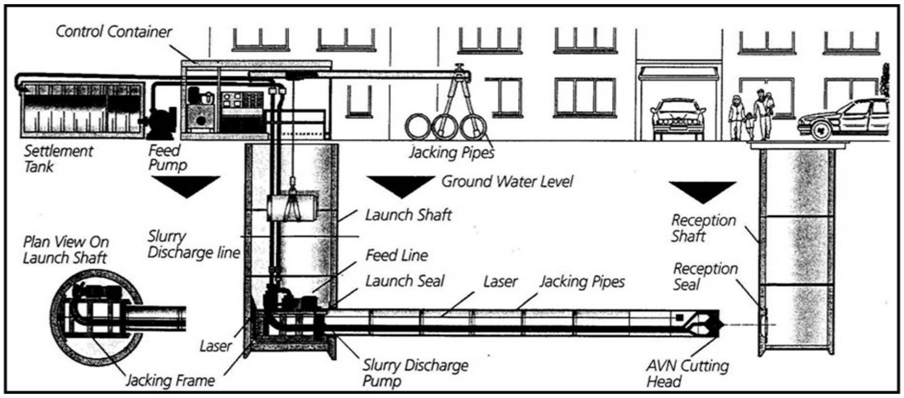
Trenchless Construction Methods

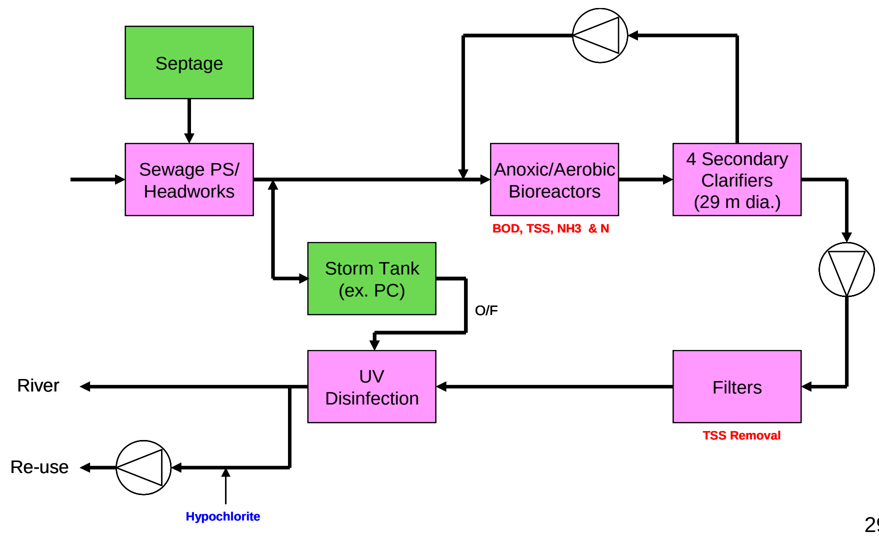
- Used for installation of sewer pipes at difficult intersections, river crossings, and for deep sewers



WWTP Design

- Plant design to accommodate population projections to 2035
  - Wet weather overflow stored then treated later
- Design to meet WPR 2006 for inland water
- Treated effluent discharges to Cipero River, at mouth of Gulf
- Waste solids will be digested and trucked off site

WWTP Design
Liquids Stream Process



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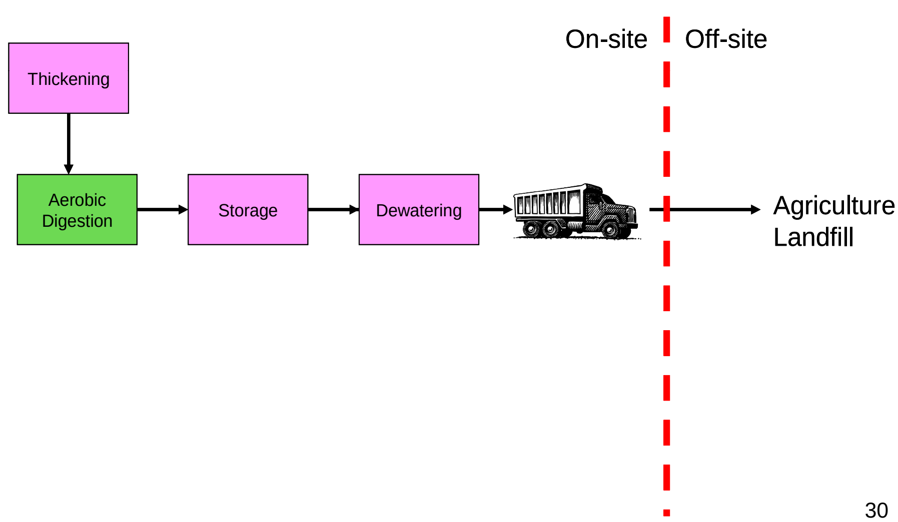
WWTP Design
Solids Stream Process



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WWTP Site

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Project Timeline

- Design completed June 30, 2010
- WASA/ government approvals
  - Obtain funds
- Tender period – 6 months
- Construction period
  - Collection system ~ 7 years
    - Phased by subcatchment
  - WWTP ~ 2 years

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EIA Parameters

- Bio-physical environment
  - Geology, soil, topography of study area
  - Water quality parameters
  - Flora
  - Fauna
    - Aquatic
    - Avifauna
  - Air and Noise studies
  - Traffic
  - Utilities

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EIA Parameters (continued)

- Socio-Cultural environment
  - Demographic characteristics, population size, growth rates, economic activity, employment and labour market
  - Customs and attitudes
  - Areas of cultural/ historic/ traditional value

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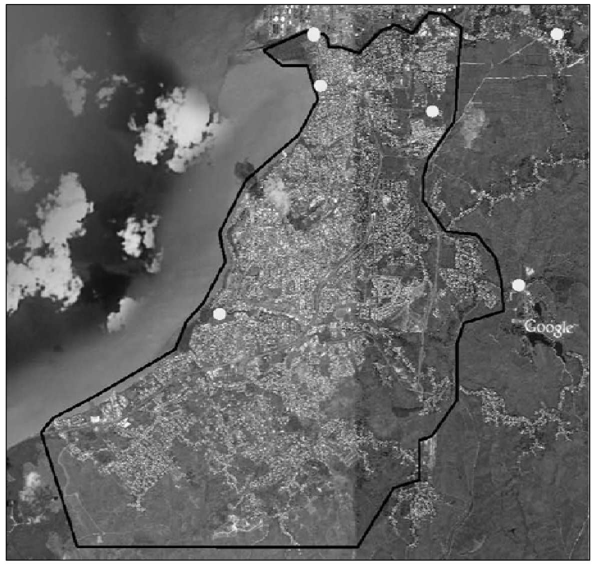
EIA Parameters
River Water Quality

- Dry season samples taken:
  - Guaracara River
  - Marabella River
  - Cipero River



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EIA Parameters
River Water Quality
Guaracara River

⇧ Inland Gulf ⇨

EIA Parameters
River Water Quality
Marabella River

Inland Gulf

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EIA Parameters
River Water Quality
Cipero River

Inland Gulf

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EIA Parameters
River Water Quality

- Extremely high Fecal Coliforms
  - Indicates raw or partially treated wastewater in rivers

River	Inland Sample (CFU/100ml)	Gulf Sample (CFU/100ml)
Guaracara	360	315
Marabella	8,000	49,000
Cipero	179,000	120,000

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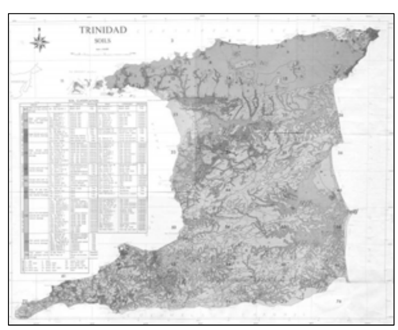
San Fernando Wastewater Project. EIA Stakeholder Meeting. 30 September 2009

EIA Parameters
Geology and Topography

- Overall area is undulating terrain
- Major geological formation is San Fernando Hill
- Overall geology:
  - Cipero Formation
  - Nariva Formation
- WWTP site geology:
  - Inorganic clays of high plasticity
  - Fat clays



EIA Parameters
Upcoming Baseline Sampling

- Social door-to-door surveys
- Flora
- Fauna
- Wet season river quality
- Air & Noise
- Traffic Counts

San Fernando Wastewater Project. EIA Stakeholder Meeting. 30 September 2009

Summary

- Integrated collection system with one WWTP
- Health and environmental benefits
- Opportunities to work with stakeholders
  - Road improvement
  - Drain improvement

San Fernando Wastewater Project. EIA Stakeholder Meeting. 30 September 2009

Questions and Discussion

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AECOM
18 Alcazar Street, St. Clair, Port of Spain, Trinidad
T 868-628-9710 F 868-628-0862 www.aecom.com

AECOM

Meeting Notes

Date of Meeting: 10 September, 2009 Start Time: 9:30 a.m.

Location: WASA – South Regional Office
St. James Street,
San Fernando, Trinidad, W.I.

Regarding: **San Fernando Wastewater Project W.T.C. 03/2007, AECOM PN 110882**
EIA Key Stakeholder Meeting

Attendees:
Denise Lee Sing- Pereira, WASA
Giselle Barnett, WASA
Josh Coutou, WASA
Krishna Persadsingh, WASA
Kimlin Austin, WASA
Vishnn Sinanan, Ministry of Agriculture
Thomas Poncelet, TriniTrain
Chris Mayhew, TriniTrain
Nigel Gopaul, CSO
Roger Parris, UDECOTT
Everson Beeda, LSA
Jim Marx, AECOM
Matt McTaggart, AECOM
Natalie Wilson, AECOM

Notes Taken By: N. Wilson

ITEM	DESCRIPTION
1.0	**Presentation**
1.1	Introductions by Denise Lee Sing Pereira, WASA.
1.2	Presentation by Jim Marx, AECOM.

ITEM	DESCRIPTION
2.0	**Question and Discussion Period**
2.1	Mr. Roger Parris (UDECOTT) - Concerns about individuals paying for connections to the new system. Ms. Denise Lee Sing Pereira (WASA) responded – WASA is planning to include service connections as a project cost.
2.2	Mr. Roger Parris (UDECOTT) - Concerns about as-built utility drawings and disrupting existing utilities with construction. Mr. Jim Marx, and Mr. Matt McTaggart (AECOM) responded – AECOM has been trying for 6 months to obtain this information. It is disappointing that there are no utility representatives here today.
2.3	Mr. Nigel Gopaul (CSO) - Curious about who was conducting social surveys. Mr. Jim Marx (AECOM) responded – We have not finalized our sub-consultant yet. Ms. Kimlin Austin (WASA) responded – The social surveys are just a representative sample of the project area, it is not everyone that is being questioned.
2.4	Chris Mayhew (TriniTrain) – Rapid Rail needs to be aware of future developments so that all projects will be catered for, and there is no overlap.
2.5	(Ministry of Agriculture) – Project will have positive impact on fishing, and groundwater. - Interested in uses of treated solid waste for agricultural application.
	These notes are in the writer's best interpretation of discussions held during the meeting. Please inform the writer of any noteworthy omissions or errors. James J. Marx **Project Manager, AECOM**

Stakeholders Invited to Key Stakeholder Meeting, 30 September 2009

Archaeological Committee
Central Statistical Office
Columbus Communications Trinidad Limited (FLOW)
Eteck
Ministry of Agriculture, Land and Marine Resources
Ministry of Labour, Small and Micro Enterprise Development
Ministry of Planning, Housing and the Environment
Trinidad and Tobago Housing Development Corporation (HDC)
Socio-Economic Policy Planning Division (SEPP)
Land Settlement Agency (LSA)
Urban Development Corporation of Trinidad and Tobago Limited (UDeCoTT)
Ministry of Public Utilities
Ministry of Works and Transport - Drainage Division
Ministry of Works and Transport - Highways Division
National Infrastructure Development Company Limited (NIDCO)
National Gas Company of T&T
Petroleum Company of Trinidad and Tobago
Princes Town Regional Corporation
San Fernando City Corporation
South Trinidad Chamber of Industry and Commerce
Trinidad and Tobago Electricity Commission
Telecommunication Services of Trinidad and Tobago
Town and Country Planning Division
Trini-Train for Rapid Rail Project

Appendix F

Key Stakeholder and Public Consultations

F.2 Public Consultation 1

EIA for Construction of a Regional Wastewater Treatment Plant and Collection System for San Fernando and Environs

Public Consultation 1

January 26, 2010

Agenda

- Introduction
- Purpose of Meeting
- Project Area and Existing Situation
- Description of Proposed Project
  - Collection System
  - Wastewater Treatment Plant (WWTP)
- Environmental Impact Assessment (EIA) Baseline Data
- Discussion

