Response to Review and Assessment Report Comments provided by letter dated 29 October 2010 CEC1597/2006 for the Establishment of a Regional wastewater Collection System and Treatment Plant for San Fernando and Environs

2.1 CRITICAL INFORMATION

Study Area - Use of GIS

EMA's Comment

Provide co-ordinates for (1) sampling points for baseline data (2) proposed monitoring stations/points (3) intended effluent discharge points (4) discharge points for existing and proposed drainage system.

Response to Comment

Co-ordinates are presented in the table below.

	Northing	Easting
Sampling points for baseline data		
Water quality (Figure 5-16)		
Guaracara River	1139996	668831
	1140018	673405
Marabella River	1138648	670837
	1139200	668884
Vistabella River	1137878	670968
	1138075	668610
Cipero River	1135460	672449
	1134613	670162
	1135025	667153
Ally's Creek	1134159	666652
Air and Noise (Figure 5-35)	1139414	670744
	1139364	669235
	1135079	667305
	1135155	669629
	1133673	666952
Terrestrial Fauna	Included in Figure 5-27	
Aquatic Fauna	Included in Table 5-14	
Soil	Included in Table 5-3	
Proposed monitoring stations/points		
Water Quality Monitoring Points - WWTP		
Upstream Cipero River	1134977	667658
Downstream Cipero River	1135054	667350
Air and Noise Monitoring Points		

	Northing	Easting
WWTP – to north, south, east and west of site	1135102 1135207 1135224 1135073	667170 667402 667307 667373
Collection system	Varies along construction site	Varies along construction site
Intended effluent discharge point	1135021	667087
Discharge points for existing drainage system		
Gulf View Development WWTP	1135017	667171
Marabella Secondary School WWTP	1138667	670995
Palmiste WWTP	1131436	667055
San F'do Tech Institute WWTP	1137793	670524
Sunkist WWTP	1132373	668923
Westpark WWTP	1137398	670292
Harmony Hall WWTP	1140191	671244
San Fernando WWTP	1135054	667350
Discharge points for proposed drainage system	1135054	667350

Description of Project

EMA's Comment

(1) Provide the total acreage of the proposed WWTP site, (2) Provide revised map of the WWTP site at a minimum scale of 1:10000 to facilitate easy comprehension, (3) Provide rationale for design flow criteria, (4) Provide data on current loads (flow) entering San Fernando and Harmony Hall WWTPs, (5) Provide expected base domestic flow, base commercial flow, base industrial component and base infiltration and inflow values.

Response to Comment

(1) Total area of the proposed WWTP site is 5 ha (12.3 acres).

(2) Revised map of the WWTP site is provided as **Attachment 1**.

(3) Rational for design flow criteria
The WWTP design flows are as summarized in the table below.

	Units	Value
Design Year	-	2035
Equivalent Population	pe	111,600
Unit ADWF	Lpcd	400
Design ADWF	ML/day	45.0
Dry Weather Peaking Factor (PDWF / ADWF)	-	2.0
PDWF	ML/d	90
Peaking Factor (PWWF / ADWF)	-	3.5
PWWF – (WWTP & Collection System)	ML/day	158

ADWF – Average dry weather flow
PDWF – peak dry weather flow
PWWF – Peak wet weather flow

The ADWF design of 45ML/d was based on a population equivalent of 111,600. This projected population was derived using:-

(i) Projected year 2000 population census data from CSO,
(ii) Housing counts from 2009 satellite imagery including vacant lots,
(iii) An average occupancy of 3.5 persons per dwelling unit,
(iv) An estimated annual growth rate of 1.2%,
(v) Data on new and proposed developments obtained from a variety of sources including WASA New Services, Town & Country Planning, Housing Development Corporation (HDC), UDECOTT, EMBD, Land Settlement Agency (LSA) and private developers,
(vi) Data from discussions with the regional corporations with respect to development plans.

(4) Current flow entering San Fernando and Harmony Hall WWTPs
The current average flow into the existing San Fernando WWTP is approximately 10 ML/d.
The current average flow into the existing Harmony Hall WWTP is approximately 1.4 ML/d.

(5) Base flow rates
The design was based on the following base flow rates as shown in the following table.