Introduction

- Project Representatives
  - Kimlin Austin, WASA
  - Carol Doyle, WASA
  - Jim Marx, AECOM
  - Matt McTaggart, AECOM
  - Natalie Wilson, AECOM
  - Sara-Jade Govia, AECOM

Purpose of Meeting

- The Water and Sewerage Authority proposes to construct an integrated wastewater collection system and treatment plant for the San Fernando Area and Environs
- This meeting will meet the Certificate of Environmental Clearance (CEC) permit requirements of the Environmental Management Authority (EMA)
  - CEC 1597/2006
- This meeting will provide:
  - Information to the public and key Stakeholders on the design
  - A forum for dialogue and feedback

Meeting Ground Rules

- Audience is encouraged to ask questions, present comments or seek clarification at the end of the formal presentations
- Please speak clearly and loud enough to be heard
- Please ask only one question at a time
- Please write your name, area or organization, and contact phone number on the small cards provided
- Turn in your card before speaking

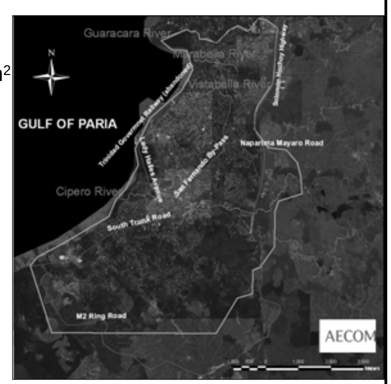
Project Overview

- Project includes:
  - Construct one new WWTP at existing San Fernando WWTP site
  - Construct ~ 200 km of new sewers
  - Combine existing sewers and new sewers into an integrated system
  - Conduct EIA to obtain CEC from EMA

Project Area

The project area ~ 44 km^2 and is defined by:

- North - Guaracara River
- West - Gulf of Paria
- East - Solomon Hochoy Highway including Ste. Madeline
- South - M2 Ring Road

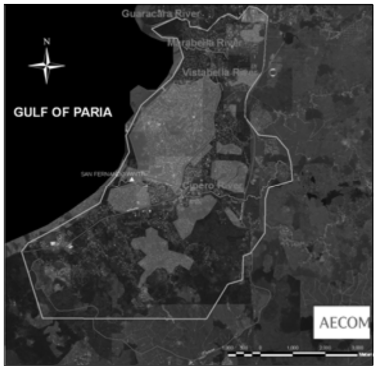


Existing Situation

- Approximately 30% of the project area is sewered
- Consisting of several wastewater treatment plants and collection systems
  - Existing WASA plants at San Fernando and Harmony Hall
  - Other WWTPs are mostly privately owned and not in operation



Current Sewered Area



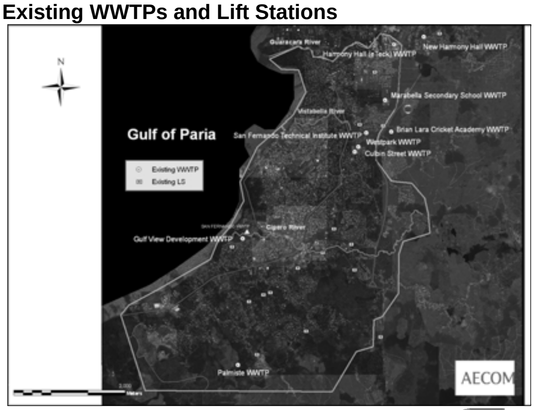
Existing Situation

- Approximately 70% of the project area has on-lot disposal systems
  – pit latrines
  – septic tanks
  – soak-aways
- Grey water connections to surface drains

Existing Situation

- Raw and partially treated wastewater is entering environment (rivers, streams, water bodies)
- Health hazards to local population
- Environmental concerns

Existing WWTPs and Lift Stations



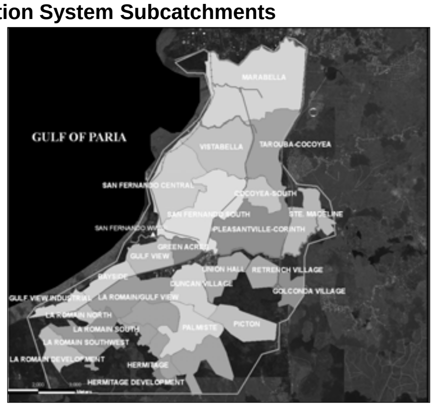
Collection System Design Criteria

- Provide service to all customers
  - Residential, commercial, institutional and light industrial customers
- Replace existing sewers where necessary
- Minimize disturbance to existing utilities to degree possible
- Minimize disruption to traffic during construction
  - Use trenchless techniques to degree possible

Collection System Design Criteria

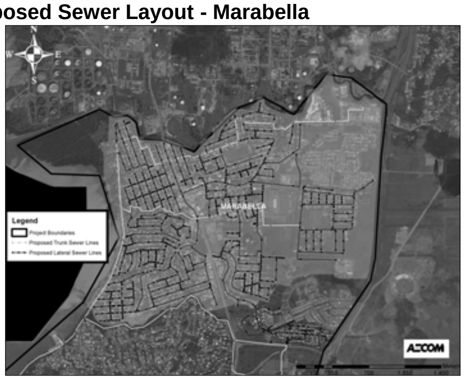
- Project area is divided into sub-catchments for construction phasing
- Gravity system with minimal number of pumping stations
- Smaller collector sewers drain into larger diameter trunk mains:
  - Guaracara River
  - Vistabella River
  - Gulf of Paria
  - Cipero River
  - Palmiste to Gulf View

Collection System Subcatchments



Collection System
Proposed Trunk Sewer Layout

Collection System
Proposed Sewer Layout - Marabella



San Fernando Wastewater Project
EIA Public Consultation
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Collection System
Proposed Sewer Layout – Ste. Madeline

San Fernando Wastewater Project
EIA Public Consultation
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Collection System
Proposed Sewer Layout – Tarouba- Cocoyea

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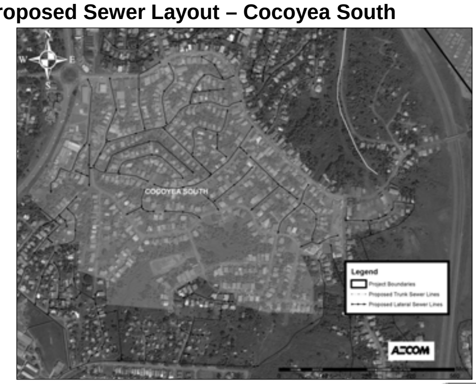
Collection System
Proposed Sewer Layout – Cocoyea South



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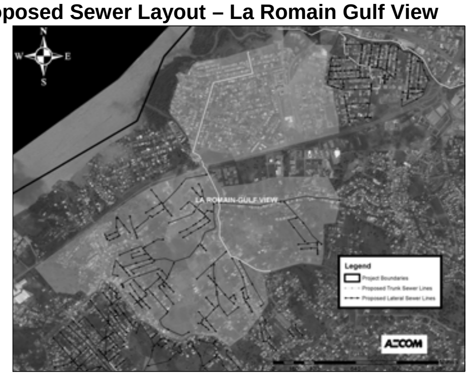
Collection System Design
Proposed Sewer Layout – Pleasantville Corinth

Collection System Design
Proposed Sewer Layout – La Romain Gulf View



Collection System Design
Proposed Sewer Layout – La Romain South

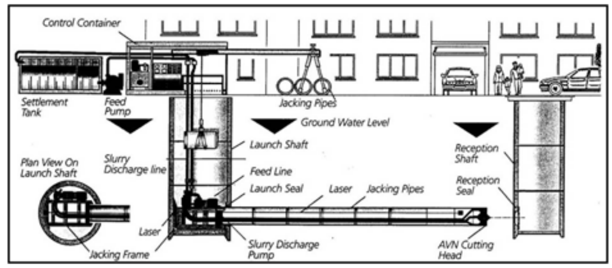
Collection System Design
Proposed Sewer Layout – Green Acres

Open Cut Construction Methods

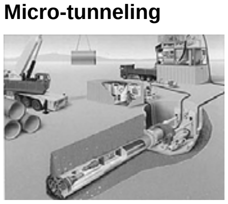
- Used for installation of sewer pipes in streets and open areas where equipment access is possible and depths are not excessive

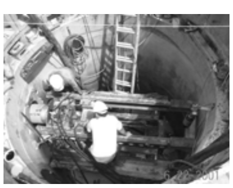
Trenchless Construction Methods

- Used for installation of sewer pipes at difficult intersections, river crossings, and for deep sewers



Micro-tunneling





WWTP Design

- Plant design to accommodate population projections to 2035
  - Wet weather overflow stored then treated when capacity available
- Design to meet:
  - WPR 2001 (as amended) for inland water
  - Reuse standards as defined by North American regulations
- Treated effluent discharges to Cipero River, at mouth of Gulf
- Waste solids will be digested, dewatered, and trucked off site

WWTP Site

Project Timeline

- Design completed July, 2010
- WASA/ government approvals
  - Obtain funds
- Tender period – 6 months
- Construction period
  - Collection system ~ 7 years
    - Phased by subcatchment
  - WWTP ~ 2 years

EIA Baseline Data Required

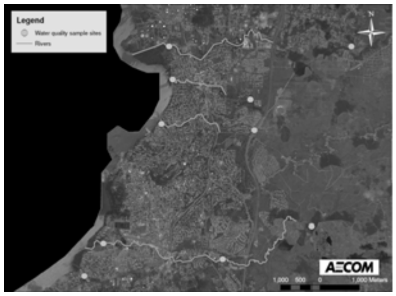
- Bio-physical environment
  - Water quality parameters
  - Flora
  - Fauna
    - Aquatic
    - Avifauna
  - Geology, soil, topography of study area
  - Air and Noise studies
  - Traffic

EIA Baseline Data Required

- Socio-Cultural environment
  - Demographic characteristics, population size, growth rates, economic activity, employment and labour market
  - Customs and attitudes
  - Areas of cultural/ historic/ traditional value

EIA Baseline Data Required

- River Water Quality
  - Dry season samples:
    - Guaracara River
    - Marabella River
    - Cipero River
  - Wet season samples:
    - Guaracara River
    - Marabella River
    - Vistabella River
    - Cipero River
    - Ally's Creek



EIA Baseline Data
River Water Quality
Guaracara River

Inland

Gulf

EIA Baseline Data
River Water Quality
Marabella River

Inland

Gulf

EIA Baseline Data
River Water Quality
Vistabella River

Inland

Gulf

EIA Baseline Data
River Water Quality
Ally's Creek

EIA Baseline Data
River Water Quality Data

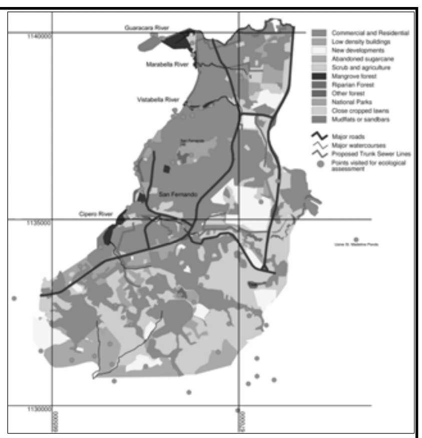
Faecal Coliform Data (CFU/100ml)

River Name	Dry Season (June 3, 2009)	Wet Season (October 20, 2009)	EMA WPR for Inland Surface Water
Guaracara	Inland – 360	Inland – 8,000	400
	Gulf – 315	Gulf – 32,000	
Marabella	Inland – 8,000	Inland – 11,000	
	Gulf – 49,000	Gulf – 46,000	
Vistabella	(Dry)	Inland – 11,000	
		Gulf – >200,000*	
Cipero	Inland – 179,000	Inland – 198,000	
	Gulf – 120,000	Gulf – >200,000*	
Ally's Creek	(Dry)	112,000	

* Too numerous to count (TNTC)

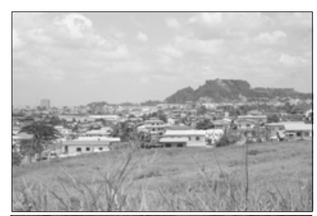
EIA Baseline Data
Flora and Fauna

- Land use map was developed to categorize habitats
  - 49% commercial and industrial
  - 22% scrub and agriculture
- West Coast Mudflats of Trinidad listed as an Important Bird Area (IBA)



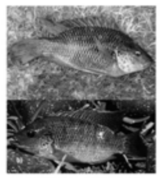
EIA Baseline Data
Flora

- Highly developed area
- Small natural remnants of:
  - Patches of mangrove
  - Riparian mixed forest
- EMA National Environmental Policy requires no net loss of wetland
  - Project will need to avoid, or restore in compliance with policy

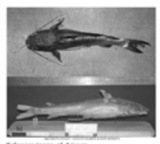


EIA Baseline Data
Fauna

- 84 bird species observed
  - Most consistent with habitats
- With the exception of the birds, comparatively few vertebrate species observed
  - Guppy
  - Black Tilapia
  - Mullet
  - Catfish
  - Speckled Caiman
  - Trinidad Squirrel



Reference images of Oreochromis mossambicus (www.Fishbase.org)



Reference image of Arius sp (www.Fishbase.org)

EIA Baseline Data
Fauna

- Few species are of commercial benefit
  - Evidence of Blue Crabs & Hairy Crabs
  - Reports of Iguanas and Manicou
  - Tilapia observed
- Protected Species
  - No endangered species encountered
  - Vulnerable species possibly expected:
    - Scarlet Ibis
    - Yellow-Crowned Parrot
    - Silky Anteater
  - Rare species possibly expected:
    - Red-capped Cardinal
    - Rufous-necked Wood-Rail

Ongoing EIA Work

- Social Surveys
  - Door-to-door surveys complete
- Air & Noise
- Traffic Counts
- Data analysis
- Impact analysis
- Mitigation and Monitoring

Project Benefits

- Properly collected and treated wastewater before discharged to environment
  - Health benefits to public
  - Clean up rivers, streams and surrounding environment
  - Meet EMA Water Pollution Rules (WPR 2006)
- One functional WWTP for entire project area
  - Cost savings
  - Easier to maintain

Conclusion

- Integrated collection system comprising
  - 72 km existing sewer – San Fernando proper
  - Additional existing sewers within catchment boundaries
  - 200 km new sewer
- One regional WWTP
- Improvement in surface water quality
- Reduce safety concerns surrounding untreated wastewater
- Opportunities to work with stakeholders
  - Road improvement
  - Drain improvement

Questions and Discussion

- Speakers are encouraged to speak clearly
- Please state your name and who you are representing
- Please hand your information card in before speaking
- Please only ask one question at a time

Thank You

AECOM

Email: Natalie.wilson@aecom.com

T: 628-9710

F: 628-0862

List of Invitees Contacted By Letter

Public Consultation # 1 – January 26, 2010

Archaeological Committee
Central Statistical Office
Citizens for a Better Trinidad and Tobago
Columbus Communications Trinidad Limited (FLOW)
Eteck
Ministry of Agriculture, Land and Marine Resources
Ministry of Labour, Small and Micro Enterprise Development
Ministry of Planning, Housing and the Environment
Trinidad and Tobago Housing Development Corporation (HDC)
Socio-Economic Policy Planning Division (SEPP)
Land Settlement Agency (LSA)
Urban Development Corporation of Trinidad and Tobago Limited (UDeCoTT)
Environmental Management Authority
Ministry of Public Utilities
Ministry of Works and Transport - Drainage Division
Ministry of Works and Transport - Highways Division
National Infrastructure Development Company Limited
National Gas Company of T&T
Petroleum Company of Trinidad and Tobago
Penal/ Debe Municipal Corporation
Princes Town Regional Corporation
San Fernando City Corporation
South Trinidad Chamber of Industry and Commerce
Trinidad and Tobago Electricity Commission
Telecommunication Services of Trinidad and Tobago
Town and Country Planning Division
Trinidad and Tobago Fire Services
Trinidad and Tobago Sustainable Development Network: The Cropper Foundation
Naparima MP, Nazim Baksh
San Fernando East MP, Prime Minister, Patrick Manning
San Fernando West MP, Junia Regrello
Point-A-Pierre MP, Christine Kangaloo
Oropouche East MP, Roodal Moonilal
Office of the Parliamentary Representative, The Honorable Senator Dr. Emily Dick-Forde

MEETING ATTENDANCE RECORD

Project Number: **WASA W.T.C. 03/2007, AECOM 110882**

Project Name: **San Fernando Wastewater Project, Public Consultation**

Name	Organization/ Area	Email contact	Phone Number
Alicia Dillan	San Fernando City Corporation, Public Health	Dillanad@yahoo.com	318-6092
Christine Wilson	San Fernando City Corporation, Public Health	Sexlady0152@yahoo.com	686-1905
Samantha Spence	Wastewater Transition Unit	spencesamantha@gmail.com	738-1888
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Devica Partap	Teemul Tr., Clarke Rd, Penal		781-3961
Parbatee Rajna	Clarke Rd, Penal		295-5982
Paromdaye Singh	56 Teemul Tr., Clarke Rd, Penal		490-3733
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Ann-Marie Medina	Ministry of Agriculture	annmariedar@hotmail.com	750-3500
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Christopher Ward	EMA	e.ward@ema.co.tt	628-8042
Jason Ganpat	EMA	J.ganpat@ema.co.tt	628-8042
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John Ramkhelawan	San Fernando City Corporation	Jramkhelawan_sando@yahoo.com	

Name	Organization/ Area	Email contact	Phone Number
Keith Cyrus	WASA		701-3562
Kenneth Athan	WASA South		653-1014
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Samuel Olubode	HDC		722-6944
S. Gunness	Ministry of Works and Transport	sgunnes@gmail.com	319-1349
Dhanraj Lookdeo	35 Teemul Tr., Clarke Road, Penal		790-8599
Ann-Marie Jamura	75 Teemul Tr. Clarke Road, Penal		647-7511
Nassiff Mohammed	35 Teemul Tr. Clarke Road, Penal		647-4343
R. Sepresad	35 Teemul Tr. Clarke Road, Penal		647-8318
Jameel Mohammed	Public Health Department, San Fernando		652-2543-7
S.L. Mohammad	WASA		299-3057
Everson Beeda	Land Settlement Agency	beedae@lsa.gov.tt	640-5535
Claudette Goddard	WASA		
Irwin Gill	WASA		
H. Bhasalod	WASA	oksin@hotmail.com	465-2157
C. Doyle	Marabella	Doyl9344@gmail.com	658-7611
D. Ramprashad	Wastewater (WASA)		223-1000
N. Johnson	Wastewater (WASA)		
I.Bickram	Wastewater (WASA)		
Nicholas Sandiford	Wastewater (WASA)		
Sheerz Hosein	Wastewater (WASA)		756-4905
Natasha Howard	San Fernando City Corp. Public Health Department	natashahoward@hotmail.com	706-0543
Lisa Calloway	San Fernando City Corp. Public Health Department		777-4414
Perkins Marshall	NIDCO	pmarshall@nidco.co.tt	290-2087
AnnMarie Lakhram	Town and Country Planning Division	AnnMarie.Labhreau@phe.gov.tt	627-9200 ext 2143
Sahadeo Latchmepersad	T&TEC transmission development	slatchme@ttec.co.tt	684-1263
Dave Montgomery	AECOM Transportation	Dave.montgomery@aecom.com	782-4212
Suresh Mathura	National Gas Co. (NGC)	sureshm@ngc.co.tt	636-4662 ext 2244
Natasha Gordon	Carib Street		383-6456

List of Presenters/Organizers

Name	Organization/ Area
Carol Doyle	WASA
Kimlin Austin	WASA
Jim Marx	AECOM
Matt McTaggart	AECOM
Sara-Jade Govia	AECOM
Natalie Wilson	AECOM

PUBLIC CONSULTATION

Water and Sewerage Authority invites members of the public to attend its Public Consultation meeting on "The Integration, Expansion and Upgrade of Wastewater Systems in the City of San Fernando and Environs".

This Public Consultation is a requirement of the Environmental Management Authority (EMA) and a necessary condition for the granting of a Certificate of Environmental Clearance (CEC).

The purpose of the consultation is to present an overview of project interventions, environmental and social issues and to seek the input of stakeholders.

The schedule for the meeting is as follows:

Tuesday 26th January, 2010
San Fernando Central Secondary School (Modsec.)
Todd Street, Les Efforts West
San Fernando
at 5:30 p.m.

For more information please contact:
KIMLIN AUSTIN – Assistant Manager, Environment and Regulatory Compliance
WASA, Wastewater Division, Liberty Building, Hakim Juman Lane, Chaguanas.
Tel. : **223-1000 Ext. 5940**

WATER AND SEWERAGE AUTHORITY
Striving towards organisational efficiency and effectiveness.

This flyer is for your attention, and to post in your business

Appendix F.2 – Public Consultation 1 – Meeting Notes

Presentation by WASA and AECOM
Question Period

1. (John Ramkhelawan) Is the construction period 7 years for the collection system plus 2 years for the WWTP?
    a. (Jim Marx)No, the WWTP will take 2 years to construct, and this will be conducted concurrently in the 7 years for the collection system.
2. What would the cost of the plant be?
    a. (Jim Marx, Matt McTaggart)The design is not yet at that stage where we can provide a cost of the plant. For comparison, a similar plant, although smaller, was priced at TTD $400 million. This would approximate the total cost of the plant to be TTD $450 million, however this number is not finalized yet.
3. What is the availability of the water after the wastewater is treated?
    a. Lets go on with the presentation, and we will return to your question at the end of the presentation.
4. (S.L. Mohammad)There is no doubt in my mind that this is a good project, however where does the water go after it is treated? In North America this water is reused. Is the water going to industry? To the people?
    a. (Jim Marx) At the beginning of the project this was not in the scope of works. Once the project got underway, WASA has asked us to look at the possibility of treating the wastewater to reuse standards. The design of the WWTP will now treat the wastewater to reuse standards through UV and filtration, in case WASA would like to use it for alternate uses.
5. (Lisa Salloway) As an officer of Public Health, we have issues all of the time with lift stations. They smell and it is a health hazard, especially the one at Pleasantville. When will these lift stations, especially this one, be phased out?
    a. (Matt McTaggart) We know which lift station you are talking about. It is loud and it smells because it is so open. In the design, this lift station will be eliminated. Our design will be completed in July 2010, and from there WASA will need to secure funds for construction. We are unsure of how long this may take.
6. (Shastri Gunness) When the traffic plan is complete, will this be given out? Can ministries see this traffic plan?
    a. (Jim Marx) We are unsure of what WASA will be doing with this traffic plan, however I am sure that something could be worked out. Please come and speak to us later to get a business card.
7. (Sahadeo Latchmepersad) How much power will the wastewater treatment plant need? When Beetham was built, it required its own substation, and this is a major undertaking. We need to be informed now, so that the provisions can be put into place.
    a. (Jim Marx, Matt McTaggart) The final numbers are not yet decided, but we do agree that coordination with T&TEC will be required as the plant will require two feeds for redundancy. It will be good that the plant will be located at the existing site, so that possibly the same feeds can be used to power the new plant.

8. (Sahadeo Latchmepersad) You will need to consider the underground facilities and that getting information on where they are located is difficult.
    a. (Matt McTaggart) Yes it is absolutely important, and the as-built information is very difficult to obtain, as most is not available. To accommodate for this, we have contact all utilities and have received some information. We are also conducting a detailed survey where our surveyors are out in the field locating every noticeable feature that may help in determining where the underground lines are located.
9. (Tiwalade Adesiyun) We have developments within your catchment area, Pleasantville, Retrench, Tarodale, etc. that all have their own wastewater treatment facilities. How will our HDC facilities be engineered into this new collection system?
    a. (Matt McTaggart) AECOM has had meetings with ministers responsible for future development in the area, as well as determining the new housing developments which are sewered and have wastewater treatment plants. The HDC developments in the project area will be tied into the new collection system.
10. (Aldxuin Beddou) How was the project area determined, and how does this fit into the overall scheme for Trinidad?
    a. (Jim Marx,Matt McTaggart, Kimlin Austin) This was determined by a master plan conducted previously for WASA that divided Trinidad into 25 catchments. This is based mainly on topography and population. WASA is currently looking at the San Fernando catchment, and hopes to eventually have all of these catchments sewered.
11. (Aldxuin Beddou) What provisions are there for Earthquakes?
    a. (Jim Marx) All of the designs are conducted in accordance with the appropriate earthquake codes for Trinidad and Tobago.
12. (Aldxuin Beddou) Has the cost been considered? Or the least cost situation?
    a. (Jim Marx) We are designing with cost in mind. The wastewater treatment plant is being built with high efficiency blowers and the plant hydraulics will be designed to minimize pumping, which will decrease the operation costs. Minimizing lift stations will decrease the operation costs because pumps will not be required and overall maintenance to the lift stations.
13. (Aldxuin Beddou)What is WASA doing to connect to the public more? More advertising should be done, and educating the public. Meetings with all subcatchments should be conducted.
    a. (Kimlin Austin) WASA has started a public education drive, which currently involves WASA staff going into schools to educate children. This public education drive will continue.
14. (John Ramkhelawan) Would like to note that this is a poor location choice and we as a people deserve better than this from WASA. Looking at the people who have come tonight indicates that this is a poor survey and should not be representative. My question is with tertiary treatment, and what tertiary treatment of effluent is occurring?
    a. (Jim Marx) The tertiary treatment that will occur at the WWTP includes UV disinfection, and cloth filters.
15. (Jameel Mohammad) In 1989 the IMA did a survey from Cross-Crossing to Vistabella when a group decided that they wanted to develop a beach along the Gulf. The results found that the level of pollution was very high. We (San Fernando City Corp) have put up signs to warn people not to bathe, but these signs have been ripped down. We put up more signs, and they rip

them down. Will the wastewater be used for agricultural purposes, and will it improve the levels of pollution in this area?

   a. (Kimlin Austin) We will guarantee that the wastewater effluent will meet the discharge levels, however we cannot guarantee the other sources. These sources need to be taken up with the EMA as it is up to them to enforce this.