Base flow rates	
Base domestic flow	240 Lpcd
Base commercial flow	12 Lpcd
Base industrial component	28 Lpcd
Base infiltration and inflow values	120 Lpcd
Total	400 Lpcd

2.2 SUPPLEMENTARY INFORMATION

Description of Project

EMA's Comment

Provide justification for use of the sludge for agricultural purposes. Include any testing regime to ensure that sludge meets the requirements of international guidelines for agricultural use of bio-solids. Specify which international guideline(s) are being referenced and its applicability to this project.

Response to Comment

Land Application of Digested Sludge

The activated sludge secondary treatment system with its long solids retention time (SRT) in combination with the proposed aerobic digestion process is expected to produce 'Class B' biosolids as defined by the United States Environmental Protection Agency (USEPA) in 40 CFR Part 503. Class B biosolids can be used in land application including agriculture with site restrictions that limit crop harvesting, animal grazing and public access for a certain period of time after application of sludge to the land. The Part 503 regulations require that sewage sludge undergo pathogen reduction treatment prior to land application and must also meet vector attraction reduction requirements. The regulation protects public health and the environment through requirements designed to reduce the potential for contact with the pathogens in sewage sludge applied to the land. The regulation also provides limits for allowable metals concentrations in sludge. Extracts from the regulations pertaining to pathogen removal, vector attraction, metal concentration and site restrictions relating to the land application of the treated sludge are included below.

Sludge Testing

Since the aerobic digestion process being provided at the WWTP does not meet the prescribed hydraulic retention time at design conditions for pathogen destruction (40 days at 20°C), testing will be required to show concentrations to be less than two million CFU (or MPN) per gram of total solids stipulated for Class B biosolids. The Part 503 regulations describe a methodology to show acceptable vector attraction reduction using volatile suspended solids (VSS) reduction. As noted above, the combination of long SRT in the activated sludge system and the aerobic digestion is expected to reduce VSS sufficiently. It might be necessary to conduct the bench-scale tests at 30°C to 37°C for 40 days to show less than 17% VSS reduction (see table below). The regulations also stipulate monitoring of process requirements such as time, temperature, and pH. If the Class B designation cannot be achieved based on the testing described above, the dewatered cake solids would not be used for agricultural purposes and would need to be disposed in landfill or used for daily landfill cover.

Landfill disposal for sludge not meeting the Class B criteria, is in keeping with the Waste Management Plan for solid waste generated at the wastetwater plant during construction as well as during plant operation. The Waste Management Plan identified possible material generated during construction (included in Appendix H2 of the EIA) and described proper storage and handling of these wastes (outlined in Appendix H1 Section 1.8). Solid waste produced during the operation such as screenings and grit are also to be disposed at the designated landfill.

Metal Concentration Limits for Land Application

EPA PART 503 LAND APPLICATION POLLUTANT LIMITS[1]				
Pollutant	**Ceiling Concentration Limits[2] (mg/kg)**	**Cumulative Pollutant Loading Rates (kg/ha)**	**"High Quality" Pollutant Concentration Limits[3] (mg/kg)**	**Annual Pollutant Loading Rates (kg/ha/yr)**
Arsenic	75	41	41	2.0
Cadmium	85	39	39	1.9
Chromium	3,000	3,000	1,200	150
Copper	4,300	1,500	1,500	75
Lead	840	300	300	15
Mercury	57	17	17	0.85
Molybdenum	75	(Under Review)	(Under Review)	(Under Review)
Nickel	420	420	420	21
Selenium	100	100	36	5.0
Zinc	7,500	2,800	2,800	140
[1] All Values on a Dry Weight Basis		[2] Maximum Values	[3] Monthly Averages	

Site Use Restrictions for Class B Sludge

EPA PART 503 Site Use Restrictions for Class B Sludge	
1.	Food crops with harvested parts that touch the sewage sludge/soil mixture (e.g., melons, cucumbers) shall not be harvested for 14 months after application.
2.	Food crops with harvested parts below the soil surface (e.g. potatoes, carrots) shall not be harvested for 20 months after application if the sewage sludge is not incorporated for at least 4 months and shall not be harvested for 38 months after application if the sewage sludge is incorporated in less than 4 months.
3.	Food crops, feed crops, and fibre crops shall not be harvested for 30 days after sludge application.
4.	Animals shall not graze on a site for 30 days after sludge application.
5.	Turf shall not be harvested for one year after sewage application if the turf is placed on land with a high potential for public exposure.
6.	Public access to land with high potential for public exposure shall be restricted for one year after sewage sludge application.
7.	Public access to land with a low potential for public exposure shall be restricted for 30 days after sewage sludge application.