16. (Jameel Mohammad) Will collection system construction take into account material construction that will not break?
    a. (Matt McTaggart and Jim Marx) Yes, especially the areas where trenchless technology will be used. When the trenchless technology is used, the material required to withstand the jacking forces during installation means that the pipes have to be very strong. The likelihood of these pipes leaking is minimal.
17. (Kerry Pariag) Will more land space be required?
    a. (Jim Marx) The wastewater treatment plant will be constructed at the existing San Fernando wastewater treatment plant, so additional land will not be required. A staging area during construction may be required, but land across the Cipero River, where the Gulf View wastewater treatment plant is located could be used. This land is also owned by WASA, so no additional land would be required. During construction of the collection system, land easements will be required, but these are construction easements only.
18. (Kerry Pariag) Will soak-aways be tied into this new collection system? On a case-by-case basis?
    a. (Jim Marx) Yes the houses with soak-aways will be connected to the new collection system. This will need to be studied on a case-by-case basis.
19. (Amar Chadee) Now that this project is so overdue, and it is going to cost so much money, why could it not have occurred incrementally over time? We are now bathing in our own filth because this project is so large and will take so long to be finished.
    a. (Jim Marx) I am from the United States, and I know that the US went through this process as well in the 70's. At that time, the water was heavily polluted and it was damaging the environment. The government had to look at it from the perspective of 'we are here now, how do we make it better'. They couldn't focus on the past, but had to move forward. That is where WASA is right now.
20. (Kerry Pariag) Is there a program to take into consideration point source pollution, including squatters along rivers?
    a. (Kimlin Austin) That is the EMA that deals with this.

Questions that were written down but not answered at the meeting (in the interest of time):

1. (Kerry Pariag) How many people live in the vicinity of the Cipero River?
   a. Populations within the entire project area were studied. The 2009 estimated population would be 94,100 and the 2035 estimated population would be 105,000.
2. (S. Gunness) Can I receive an email copy of the presentation?
   a. A copy was emailed out.

3. (Natasha Howard). Will this project consider connections to existing systems in the project area, and repairs to existing systems?
    a. Yes, all existing sewers within the project area will be integrated into the collection system. A CCTV program is currently underway to look for existing damaged pipes, and to replace those pipes under this project.

Appendix F

Key Stakeholder and Public Consultations

F.3 Public Consultation 2

EIA for Construction of a Regional Wastewater Treatment Plant and Collection System for San Fernando and Environs

Public Consultation 2

April 13, 2010

AECOM

Agenda

- Introduction
- Purpose of Meeting
- Project Area and Existing Situation
- Description of Proposed Project
  - Collection System
  - Wastewater Treatment Plant (WWTP)
- Environmental Impact Assessment (EIA) Baseline Data
- Impacts and Mitigation Measures
- Discussion

Introduction

- Project Representatives
  - Carol Doyle, WASA
  - Kimlin Austin, WASA
  - Jim Marx, AECOM
  - Natalie Wilson, AECOM
  - Sara-Jade Govia, AECOM

Purpose of Meeting

- The Water and Sewerage Authority proposes to construct an integrated wastewater collection system and treatment plant for the San Fernando Area and Environs
- This meeting will provide:
  - Information to the public and key Stakeholders on the design
  - A forum for dialogue and feedback
- This meeting will meet the Certificate of Environmental Clearance (CEC) permit requirements of the Environmental Management Authority (EMA)
  - CEC 1597/2006

Meeting Ground Rules

- Audience is encouraged to ask questions, present comments or seek clarification at the end of the formal presentation
- Small cards provided are for questions
  - Please write your name, area or organization, and question
- Turn in your card after presentation
- Please ask only one question at a time, and state your name
- Please speak clearly and loud enough to be heard

Project Overview

- Project will:
  - Construct one new WWTP at existing San Fernando WWTP site
  - Construct more than 200 km of new sewers
  - Integrate new and existing sewers into a comprehensive system
  - Conduct EIA to obtain CEC from EMA

Project Description
Design of Collection System and WWTP

Project Area

The project area ~ 44 km^2 and is defined by:

- North - Guaracara River
- West - Gulf of Paria and M2 Ring Road
- East - Solomon Hochoy Highway including Ste. Madeline
- South – Approximately the southern border of existing developments

Existing Situation

- Approximately 30% of the project area is sewered
- Consisting of several wastewater treatment plants and collection systems
  - Operating WASA plants at San Fernando and Harmony Hall
  - Other privately owned WWTPs – most not in operation



Existing Situation

- Approximately 70% of the project area has on-lot disposal systems
  - pit latrines
  - septic tanks
  - soak-aways
- Grey water connections to surface drains


Existing Situation

- Raw and partially treated wastewater is entering environment (rivers, streams, water bodies)
- Health hazards to local population
- Environmental concerns


Collection System Design Criteria

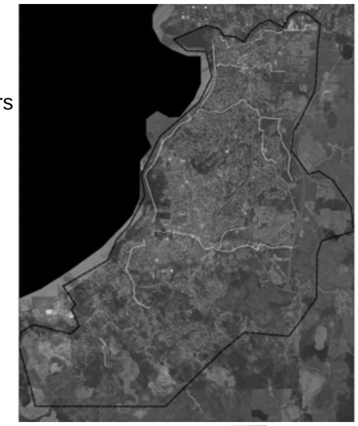
- Provide service to all customers
  - Residential, commercial, institutional and light industrial customers
- Replace existing sewers where necessary
- Minimize disturbance to existing utilities to degree possible
- Gravity system with minimal number of pumping stations
- Minimize disruption to traffic during construction
  - Use trenchless techniques where possible

Collection System
Project Subcatchments

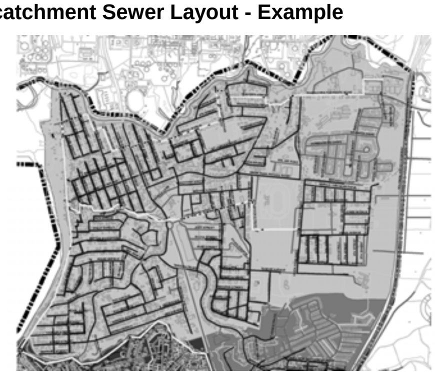
- 17 subcatchments
- Sewer modeling
- Construction phasing
- Minimize disruptions

Collection System
Trunk Sewers

- Smaller collector sewers drain into larger diameter trunk mains:
  - Guaracara River
  - Vistabella River
  - Gulf of Paria
  - Cipero River
  - Palmiste to Gulf View



Collection System
Subcatchment Sewer Layout - Example

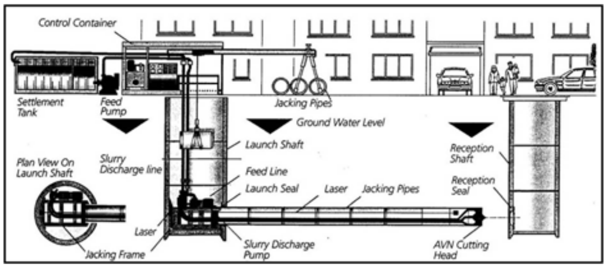


Open Cut Construction Methods

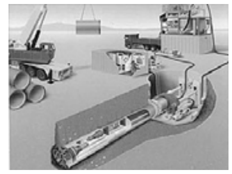
- Used for installation of sewer pipes in streets and open areas where equipment access is possible and depths are not excessive

Trenchless Construction Methods

- Used for installation of sewer pipes at difficult intersections, river crossings, and for deep sewers



Micro-tunneling



WWTP Design

- Plant design to accommodate population projections to 2035
  - Wet weather overflow stored then treated when capacity available
- Design to meet:
  - WPR 2001 (as amended) for inland water
  - Reuse standards as defined by North American regulations
- Treated effluent discharges to Cipero River, at mouth of Gulf
- Waste solids will be digested, dewatered, and trucked off site

WWTP Site

Project Timeline

- Design completed July, 2010
- WASA/ government approvals
  - Obtain funds
- Tender period – 6 months
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  - Collection system ~ 7 years
    - Phased by subcatchment
  - WWTP ~ 2 years

Environmental Impact Assessment
Baseline Data

EIA Baseline Data Required

- Bio-physical environment
  - Water quality parameters
  - Flora
  - Fauna
    - Aquatic
    - Avifauna
  - Geology, soil, topography of study area
  - Air quality and noise studies
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- Socio-Cultural environment
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River Water Quality

- Dry season samples:
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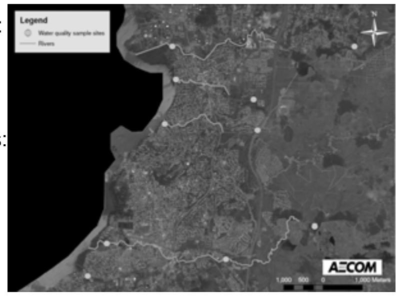

EIA Baseline Data
River Water Quality

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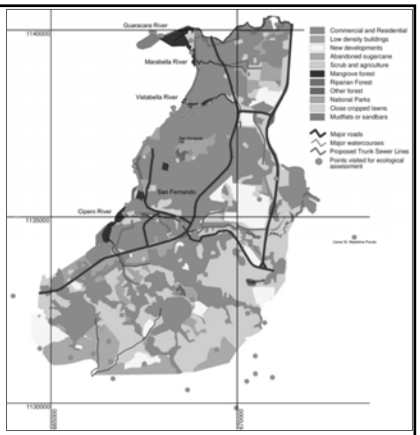
	Gulf – 49,000	Gulf – 46,000	
Vistabella	(Dry)	Inland – 11,000	
		Gulf – >200,000*	
Cipero	Inland – 179,000	Inland – 198,000	
	Gulf – 120,000	Gulf – >200,000*	
Ally's Creek	(Dry)	112,000	

* Too numerous to count (TNTC)

EIA Baseline Data
Flora and Fauna

- Land use map was developed to categorize habitats
  - 49% commercial and industrial
  - 22% scrub and agriculture
- West Coast Mudflats of Trinidad listed as an Important Bird Area (IBA)

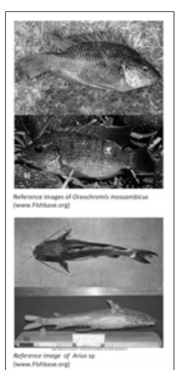


EIA Baseline Data
Flora

- Highly developed area
- Small natural remnants of:
  - Patches of mangrove
  - Riparian mixed forest
- EMA National Environmental Policy requires no net loss of wetland
  - Project will need to avoid, or restore in compliance with policy

EIA Baseline Data
Fauna

- 84 bird species observed
  - Most consistent with habitats
- With the exception of the birds, comparatively few vertebrate species observed
  - Guppy
  - Black Tilapia
  - Mullet
  - Catfish
  - Speckled Caiman
  - Trinidad Squirrel

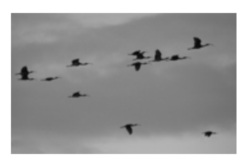


Reference images of *Oreochromis mossambicus* (www.Fishbase.org)

Reference image of *Arius sp* (www.Fishbase.org)

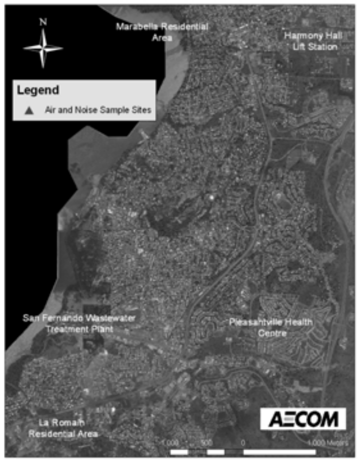
EIA Baseline Data
Fauna

- Few species are of commercial benefit
  - Evidence of Blue Crabs & Hairy Crabs
  - Reports of Iguanas and Manicou
  - Tilapia observed
- Protected Species
  - No endangered species encountered
  - Vulnerable species possibly expected:
    - Scarlet Ibis
    - Yellow-Crowned Parrot
    - Silky Anteater
  - Rare species possibly expected:
    - Red-capped Cardinal
    - Rufous-necked Wood-Rail



Air Quality and Noise Results

- Air Quality
  - PM_{10}
  - $PM_{2.5}$ (results pending)
  - TSP (results pending)
- Noise Levels
  - Leq
  - Lpeak



Air Quality Results

PM_{10} Results (µg/m^3)

Location	24 hour Average	EMA Draft Air Pollution Rules, 2001
Marabella	168	75
San Fernando WWTP	56	
Harmony Hall	33	
Dumfries Road	35	
Pleasantville	25	