FEDERAL PART 503 BIOSOLIDS REGULATION PATHOGEN AND VECTOR ATTRACTION REDUCTION REQUIREMENTS		
PATHOGEN REQUIREMENTS		**VECTOR ATTRACTION REDUCTION REQUIREMENTS**
CLASS A	**CLASS B**	
1. Fecal Coliform <1,000 MPN/gr TS, or Salmonella <3 MPN/4 gr TS - In Addition - 1. Raise temperature of biosolids and maintain for an amount of time according to a time/temperature formula, or	1. Fecal coliform <2,000,000 MPN/gr TS, or	1. Anaerobic or aerobic digestion where mass of VSS reduced by 38% or more, or
	2. Fecal coliform <2,000,000 CFU/gr TS, or	2. Anaerobic digestion. If 38% VSS cannot be achieved, further digestion using bench scale unit at 30°C to 37°C for 40 days results in <17% VSS reduction, or
	3. Aerobic digestion for 40 days at 20°C or 60 days at 15°C, or	3. Aerobic digestion. If 38% VSS cannot be achieved, further digestion at 2% TSS using bench scale unit 20°C for 30 days results in <15% VSS reduction, or
2. Alkaline treatment. Raise pH above 12 for at 72 hours maintaining a temperature greater than 52°C for at least 12 hours. After the 72 hours, biosolids is to be air dried to over 50 percent TS, or	4. Air drying for 3 months. Two of three months air temperature >0°C, or	4. Aerobic digestion. SOUR <1.5 mg O_2/gr TS/hr at 20°C, or
3. Enteric viruses <1 PFU/4 gr TS and viable helminth ova <1/4 gr TS, or	5. Anaerobic digestion for 15 days at 35°C to 55°C or 60 days at 20°C, or	5. Composting or other aerobic process: temp. >40°C for 14 days with average temp. >45°C.
4. Composting. In-vessel or static aerated, maintain at 55°C for 72 hours. Windrow, maintain at 55°C for 15 days.	6. Composting at 40°C for 5 days maintaining 55°C for 4 hours during the 5 days, or	6. Alkaline stabilization. Raise pH to 12 and maintain pH at 12 for 2 hours and at least 11.5 for additional 22 hours, or
5. Heat drying. Reduce moisture <10 percent.	7. Lime stabilization. Raise pH to 12 for 2 hours, or	7.,8. Drying to 75% when there are no unstabilized primary biosolids and to 90% when unstabilized primary biosolids is included, or
6. Heat treatment. Liquid biosolids heated to 180°C for 30 minutes.	8. PSRP equivalent process.	9. Injection beneath soil surface. Class A biosolids must be injected within 8 hours of discharge from PFRP, or
7. Thermophilic aerobic digestion at 55°C to 60°C for 10 days.		10. Incorporation within 6 hours of application. Class A biosolids must be incorporated within 8 hours of discharge from PFRP.
8. Beta Ray or Gamma Ray irradiation.		11. Surface disposal daily cover. Sewage biosolids or domestic septage placed on a surface disposal site must be covered with soil or other material at the end of each day.
9. Pasteurization. Raise temperature to 70°C for 30 minutes.		12. Domestic septage treatment. Raise pH to 12 and without adding more alkali, pH remains above 12 for 30 minutes.
10. PFRP equivalent process.		
- Site restrictions placed on land applied Class B biosolids (see Table 3-3).		
- Biosolids must meet one of the pathogen requirements and a vector attraction reduction requirement. For Class A biosolids, vector attraction must be reduced simultaneously with or following pathogen reduction.		
Note: MPN - Most Probable Number, CFU - Colony Forming Unit, VSS - Volatile Solids, TS - Total Solids, PFU - Plaque Forming Unit, PSRP - Process to Significantly Reduce Pathogens, PFRP - Process to Further Reduce Pathogens.		