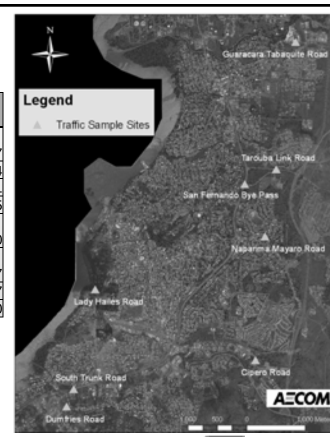
Noise Results

Location	Lpeak 8am-8pm (dB)	Lpeak 8pm-8am (dB)
Marabella	103	102
Harmony Hall	113	113
Dumfries Road	115	115
Pleasantville	123	111
EMA Noise Pollution Rules General Area	**120**	**115**
San Fernando WWTP	119	117
EMA Noise Pollution Rules Industrial Area	**130**	**130**

Traffic Counts

Street	Total Count	Cars Per Minute
San Fernando By-Pass	25,475	47
Tarouba Link Rd	23,873	44
South Trunk Rd	16,600	31
Lady Hailes Rd	13,556	25
Naparima-Mayaro Rd	10,824	20
Guaracara Tabaquite Rd	9,419	17
Cipero Rd	8,970	17
Dumfries Rd	5,169	10

- Morning: 6-9am
- Mid-Day: 11am-2pm
- Afternoon: 3-6pm



Environmental Impact Assessment
Impacts
Mitigation Measures
Summary & Conclusion

Impacts

- Increased sewage disposal efficiency
- Decreased odors from non-functioning WWTPs
- Improvement in water quality in rivers within catchment
- Traffic congestion during construction
- Construction noise and dust
- Short-term employment opportunities during construction
- Road improvement after construction

Mitigation Measures – Construction

- Traffic management plan
- Trenchless technology on some collection system construction
  - Busy roads
  - Rivers
- Dust abatement
- Erosion Control

Mitigation Measures - Operation

- Sound attenuation equipment
  - WWTP
  - Lift stations
- Storm water storage tanks
- Odour control equipment

Project Benefits

- Properly collected and treated wastewater before discharged to environment
  - Health benefits to public
  - Clean up rivers, streams and surrounding environment
  - Meet EMA Water Pollution Rules WPR 2001 (as amended)
- One functional WWTP for entire project area
  - Cost savings
  - Easier to maintain
- Opportunities to work with stakeholders
  - Road improvement
  - Drain improvement

Conclusion

- Integrated collection system comprising
  - 72 km existing sewer – San Fernando proper
  - Additional existing sewers within catchment boundaries
  - 200 km new sewer
- One regional WWTP
- Improvement in surface water quality
  - Reduce safety concerns surrounding untreated wastewater
- Impacts to traffic during construction
  - Minimize impact with trenchless technology and traffic management plan

Questions and Discussion

- Speakers are encouraged to speak clearly
- Please state your name and who you are representing
- Please hand your information card in after presentation
- Please only ask one question at a time

Thank You

AECOM

Email: Natalie.wilson@aecom.com

T: 628-9710

F: 628-0862

List of Invitees Contacted By Letter

Public Consultation # 2 – April 13, 2010

Central Statistical Office
Citizens for a Better Trinidad and Tobago
Columbus Communications Trinidad Limited (FLOW)
Eteck
Ministry of Agriculture, Land and Marine Resources
Ministry of Labour, Small and Micro Enterprise Development
Ministry of Planning, Housing and the Environment
Trinidad and Tobago Housing Development Corporation (HDC)
Land Settlement Agency (LSA)
Urban Development Corporation of Trinidad and Tobago Limited (UDeCoTT)
Environmental Management Authority
Ministry of Public Utilities
Ministry of Works and Transport - Drainage Division
Ministry of Works and Transport - Highways Division
National Infrastructure Development Company Limited
National Gas Company of T&T
Petroleum Company of Trinidad and Tobago
San Fernando City Corporation
South Trinidad Chamber of Industry and Commerce
Trinidad and Tobago Electricity Commission
Telecommunication Services of Trinidad and Tobago
Town and Country Planning Division
Naparima MP, Nazim Baksh
San Fernando East MP, Prime Minister, Patrick Manning
San Fernando West MP, Junia Regrello
Point-A-Pierre MP, Christine Kangaloo
Oropouche East MP, Roodal Moonilal
National Trust, National Museum

MEETING ATTENDANCE RECORD

Project Number: **WASA W.T.C. 03/2007, AECOM 110882**

Project Name: **San Fernando Wastewater Project**

Meeting Subject: **Public Consultation # 2**

Meeting Date & Time: **Tuesday April 13th, 5:30 pm**

Meeting Location: **Pleasantville Community Centre**

Name	Organization / Title	Email contact	Phone Number
Narine Charran	Minister of Public Utilities, Sr. Economist	ncharran@mpu.gov.tt	497-1517
Jean Archie	Resident		
Nova Johnson	WASA, Project Planning	Nova_johnson@hotmail.com	223-1000 ext 5715
Michelle Granderson	WASA, Customer Care	Gran_4@hotmail.com	223-1000 ext 6026, 29
Sunil Ramlal	HSE Specialist, Petrotrin	Sunil.ramlal@petrotrin.com	658-4200 ext 2584
Kerry Pariag	Town Planner	Kerry.pariag@phe.gov.tt	627-9700 ext 2161
Joseph Allan	NGC	Josepha@ngc.co.tt	636-4662 ext 2255
N. Seepersad	WASA, Hydro tech	nabillap@wasa.gov.t	223-1000 ext 5704
Gopaul Singh	WASA, Transport Admin	Sing15068@wasa.gov.tt	789-8450
T. Andre Villaruel	Resident	Tandre24@gmail.com	481-8592
Asraf Hosein	Resident, TTPost	AT2SServices@gmail.com	467-7570
Laurel Williams	Newsday	Laurel_joe8@hotmail.com	652-2592
Rima Dehabastel	Resident		657-6182
Anthony Dehabastal	Resident		657-6182
Farzad Nobbee	Engineer, T&TEC	fnobee@ttec.co.tt	657-7281

Name	Organization / Title	Email contact	Phone Number
Kuptal Jack	EMA	kjack@ema.co.tt	730-3231
Irwin Gill	WASA, Assistant Manager, Wastewater	Irwin.e.gill@gmail.com	
Tyrone Boberts	Resident		
Liselle Boberts	Resident	Ghadi37@yahoo.com	350-8295
Robert Parris	Resident	Robsta8@hotmail.com	687-4229
Merle Edwards	Resident		657-6124
Kerry Jadson	Resident		653-1042
Ann Marie La Caills	Resident		343-8318
Marion Norton	Pleasantville Councillor	Nortonmarion@gmail.com	689-9881
Roslyn Archibald	Resident		
Gloria Coward	Resident		737-2231
Khadine Christoper	Resident	khadinechristoper@hotmail.com	327-7330
Shirlyn Nickles	Resident		488-0973
Tennile Leach	Resident	tennileleach@live.com	772-3398
Colleeen Grant	Resident	wallandcoll@yahoo.com	755-0861
Delores Luke	Resident		657-5109

PUBLIC CONSULTATION

Water and Sewerage Authority invites members of the public to attend its Public Consultation meeting on "The Integration, Expansion and Upgrade of Wastewater Systems in the City of San Fernando and Environs".

This Public Consultation is a requirement of the Environmental Management Authority (EMA) and a necessary condition for the granting of a Certificate of Environmental Clearance (CEC).

The purpose of the consultation is to present an overview of project interventions, environmental and social issues and to seek the input of stakeholders.

The schedule for the meeting is as follows:

Tuesday 13th April, 2010
Pleasantville Community Centre
Prince Albert Street
Pleasantville
at 5:30 p.m.

For more information please contact:
KIMLIN AUSTIN – Assistant Manager, Environment and Regulatory Compliance
WASA, Wastewater Division, Liberty Building, Hakim Juman Lane, Chaguanas.
Tel. : **223-1000 Ext. 5940**

WATER AND SEWERAGE AUTHORITY
Water Conservation... it's a Partnership.

<table>
<tr><th>Question</th><th>Answer</th></tr>
<tr><td>Will the existing WASA plant on Riverside Drive, San Fernando be upgraded or expanded? Or will a completely new plant be built?</td><td>A new plant will be built on the site of the existing WWTP. The existing plant will be demolished upon completion and commissioning of new facilities.</td></tr>
<tr><td>What technology is proposed?</td><td>Preliminary treatment consisting of fine screens (6 mm opening) and vortex grit removal chambers; secondary treatment consisting of activated sludge flow through bioreactor with nitrogen removal and circular clarifiers; tertiary treatment consisting of disc filters, UV disinfection and chlorination to maintain 1 mg/l residual on final effluent.</td></tr>
<tr><td>What is the design capacity?</td><td>Population projections to 2035.

Average dry weather flow is 45 ML/d. The plant will be sized to treat the design year 2035 Peak Dry Weather Flow (PDWF) of 90 ML/d through secondary and tertiary treatment.</td></tr>
<tr><td>What are the performance parameters, both influent and effluent design?</td><td>
Average Design Loads to WWTP
<table>
<tr><th>Parameter</th><th>Unit</th><th>Average Value</th></tr>
<tr><td>BOD</td><td>mg/L</td><td>176</td></tr>
<tr><td>COD</td><td>mg/L</td><td>386</td></tr>
<tr><td>TSS</td><td>mg/L</td><td>248</td></tr>
<tr><td>TKN</td><td>mg/L</td><td>35</td></tr>
<tr><td>TP</td><td>mg/L</td><td>4.8</td></tr>
</table>
San Fernando WWTP Effluent Criteria
<table>
<tr><th>Parameter</th><th>Design Effluent Criteria</th></tr>
<tr><td>BOD_5</td><td>< 20 mg/L (CBOD)</td></tr>
<tr><td>TSS</td><td>< 5 mg/L</td></tr>
<tr><td>Dissolved Oxygen</td><td>> 4 mg/L</td></tr>
<tr><td>Temperature</td><td>< 35°C</td></tr>
<tr><td>Ammonia-Nitrogen</td><td>< 10 mg/L</td></tr>
<tr><td>Total Nitrogen</td><td>< 15 mg/L</td></tr>
<tr><td>Total Phosphorus</td><td>< 5 mg/L</td></tr>
<tr><td>Faecal Coliform</td><td>Max: 25/100 mL and 75% samples below detection</td></tr>
<tr><td>pH</td><td>6 to 8.5</td></tr>
<tr><td>Total Residual Chlorine</td><td><1 mg/L</td></tr>
</table>
</td></tr>
</table>

Question	Answer
Will treated water be reused? If yes, for what purpose?	Yes, tertiary treatment is included for effluent reuse. The reclaimed water will be suitable for use in agricultural irrigation, indirect aquifer recharge and for industrial uses (cooling water, process water).
Is project timeline shown for presentation still valid?	- Design completed July 2010 - WASA/Government Approvals and securing funding - Tender Period – 6 months - Construction period o Collection system ~ 7 years (phased by subcatchment, with first high impact 1st phase completed in 2 years) o WWTP ~ 2 years
Will AECOM be willing to look at new or alternative treatment technology?	An evaluation of applicable technologies was performed to determine the overall best treatment processes. The tender documents will identify any acceptable alternatives to those specified.
There is a movement internationally towards "Decentralised WWTP's" for several known reasons including the high cost of underground sewers at an average of 6 to 8 times the cost of WWTP. How will this phenomenon impact or affect this project?	WASA conducted a Water and Wastewater master plan that evaluated several scenarios and recommended dividing Trinidad into a number of regional catchments, with each catchment sewered and serviced by one regional WWTP. San Fernando and environs is one of the regional catchments.

Appendix G

Impact Assessment and Mitigation Measures

Appendix G

Impact Assessment and Mitigation Measures

G.1 Erosion Control Specification

EROSION PROTECTION

1. GENERAL

1.1 Scope of Work

.1 This section outlines the requirements for rip rap and geotextile fabric related to erosion protection of slopes and trenches along river banks and slopes.

2. PRODUCTS

2.1 Bedding

.1 Geotextile fabric bedding material shall be reasonably well graded granular material consisting of sound, hard crushed rock or crushed gravel and shall be free from organic or soft material which would disintegrate through decay or weathering.

.2 Gradation limits for rip rap bedding gravel are as described below:

Sieve Opening	Percentage Passing
75 mm	100
50 mm	55 - 100
25 mm	38 - 100
5 mm	20 - 65
0.315 mm	6 - 30
0.080 mm	2 - 10

.1 Max. Los Angeles Abrasion Loss 35%

2.2 Rip Rap

.1 Hard, dense crushed quarry stone with specific gravity not less than 2.65 durable, a point load index greater than 4.0 Mpa, a water absorption rate ranging between 0.5% to 2.0% maximum, Abrasion Resistance Value less than 20% and magnesium sulphate Soundness less than 12 %.

.2 Gradation as indicated on the drawings.

2.3 Geotextile

.1 Geotextile fabric shall be as indicated on the standard detail.

.2 Furnish geotextile fabric of either woven or nonwoven polyester, polypropylene, stabilized nylon, polyethylene, or polyvinylidene chloride. All fabric shall have the minimum strength values in the weakest primary direction. The Contractor may use nonwoven fabric that is one or a combination of the following: needle punched, heat bonded, or resin bonded.

.3 Furnish geotextile fabric that is insect, rodent, mildew and rot resistant.

.4 Furnish geotextile fabric in a wrapping that protects the fabric from ultraviolet radiation and from abrasion due to shipping and hauling. Keep the geotextile dry until installed.

.5 Clearly mark the geotextile fabric rolls to show the type of fabric.

.6 Provide samples of fabric for testing from the job site as specified by the Engineer.

.7 If using sewn seams, furnish a field sewn seam sample produced from the geotextile fabric and thread and with the equipment proposing to use on the project, before incorporating into the work.

.8 Use fabric conforming to the following physical properties (based on minimum average roll values):

.1 Minimum grab tensile strength: To ASTM D 4632, 1350 N.

.2 Minimum puncture strength: To ASTM D 4833, 425 N.

.3 Minimum apparent breaking elongation: To ASTM D 4632, 15%.

.4 Maximum apparent opening size: To ASTM D 4751, 600 micron.

.5 Minimum permittivity: ASTM D 4491, 0.40, s^{-1}

.9 Securing pins: 4.5 mm x 450 mm steel bars, pointed at one end and fabricated with a head to retain a steel washer having an outside diameter of not less than 38 mm.

2.4 Acceptable Manufacturer

.1 Trevira 1125, manufactured by Hoechst Fibers Industries, or equal.

3. EXECUTION

3.1 Geotextile

.1 Place geotextile for trench/ slope erosion protection as indicated on drawings and shown on Standard Details.

.2 At time of installation, fabric shall be rejected if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, storage or handling.

.3 Grade area where geotextile is to be placed to a uniform, even surface and remove all stones, sticks, roots and other sharp objects. Fill depressions with additional bedding material and compact to provide firm level bed.

.4 Where geotextile is to be placed on slopes, a minimum of 50 mm of Type 3 granular bedding is required.

.5 Place the fabric loosely and lay it parallel to the direction of water movement in a sequence approved by the Engineer. A minimum of 600 mm of overlap is required on all abutting lengths of geotextile. Overlap the fabric in the joints at least 600 mm in the direction of flow.

.6 Pin geotextile in the excavated trench at a minimum of 2.0 m on center.

.7 After placing, do not expose the fabric longer than 48 hours before covering.

.8 The plans indicate one method of installation of the geotextile. The "trench" shown on the plans is not required. Contractor may propose an alternative rather than the one shown on the drawings. Alternatives are subject to approval of Engineer.

.9 Geotextile manufacturer's installation recommendations shall take precedence over the specifications.

3.2 Placing Rip Rap Bedding Gravel

.1 Where rip rap bedding gravel is to be placed on slopes, excavate a trench at toe of slope in accordance with dimensions indicated or directed.

.2 Fine grade area to be rip rapped to a uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.

.3 Do not start the placing of rip rap bedding gravel until the geotextile fabric is in place and has been accepted by the Engineer.

.4 Place rip rap bedding gravel to the thickness and according to details indicated or as directed by Engineer.

.5 Do not dislodge or tear the geotextile while placing. Remove and replace any geotextile which is damaged by the rip rap bedding gravel placing operation.

3.3 Placing Rip Rap

.1 Where rip rap is to be placed on slopes, excavate a trench at toe of slope in accordance with dimensions indicated or directed.

.2 Fine grade area to be rip rapped to a uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.

.3 Do not start the placing of rip rap until the geotextile and granular rip rap bedding gravel is in place and has been accepted by the Engineer.

.4 Place rip rap to the thickness and according to details indicated or as directed by Engineer.

.5 Place stones by intermixing the sizes of rip rap material to provide a broad and consistent gradation between the small and large rip rap materials in approved manner to secure surface and provide a stable mass. Place larger stones at bottom of slopes.

.6 Place rip rap to ensure the larger rock and smaller rock is uniformly distributed and that the smaller rock fragments serve to fill the voids between the larger rock, in a manner that will result in a uniform dense layer of rip rap of specified thickness. Place individual rip rap particles to fill visible voids as necessary to secure the results specified.

.7 Do not dump rip rap at the top of the slope for downslope pushing into place. Place to ensure that segregation of sizes does not occur. Place and level rip rap to ensure the completed rip rap is stable with no tendency to slide.

.8 In case shall the free fall height of the riprap exceed 150 mm.

.9 Do not dislodge or tear the rip rap bedding and/or geotextile while placing. Remove and replace any geotextile which is damaged by the rip rap operation. Repair or replace any bedding gravel which is displaced or disturbed by the rip rap operation.

END OF SECTION

Appendix G

Impact Assessment and Mitigation Measures

G.2 Traffic Control Specification

1. GENERAL

1.1 Reference Standards

.1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out work or haul materials or equipment.

1.2 Submittals

.1 Contractor must prepare a detailed Traffic Management Plan including:

.1 Schedule of street and walkway closings, partial closings and detours.

.2 Update areas in detail as Project progresses to keep Engineer informed of traffic routing.

.2 Engineer will review Plan and updates only for maintenance of adequate traffic patterns within and through construction areas.

.1 Engineer's review and acceptance shall not be construed as confirming adequacy of protection measures proposed.

.2 Engineer will notify residents of construction schedules and traffic plans. Contractor shall be solely responsible for full protection of public and Contractor's own forces.

.3 Submit in accordance with Section 01300 – Submittals

2. PRODUCTS (NOT USED)

3. EXECUTION

3.1 Traffic Management Plan

.1 Plan for pedestrian and vehicular traffic control compatible with construction procedures employed in each construction area.

.1 Incorporate construction sequencing, Section 01016, to form continuous traffic management plan.

.2 Include procedures for pedestrian and vehicular traffic routing and protection in immediate construction area and surrounding area during working and nonworking hours.

.3 Minimize potential traffic disruptions resulting from construction of the sewers in the roadways.

.4 Minimize delays of public transit vehicles.

.5 Minimize dust and mud.

.6 Reduce the length of detours to the degree possible.

.7 Schedule shall include:

.1 Dates and duration of stages and closures.

.2 Contractor's contact person(s) with 24-hour telephone number.

.3 Contact agencies with telephone numbers as applicable: Employer, Regional Corporation, Fire Department, Ministry of Works and Transport Highways Division, Ministry of Local Government, Police (Traffic Branch), Public Transport Service Corporation (PTSC), Trinidad and Tobago Unified Maxi Taxi Association, Schools, Hospitals, and other effected agencies.

.2 Do not proceed with construction of any portion of sewers until relevant plans for traffic control measures have been presented and the implementation of those measures have been reviewed and approved.

3.2 Traffic Control Committee

.1 To expedite traffic control planning strategies and the necessary approval process, set up a Traffic Control Committee consisting of the following parties:

.1 Contractor's Representative (Traffic Manager).

.2 Engineer.

.3 Employer's Representative.

.4 Representative from each of responsible Regulatory Authorities including, but not limited to, those agencies listed in 3.1.7.3.

.2 Representatives from Commercial Businesses, Hotels, Restaurants, etc. which are affected during construction will be invited to attend Committee meetings, as required by the Engineer.

.3 Contractor's representative shall be qualified to assume overall responsibility for traffic management, specifically for planning and coordinating the approved implementation measures and shall accept on the Contractor's behalf, liability for any damage or delays caused by negligence or failure to comply with this specification.

.4 Prior to commencing work and thereafter as specified, conduct meetings of the Traffic Control Committee at locations and at times suitable for all parties concerned to ensure appropriate attendance. Give at least forty eight (48) hours notice.

3.3 Vehicular Traffic Control

.1 Provide traffic control for Work in or adjacent to streets, back lanes, and highways.

.2 Do not close any lanes of road or highway without consultation with and acceptance by the Engineer.

.3 Keep travelled way well graded, free of pot holes and of sufficient width that required number of lanes of traffic may pass.

.4 Provide and maintain reasonable road access and egress to property fronting along or in vicinity of Work unless other reasonable means of road access exist.

.5 Provide competent flagpersons, properly equipped as specified in applicable regulations, in the following situations:

  .1 When public traffic is required to pass working vehicles or equipment which may block all or part of travelled roadway.

  .2 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.

  .3 When workers or equipment are employed on travelled way at other locations where oncoming traffic would not otherwise have adequate warning.

  .4 Where temporary protection is required while other traffic control devices are being erected or taken down.

  .5 For emergency protection when other traffic control devices are not readily available.

  .6 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.

.6 General:

  .1 For streets or back lanes along or in which construction is occurring, and for areas where construction vehicles are entering or leaving streets or back lanes:

    .1 Warning signs informing traffic of construction activities ahead and restricting roadway to local traffic only.

  .2 For roadway restricted to one-way travel:

    .1 Traffic control signs at cross-streets, back lanes, and 31 m intervals between.

  .3 For unpaved trenches and other disturbed areas in pavement:

    .1 Flashing light barricades, to channelize traffic into undisturbed pavement.

.4 At cross-streets and back lanes:

.1 Flashing light barricades, to screen off disturbed areas in trenches.

.5 Where permanent traffic signals disturbed by construction operation:

.1 Temporary traffic signals.

.2 Temporary signals shall have same general signalling sequence and indicator arrangement as permanent signals removed except as necessary to be compatible with construction operations.

.6 Install temporary signals in other areas as necessary to protect public and aid travel of construction vehicles. Such installation shall be approved by Employers Personnel and appropriate maintaining agency.

.7 Provide temporary type pavement markings on replacement pavement surfaces. Markings shall match existing marking patterns. Place markings on temporary bituminous pavements, base courses of bituminous final pavements to be left more than 3 days without applying final courses, and final bituminous and concrete pavement surfaces.

.8 Protect drop off greater than 8 cm, but less than 16 cm within 2.5 m of pavement edge by barricades equipped with mono-directional steady burn lights at 15.5 m centre-to-centre spacing. If drop off within 2.5m of pavement edge exceeds 8 cm. but less than .6 m, barricades shall be placed at 7.6 m centre-to-centre spacing. Barricades placed in excavated areas shall have leg extensions installed such that top of barricade is in compliance with height requirements of Traffic Branch.

.9 Placement of signs and barricades shall proceed in direction of flow of traffic. Remove signs and barricades at end of construction area and proceed toward oncoming traffic unless otherwise approved by Employers Personnel.

.7 Specific Traffic Control Measures

.1 Plan and implement well graded, gravelled detours or temporary roads for all main roads; including

.1 Solomon Hochoy Highway

.2 San Fernando By Pass

.3 South Trunk Road

.4 Southern Main Road

.5 Lady Hailles

.6 Naparima-Mayaro

.7 Tarouba Link Road

.8 Guaracara-Tabaquite Road

.9 Union Hall Road

.10 Cipero Road

.11 Manahambre Road

.12 Dumfries Road

.13 Palmiste Blvd

.14 San Fernando Siparia Erin Road

.2 Detours must be suitable for service vehicles. The design vehicle to be used to plan, construct or reconstruct detour routes is a bus with the following physical characteristics:

Length:	9.15 m
Maximum Width:	2.44 m
Front of Bus to Front axle:	1.825 m
Axle to axle:	4.312 m
Rear axle to rear of bus:	2.634 m
Internal Turning Circle Right rear wheel/ Right front wheel:	34.92 m
Passengers:	64
Gross Weight:	10,980 kg
Tare Weight:	7,020 kg

.3 Turning capacity at corners on all proposed detour routes shall be according to the AASHTO design vehicle template No. B10 (10 m bus).

.1 Some of the modifications or improvements may include but not necessarily limited to the following:

.1 Widening of roadways.

.2 Overhead utility relocations.

.3 Improving turning radii at junctions.

.4 Visibility improvements at junctions.

.5 Modify or improve traffic flow patterns, signing etc.

.6 Temporary strengthening of roadway surface for detour use.

.7 Infrastructure reinstatement.

.8 Temporary easement or land acquisition requirements for new detour roads.

.4 On other roads where there is access from both ends, maintain local access from both ends at all times during construction.

.5 In areas where only single access exists, maintain this access to the degree possible during construction. If road closure is unavoidable, restrict to between the hours of 8:00 a.m. and 5:00 p.m.

.6 On residential streets and cul-de-sacs maintain access and/or parking between the hours of 5:00 p.m. and 8:00 a.m.

.8 During Working Hours:

.1 2-Lane Streets: One lane continuously open in alternating directions controlled by flagpersons; or restricted to 1-way travel in normal travel direction of open lane.