Analysis of Alternatives to the Proposed Project

EMA's Comment

The Report does not properly assess all the possible treatment alternatives. No comparison was made to the establishment of many smaller wastewater treatment plants as a possible treatment method, to ensure that any upset condition will not lead to significant untreated wastewater discharge.
Furthermore there were no comparisons of impacts associated with alternative disinfection methods such as ozonation, which research has shown is better capable of removing oestrogen-mimicking chemicals, than typical wastewater treatment processes (chlorination).
Also, the justification for the disinfection methods should be placed in the context of a water management plan regarding the water consumption needs of the southern region of the island of Trinidad.

Response to Comment

Treatment Alternatives
An assessment of the project area was carried out to determine the best technical and economical option to treat the wastewater. The options included directing all the flow to the San Fernando WWTP or to a combination of two regional plants.

The rational for a single plant was developed through the Master Plan and other previous studies done by WASA that divided the country into regions with one plant serving each region. With a single plant, WASA can focus their resources to ensure the plant performs satisfactorily and reduce the extent of mechanical equipment that requires regular maintenance. For San Fernando, however, the regional boundaries were previously not well defined and therefore the appropriateness of the alternative option for two or more plants had to be assessed.

The existing situation in the San Fernando project area is that the region is served by multiple plants. A number of these plants are either abandoned or dysfunctional due to a variety of reasons including inadequate design, poor construction, inadequate operation and inadequate maintenance.

It was determined that providing a single plant was the most appropriate since it was in keeping with the regional plant philosophy. Additionally, land availability/ land acquisition issues, location of suitable discharge points and the fact that the existing sewers all flow towards the existing San Fernando WWTP were all advantages to selecting a single plant. A single plant allowed for eliminating many existing pumping stations and this was in keeping with WASA's policy to reduce pumping and the amount of mechanical equipment within the regional systems. Therefore, from the evaluation, it was concluded that the most cost-effective and sustainable approach for wastewater collection and treatment would be to centralize all treatment at one location, rather than having two or more sub-regional plants.

Disinfection
Disinfection of the effluent is by UV light irradiation. In the selection of the disinfection system, there were several criteria considered during the evaluation process. The evaluation criteria are defined in the following table. The options evaluated for the disinfection process included chlorination, ultraviolet (UV) light irradiation as well as ozonation. The option for UV irradiation was considered the most technically and economically feasible for the disinfection of the secondary effluent. A major consideration of the selected option was WASA's familiarity with the process. Currently UV irradiation is provided to meet the disinfection requirements at the existing Beetham WWTP. UV disinfection has another advantage in that it can be easily upgraded to an advanced oxidation system by adding hydrogen peroxide. The advanced oxidation process has been shown to be effective in removing trace contaminants such as oestrogen-mimicking chemicals.

The plant is also provided with a chlorination system for disinfecting a small fraction of the effluent,which is used as the service water (W3) supply within the plant boundaries. Service water is used on site for

washdown and other non-potable applications. It is chlorinated before distributing around the plant site to keep the distribution system clean and to protect the health and safety of plant personnel.

Criteria for Evaluation

Criteria	Description
Technical	
Proven Reliability	Ability to reliably produce the required effluent quality, with an emphasis on being proven in Trinidad and Tobago.
Robustness	Ability to respond to varying conditions, such as shock loads.
Flexibility	Ability to respond to varying operational requirements, such as taking unit out of service, and redundancy requirements
Space Requirements	Footprint
Expandability	Ease with which the process can be modularized and expanded
Constructability	Ease of construction with an emphasis on the effects of construction on the existing operating plant.
Operational	
Ease of Operations	The ability of the process to be easily operated.
Ease of Maintenance	Refers to how equipment-intensive the process is.
Operator Safety	Predominantly refers to chemicals and chemical handling
Operator Environment	The working environment to which the operational staff are exposed
Economic Criteria	
Relative Construction Cost	Generic comparison of capital cost
Relative O&M Cost	Predominantly refers to electrical power costs and chemical costs

2.3 GENERAL COMMENTS

EMA's Comment

Provide a complete copy of the "WASA Water and Wastewater Design Guideline Manual".

Response to Comment

A complete electronic copy of the WASA Water and Wastewater Design Guideline Manual is included in pdf form as **Attachment 2**.

Attachment 1