.2 Multi-lane Streets: One lane continuously open in each direction.

.3 Back lanes: Closed to through traffic; open to adjoining property to maximum practical extent.

.4 Driveways: Open to maximum practical extent. Maximum duration of closure - 4 hrs.

.5 Sidewalks and Cross-Walks: Open to maximum practical extent.

.9 During Nonworking Hours:

.1 2-Lane Streets: One lane continuously open restricted to 1-way travel in normal travel direction of open lane.

.2 Multi-lane Streets: One lane open in each direction.

.3 Back lanes: Open, 1-way travel restriction permitted.

.4 Driveways: Open.

.5 Sidewalks and Cross-Walks: Open.

3.4 Pedestrian Traffic Control

.1 Protect pedestrians and residents from construction operations and vehicular traffic traveling through construction area.

.2 Stockpile materials so as not to block streets, back lanes, drives, sidewalks, and cross-walks. Grade backfilled trenches uniformly and install temporary pavements as required to permit safe crossing by vehicles. Install bridging and handrails where necessary for safe passage by pedestrians over sewer trenches or other disturbed surfaces.

.3 Provide and maintain pedestrian access along roadways to allow the public to safely pass by the immediate construction zone. Maintain temporary access to all properties at all times during construction.

3.5 Traffic Control for Contractor's Equipment

.1 Where equipment enters or leaves public roadways, provide warning signs or barricades. In moderate and high vehicular traffic volume areas, provide flagpersons or temporary traffic signals to control traffic and aid travel of construction equipment. In moderate or high pedestrian traffic areas, provide flagpersons to control traffic.

.2 When travelling in lanes open to public traffic, Contractor's vehicles shall always move with, not against or across flow of traffic. Vehicles shall enter or leave work areas in manner which will not be hazardous to, or interfere with, traffic and shall not park or stop except within designated work areas. Keep equipment units as close together as working conditions will permit and preferably on same side of travelled way.

.3 Personal vehicles shall not park within right-or-way except in areas approved by Employers Personnel.

.4 Do not leave equipment on travelled way overnight.

3.6 Informational and Warning Devices

.1 Provide and maintain signs and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Work which may require road user response.

.2 Supply and erect signs, delineators, barricades and miscellaneous warning devices as specified in applicable regulations.

.3 Place signs and other devices in locations recommended in applicable regulations.

.4 Meet with the Engineer prior to commencement of Work to prepare list of signs and other devices required for project.

.5 Continually maintain traffic control devices in use by:

.1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.

.2 Removing or covering signs which do not apply to conditions existing from day to day.

3.7 Contractor's Responsibilities and Construction Practices

.1 Assume overall responsibility for developing plans, obtaining approvals and implementing the appropriate traffic control measures. Assign a Traffic Manager to represent the Contractor.

.2 Arrange and lead Traffic Control Committee meetings. Record and distribute the minutes of the meeting to all parties concerned.

.3 Inform the Engineer at least 5 working days in advance of the need for review or approval of any implementation plan or proposed revision of any approved plan and arrange for a meeting of the Traffic Control Committee.

.4 Coordinate construction forces to avoid any unnecessary delays and to ensure that the desired measures comply with the framework stipulated by the Traffic Control Committee and this Section.

.5 Provide all necessary information to Engineer at scheduled meetings and directly on regular basis when deviation from plan occurs.

.6 Provide all necessary labour, equipment, tools, materials, temporary traffic control signals and whatever other devices and measures are necessary to successfully implement the approved plan, including the distribution of information notices to affected individual residents/properties at least two weeks and no greater than four weeks in advance of construction on any street.

.7 Perform all work necessary to implement the approved traffic diversions and other management strategies in accordance with the requirements of the Regulatory Authorities having jurisdiction. Include in this work the necessary road reconstruction, upgrading and/or signing required along detour routes to enable them to handle the anticipated traffic flows. Repair damage to roads used for detours.

.8 Construct sewer mains according to but not necessarily limited to the following:

.1 On main roads listed in 3.3.7.1, major thoroughfares and local collector roads respectively, the length of open trench is limited to 15 m ahead and 15 m behind pipe laying. Do not leave any pipe trench open at the end of working hours. Manhole excavations shall be open for no more than 24 hours.

.2 On all other roads and lanes, the length of open trench is limited to 30 m ahead and 30 m behind pipelaying. No more than 10 m of open trench to be left at end of working hours.

.3 Provide lighted barricades or temporary steel traffic covers for any excavations left open overnight.

.4 All fencing, barricades and covers shall be subject to the approval of the Engineer, shall comply with specifications outlined in 01530 and shall be designed for the purpose intended. Light weight barriers will not be approved to protect open excavations with adjacent vehicular traffic.

.5 On main roads listed in 3.3.7.1 place temporary reinstatement within one week of laying any section between manholes.

.6 On all other roads and lanes, temporary reinstatement to be placed within two weeks of pipe installation.

.7 Provide and maintain temporary parking facilities for vehicles in residential areas where construction inhibits access to existing parking.

.8 Provide temporary parking facilities for employees so as not to obstruct the construction zone and the flow of the vehicular and pedestrian traffic.

.9 Provide and maintain dust control in the construction area and along any approved traffic diversion route or temporary parking area.

3.8 Engineer's Responsibility

.1 Attend all Traffic Control Committee meetings and review the proposed implementation plans.

.2 Inspect all traffic control measures to ensure compliance. Immediately inform Contractor of any substandard measures or deviations from the approved plan.

.3 Liaise with the Employer and the appropriate Authorities during construction upon being informed by the Contractor of any pending deviations or requested modifications to the plan.

.4 Liaise with the Contractor during construction and inform him of any requests, complaints or other problems that arise.

.5 Mediate any disputes that arise as result of traffic problems and control measures between the Contractor, the Employer and any Regulatory Authority.

3.9 Employer's Responsibility

.1 To attend all Traffic Control Committee meetings, review the Contractor's methods proposed and approve the accepted implementation plan.

.2 Obtain all necessary statutory instruments required to implement the Contractor's approved plan.

.3 Give authority to Engineer to contact Regulatory Agency directly or otherwise inform the Regulatory Authorities of any traffic situation that requires their immediate review or action upon request by Contractor or Engineer.

.4 Engage a Public Relations Officer (PRO) to work in close conjunction with the Traffic Control Committee. This Public Relations Officer has already issued various general information bulletins to the general public and the media regarding the Project.

.5 Ongoing responsibilities of the PRO will include:

.1 Preparation of a leaflet for the Contractor to distribute two weeks prior to construction on any street.

.2 Attend all traffic control meetings in order to gather all the necessary information necessary to generate public pronouncements.

.3 Develop and coordinate a media campaign to apprise the affected residents and commercial establishments of all upcoming work and progress of ongoing work.

.4 Act as a contact for public inquiries and complaints during the Work.

.5 Arrange and lead public meetings, as necessary, to inform the residents of the upcoming work.

3.10 Alternative Responsibility Distribution

.1 The Employer may elect to require the Contractor to take responsibility for the following tasks:

.1 Preparation and distribution of information leaflets to affected property owners and residents on a street by street basis at least two weeks and no more than four weeks in advance of construction on any street.

.2 Preparation and distribution of media releases and notices to residents and business as necessary describing upcoming road closures and detours, at least two weeks and no more than four weeks in advance of any such closures.

.3 To facilitate these activities the Contractor may be required to assign a representative who will be assigned <u>full time</u> to public relations activities and who will be located in the Employer’s Public Relations Office.

.4 This role is in addition to the normal public relations activities and staffing which it is expected the Contractor would normally assign to deal with day to day matters during the course of the Work.

.5 All documentation for public distribution to be prepared by the Contractor will be subject to the review and approval of the Engineer of the Employer.

3.11 Other Regulatory Authorities Responsibilities

.1 Attend Traffic Control Committee meetings as requested by the Contractor or Engineer.

.2 Review and approve Contractor's plan for traffic control, as it affects their jurisdiction.

END OF SECTION

Appendix G

Impact Assessment and Mitigation Measures

G.3 Safety Policy Information

AECOM

SAFETY, HEALTH, AND ENVIRONMENTAL GUIDING PRINCIPLES

To help all employees understand and implement the AECOM Safety, Health and Environmental (SH&E) Policy and achieve the vision of our Safety Core Value, AECOM Senior Executives have established the following SH&E Guiding Principles.

Risk Management
We will only undertake activities that we have evaluated thoroughly from an SH&E risk standpoint. Where risks are identified, we will develop and implement appropriate mitigation strategies to reduce the possibility of injuring people, damaging property, or impairing the environment.

Resources
We will provide the necessary human, financial and material resources to implement, maintain and monitor the AECOM SH&E Program.

Leadership
Management will be directly involved in the SH&E program. All supervisors will lead by example and through appropriate decision-making.

Compliance
We will comply with all relevant and applicable rules and regulations pertaining to SH&E issues as well as those voluntary requirements to which we subscribe.

Involvement
All employees will be encouraged to provide continual feedback on the effectiveness of our existing programs and to provide recommendations for the development of new ones that can advance our SH&E program.

Sustainability
We will promote environmental sustainability through the efficient use of energy, conservation of natural resources, and prevention of pollution through reuse, recycling, and reduction whenever practical throughout our company.

Training
We will provide thorough and effective training programs to employees. Our management teams will evaluate the training needs for all projects and only assign competent personnel.

Industry Leaders
We will work with clients, partners, suppliers, competitors and regulators to raise the SH&E standards of our industry.

Work With Others
We will assess the competencies and capabilities of our subcontractors prior to selecting them and hold them accountable to the same high standards we have for AECOM. We will also monitor the implementation of our subcontractors' SH&E programs while they work on our projects.

Performance
We will establish short and long-term performance goals relative to SH&E. We will report regularly on our progress to our employees and other stakeholders.

Assessment
We will routinely assess our programs at corporate, business line, region and individual project levels to enable continual improvement of our programs and systems.

Reporting
Every employee will report any occupational injury, illness, environmental release, near-miss incident and property damage incident in a timely, open and thorough manner. Information gained from this reporting will be used to enhance our ability to prevent future incidents.

Safety, Health and Environmental Policy Statement

AECOM

PURPOSE

The purpose of this policy is to:

- Establish and maintain a framework for a safe and healthy workplace for all AECOM employees and minimize our impact on the environment
- Outline expectations relative to compliance with governing occupational safety, health and environmental legislation

COMMITMENT

AECOM is committed to protecting the safety and health of our employees and meeting our obligations with respect to the protection of others affected by our activities. We are also committed to protecting and preserving the natural environment in which we operate. We will actively seek to conserve energy, water and natural resources and to recycle and reduce waste where appropriate during the execution of our business activities. We will be good corporate citizens by striving to ensure that our facilities and operations do not pose unreasonable safety or environmental risks, and by participating in community-related activities that promote excellence in safety, health and environmental practices. In all of our activities we will develop and implement appropriate systems and procedures designed to comply with applicable laws, legislation, licensing requirements and stakeholder expectations. AECOM will plan and design its processes, facilities and projects in a manner that reduces risks and impacts during their entire life cycle, consistent with the direction and objectives of our clients.

OBJECTIVES

Our ultimate goals are simple and are derived from AECOM's Core Values:

- Prevent work-related injuries or illnesses
- Prevent damage to property and/or equipment from our activities
- Prevent adverse impacts to the environment from our ongoing projects or operations

IMPLEMENTATION

In order to guide the implementation efforts required by this policy, the **Group Chief Executives, Business Line Leaders** and **Regional Leaders** will collaborate to establish Safety, Health and Environmental (SH&E) programs that:

- Embrace the AECOM SH&E Guiding Principles and this policy statement
- Comply with all applicable safety, health and environmental rules and regulations at the local, state, provincial and national level
- Meet client requirements
- Where no specific regulation exists, comply with AECOM standards and appropriate industry practices
- Report on performance relative to short- and long-term SH&E metrics designed to help achieve established goals
- Consult with, listen to, and respond to employees, customers and partners in order to continuously improve their SH&E performance. The establishment of formal SH&E committees, with documented charters, is recognized as an effective tool for this purpose
- Recognize those who contribute to their improved SH&E performance

AECOM EMPLOYEE RESPONSIBILITIES

All employees will be responsible for:

- Conducting themselves in accordance with directives, standards and procedures established by the applicable SH&E program
- Temporarily suspending their personal work activities and requesting guidance from their supervisor before continuing a task when they identify a condition or practice that creates a serious safety, health or environmental risk
- Immediately reporting safety, health and/or environmental incidents to their supervisor

POLICY REVIEW

This policy will be formally reviewed annually. However, if substantial changes occur in legislation, organization and/or other business drivers, changes may be made on an interim basis.

COMMUNICATION

This policy is to be displayed prominently in all permanent and temporary offices of AECOM where employee information is normally communicated. An electronic version will also be posted on the AECOM intranet.

A copy of this policy will be provided to entities working for, or on behalf of, AECOM and will also be made available to other stakeholders upon request.

Signature:

John M. Dionisio
President and CEO

John M. Dionisio

Date: April 13, 2009

Appendix G

Impact Assessment and Mitigation Measures

G.4 WASA Safety and Health Policy Statement

Appendix G.4 – WASA Safety and Health Policy Statement

The Board of Commissioners and Management of the Water and Sewerage Authority is committed to ensuring the safety, health and welfare of its employees, trainees, contractors, visitors and members of the general public who may be affected by its operations. Our commitment extends to providing a work environment where safety and health are factored into every task and based on the principle that all injuries and occupational illnesses can be prevented.

On this premise, the Authority shall not in any way sacrifice nor compromise the safety and health of the employees or any other person, nor the security of any structure or property in the due performance of its duties as a service provider. It shall strive continuously to develop and sustain a positive safety culture by accepting that high standards of safety, health and environment management are achievable as part of a long term strategy formulated by the Authority.

The Authority will establish strict policies and procedures which must be observed and followed by all individuals to ensure safety of people and property in work-related activities and it is the principal responsibility of management at all levels to ensure conformity with these standards and guidelines. The Chief Executive Officer shall be responsible for the implementation of this policy.

In pursuit of the policy the Executive Management commits itself to:

- Demonstrate leadership and commitment to the safety, health and welfare of employees.
- Provide adequate/appropriate resources for the management of the safety, health and welfare of employees.
- Establish a Joint Health and Safety Committee (JHSC) comprising representatives of management and trade unions to co-manage the safety, health and welfare of employees.
- Comply with national safety and health laws, regulations and standards.

- Develop aggressive inspection programmes and execute company-wide safety and health audits to identify compliance gaps and to assess the effectiveness of the Authority's Safety and Health Management System.
- Execute timely and effective remedial works affecting safety and health.
- Develop relevant training programmes in support of this policy.
- Develop communication and consultation procedures aimed at gaining support of all employees and stakeholders to foster a positive safety culture
- Assess all safety and health risks in the organization and develop appropriate controls, and monitoring systems.
- Achieve hazard and risk control systems through the adoption and/or adaptation of modern designs and effective purchasing policies.
- Ensure that all employees trained in recognition/evaluation/control of hazards
- Ensure that contractors, consultants and others who provide services on the Authority's behalf comply with all safety and health standards/guidelines.
- Co-operate with government and non-governmental organizations, industrial groups and others involved in safety, health and environmental issues.

The success of this policy hinges on the involvement and full co-operation of all employees who are expected to adhere to safe work practices, safety standards and guidelines. Additionally, employees must report all accidents, incidents and near misses to their supervisors/managers and refrain from misuse, damage or interference with any item/s provided for the purpose of occupational safety and health.

This policy shall be reviewed and revised as required to ensure its relevance and effectiveness. Management shall provide the necessary resources to the Joint Health and Safety Committee to facilitate these reviews.

Appendix H

Environmental Monitoring and Management

Appendix H

Environmental Monitoring and Management

H.1 Environmental and Aesthetic Protection Specification

ENVIRONMENTAL AND AESTHETIC PROECTION

1. GENERAL

1.1 Summary

.1 Contractor, in executing Work, shall maintain Work areas on- and off-site free from environmental pollution that would be in violation of these contract documents and local regulations.

.2 Perform work in accordance with the Environmental Management Act and governing regulations of the relevant environmental management and protection authorities having jurisdiction, including but not limited to the Environmental Management Authority (EMA), Town & Country Planning Division (TCPD), the Ministry of Planning, Housing and the Environment, Ministry of Health, Ministry of Agriculture, Ministry of Works and Transport, Ministry of Local Government and other environmental protection agencies.

.3 Horizontal directional drilling (HDD) and microtunnelling has been chosen by the Employer for construction of sections of the collection system, to the degree possible, to minimize traffic disruption and habitat destruction. All other areas apart from these sections; open cut construction techniques are to be employed by the Contractor.

1.2 Environmental Management Plan and Construction Mitigation Strategy

.1 Prepare and submit a draft Environmental Management Plan (EMP) and Construction Mitigation Strategy (CMS) at the Pre-construction meeting. The EMP/ CMS is to identify various environmental concerns that may be adversely impacted by the construction or the works. The EMP/ CMS is to outline the steps the Contractor intends to take to mitigate these impacts so as to minimize any adverse impacts on the delicate ecosystem.

.2 This EMP/ CMS is to be reviewed and approved by the Engineer prior to commencing any construction activities.

1.3 Site Clearing and Plant Protection

.1 Protect trees and plants on site and adjacent property where designated to stay.

.2 Do not remove any trees without approval of the Town and Country Planning Division, Forestry Division, and State Lands.

.3 Protect roots of trees designated to remain to dripline during excavation and site grading to prevent disturbance or damage.

.4 Minimize stripping of topsoil and vegetation.

1.4 Archeological Significant Site

.1 Prior to commencement of on-shore excavation activities the contractor is to meet with the Archeological Committee, the Engineer and the Employer's representative to establish procedures for excavation works.

.2 The contractor is to use every precaution during on-shore excavation work and notify the Engineer immediately upon discovery of an artifact or archeological find.

1.5 Drainage

.1 Prevent construction material, pavement, concrete, earth or other debris from entering existing drains and drainage courses.

.2 Disposal of any construction materials or debris from runoff into any watercourses including the Cipero, Guaracara, Vistabella or Marabella Rivers is strictly forbidden.

.3 Provide holding ponds or approved method which will divert flows, including storm flows and flows created by construction activity, to prevent silting of waterways, flooding damage to property, or discharge to the rivers.

.4 Do not dispose of water containing suspended material (greater than 30 mg/L) into waterways.

1.6 Erosion and Sediment Control

.1 Apply appropriate soil conservation measures to protect project area and adjacent lands. These measures may include, but not be limited to, mulching, rapid growth vegetation, fabric mat, hay bales, filter barriers, sediment traps, and basins.

.2 Select methods of erosion and sediment control for specific job site.

  .1 Adjust sediment control measures in field to meet conditions encountered.

.3 Prepare and submit erosion control plan to Engineer. Plan shall include:

  .1 Limits of disturbance.

  .2 Types(s) of stabilization to be used.

  .3 Existing and proposed culverts, storm drains, and outfalls.

  .4 Location of stabilized construction entrance.

  .5 Location of proposed sediment control measures.

.6 Details of sediment traps and basins and other sediment control measures.

.7 Sequence of construction as it relates to installation, phasing, and removal of sediment control measures.

.4 Provide erosion control measures, in place, before commencing work on project site.

.1 Maintain erosion control measures during the course of construction.

.2 Remove any temporary erosion control measures upon completion of constuction.

1.7 Disposal of Excess Excavated Materials

.1 Excess excavated material not required or not suitable for backfill and other waste material shall be disposed of off-site to an approved disposal site.

.2 Provide watertight conveyance for liquid, semi-liquid or saturated solids which tend to bleed during transport. Liquid loss from transported materials is not permitted, whether being delivered to construction site, hauled to designated spoils area, or hauled away for disposal. Fluid materials hauled for disposal must be specifically acceptable at selected disposal site.

1.8 Disposal of Construction Waste and Debris

.1 All garbage and debris generated on- and off-shore shall be stored and handled in a manner acceptable to the Engineer and in compliance with the Ministry of Local Government Refuse Collection and Disposal Regulations of Trinidad and Tobago.

.2 Do not bury rubbish and waste materials on site.

.3 Do not dump rubbish or debris into any watercourses or water bodies.

.4 Remove all construction waste from the site and dispose at a designated, approved waste landfill on a regular basis or as directed by the Engineer. Waste sites for this project shall be designated by the Ministry of Health.

.5 Provide garbage containers on site and for domestic garbage generated by Contractor’s and Engineer’s personnel and make arrangements for collection and disposal on a regular basis or when directed by the Engineer.

.6 Maintain the site in a tidy condition, free from the accumulation of waste products, debris and litter.

.7 Do not dispose, or allow to be disposed, waste or volatile materials such as mineral spirits, oil, paint, or paint thinners into any waterway, drain or sewer.

.8 Used oil, filter and grease cartridges, lubrication containers and other products of equipment maintenance shall be collected and disposed of at a location approved by the Ministry of Health. Settled oil can be disposed of at the Petrotrin oil refinery.

1.9 Fires

.1 Do not burn trash or grubbed material on construction sites.

1.10 Use of Chemicals

.1 Drilling fluids for use in directional drilling to be approved by the Engineer prior to commencement of drilling activities.

.2 Other chemicals used during project construction or furnished for project operation, whether disinfectant, polymer, reactant or of other classification, shall be approved by the appropriate governmental agency prior to use.

1.11 Fuels and Lubricants

.1 If required, obtain permit for on-site storage of fuel or other inflammable liquids. Observe all restrictions and conditions imposed by the permit regarding special protection and berming to control spills and tank damage; fire protection considerations; provisions for disposal of failed material and used petroleum products.

.2 Fuel storage area and fuel equipment shall be approved by the Engineer and Trinidad & Tobago Fire Service prior to installation. Submit containment provisions to Engineer for approval.

.3 Report spills or leaks from fueling equipment or construction equipment/ vessels to Engineer and local authorities and cleanup as required.

.4 Employer may require Contractor to remove damaged or leaking equipment from Project site.

.5 Used fuels and lubricants to be disposed of according to Section 1.8.8.

1.12 Noise Control

.1 Conduct operations to cause least annoyance to residents in vicinity of Work, and comply with applicable local ordinances.

.2 Equip compressors, hoists, and other apparatus with mechanical devices necessary to minimize noise and dust. Equip compressors with silencers on intake lines.

.3 Equip gasoline or diesel-operated equipment with silencers or mufflers on intake and exhaust lines.

.4 Line storage bins and hoppers with material that will deaden sounds.

.5 Conduct operation of dumping materials and hauling slurry away in trucks so as to cause minimum of noise and dust.

.6 Route vehicles carrying rock, slurry, concrete or other material over such streets as will cause least annoyance to public and do not operate on public streets between hours of 6:00 p.m. and 7:00 a.m., or on Saturdays, Sundays or legal holidays unless approved by Employer.

1.13 Dust Control

.1 Take special care in providing and maintaining temporary site roadways, existing roads and utility roads used during construction operations in clean, dust free condition.

.2 Comply with local environmental regulations for dust control. If Contractor's dust control measures are considered inadequate by Engineer, Engineer may require Contractor to take additional dust control measures.

.3 Prevent sandblasting, blasting and other extraneous materials from contaminating air beyond application area by providing suitable, temporary enclosures or mats.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for access roads, temporary roads and on-site work as specified by the Engineer.

1.14 Site Access and Parking

.1 All site access and parking to be in compliance with Section 01570.

.2 Access to sewer construction site will be along designated road approved by the Engineer, the Ministry of Works and Transport and the Ministry of Local Government. Maintain these roads and repair any damage caused by construction activities to the satisfaction of the Engineer.

.3 Provide and maintain access road to Lift Station sites as indicated or approved by the Engineer.

.4 Restrict vehicle access to these roadways and within the confines of the site.

.5 Employee parking will be restricted on sewer construction site to designated areas off the main roads to avoid traffic congestion.

.6 Employee parking will be permitted on Lift Station sites.

1.15 Contractor's Operations

.1 Confine all operations to the work limits as stated or designated by the Engineer. No activities of any kind may be carried out beyond these work limits without written permission of the Engineer.

.2 Equipment maintenance shall only be carried out at the Contractor's main yard or where approved by the Engineer. Random use of the site for equipment oil changes and other servicing will not be permitted.

.3 Conduct operations at all times in such a manner as to preserve the natural features and vegetation in the area. Cut and fill slopes shall be blended with adjoining topography.

.4 When, in the opinion of the Engineer, negligence on the part of the Contractor results in damage or destruction of any waterways or surrounding land, its vegetation or other environmental features, the Contractor shall be responsible, at his expense, for complete restoration to the satisfaction of the Environmental Management Authority.

1.16 Contractor's Employee Briefing

.1 Conduct regular briefing sessions for all employees and subcontractor employees highlighting the requirements of this specification and the Environmental Management Plan and Construction Mitigation Strategy The personnel should also be instructed on operation of equipment; pollution and garbage management; vehicle access and parking; and care of the environment in the work area.

2. PRODUCTS (NOT USED)

3. EXECUTION (NOT USED)

END OF SECTION

Appendix H

Environmental Monitoring and Management

H.2 Waste Management

Appendix H.2 – Waste Management (County of San Mateo, 2010)

Category	Material	√	Reuse, Recycling or Disposal Facility
Mixed C&D	Mixed Debris		
Inerts	Asphalt		
	Bricks		
	Concrete		
	Dirt		
	Other Inert Solids		
Source Seperated	Cardboard		
	Metals		
	Wood		
	Roofing		
	Carpet		
	Drywall		
	Green Waste		
	Other		
Disposal	Waste		

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