TWAD BOARD

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

OF

UGSS TO KARAIKUDI MUNICIPALITY

Prepared by

HUBERT ENVIRO CARE SYSTEMS (P) LTD.
CHENNAI – 600 032
January 2020

SYMBOLS AND ABBREVIATION

TWAD	-	Tamil Nadu Water Supply and Drainage Board
km	-	Kilo meter
^{o}c	-	Degree Celsius
UGSS	-	Underground sewerage system
MLD	-	Million litre per day
STP	-	Sewage treatment plant
MoEF& CC	-	Ministry of environment, forest and climate change
Km^2	-	Square kilometre
ha	-	Hectare
TNUIFSL	-	Tamil Nadu urban infrastructure financial services
LS	-	Lifting station
PS	-	Pumping station
uPVC	-	Un – plasticized poly vinyl chloride
mm	-	Millimetre
m	-	Metre
DZ	-	Draining zone
MH	-	Man hole
SBR	-	Sequencing batch reactor
mg / l	-	Milligram per litre
m^3	-	Cubic metre
Kg / day	-	Kilogram per day
m^3 / hour	-	Cubic metre per hour
PCC	-	Power control centre
KWH	-	Kilowatt hour
KfW	-	Kreditanstalt fur wiederaufbau
HP	-	Horse power
BHP	-	Brake horse power
BKW	-	Brake kilo watt
ECSMF	-	Environmental, climate change and social management framework

PM	-	Particulate matter
SO_2	-	Sulphur dioxide
NO_x	-	Oxides of nitrogen
BOD	-	Biological oxygen demand
COD	-	Chemical oxygen demand
AAQ	-	Ambient air quality
GW	-	Ground water
µs / cm	-	Micro siemen per centimetre
MPN	-	Most probable number
DG	-	Diesel generator
dB	-	Decibel
ϕ	-	Diameter
SLD	-	Single line diagram
TEFC	-	Totally enclosed, fan closed
RCC	-	Reinforced cement concrete
XLPE	-	Cross linked poly ethylene

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

List of Annexure

EXECUTIVE SUMMARY

INTRODUCTION & PROJECT BACKGROUND

- Karaikudi Municipality is located at a distance of 80km from Madurai town(east). 30Km from Aranthangi(west), 34Km from Pudukottai (south). The town is located at latitude 10˚02'56.64" to 10˚ 06' 08.04"'N and longitude 78˚ 45' 34.49" to 78˚47'41.39"E. Average Elevation of the town is 82m (269 ft). As per 2011 census, the population of Karaikudi is 1,06,714.
- Males constitute 50.35% of the population and female constitute 49.65%. Karaikudi has an average literacy rate of 81.48%.
- Tamil Nadu Government made a policy announcement of providing Under Ground Sewerage Scheme in all urban local bodies in a phased manner at District head quarter towns. The Municipal Sewerage collection network systems are implemented and the household sewage are collected and moved to the collection chamber of STP.
- The STP consists of various unit operations and processes to treat the raw sewage into the final treated effluent quality as per the stipulated standards.
- The project will have construction phase and operation phase impacts which have been assessed and the Environment Impact Assessment has been prepared.

Existing Drainage System

- Karaikudi town does not have any underground sewerage scheme at Present. Individual septic tanks are in use for collecting the night soil from toilets. However the sullage water from kitchens, bathrooms, wash basins, cloth washing etc. is directly discharged into existing road side open drains.
- In places where economically weaker sections of the society reside, there are no septic tanks either and total waste water is discharged into road side open drains, resulting in large scale pollution of existing natural water courses i.e. major storm water drains. The discharge of raw sewage/effluent into storm water drains creates unhygienic conditions around drains, lake and posing serious hazard.

Need for the Project

- With the rapid growth of the population in Karaikudi town, the lack of proper drainage system and sewage treatment facility has become an ever – larger problem for public and from environmental point of view. Therefore, TamilNadu Government has decided to provide an Underground Sewerage Scheme with STP at Karaikudi to Devakottai road, near Rasta, Opposite to Solid waste dumping yard, Karaikudi as a part of urban development project for Karaikudi Municipality.

Project Proposal

- It is proposed to provide sewerage system for the entire Karaikudi Municipality with collection system network which will be treated in the sewage treatment plant proposed in Devakottai Road. The proposed sewerage system was designed for the targeted population of about 1,06,714 people (As per 2011 Census) and 1,10,030 People (Present Status). The project has the following components:
    - Sewerage network consisting of the main sewer line, branch sewer line and manholes;
    - Construction of sewage pumping station and
    - A Sewage Treatment Plant.
- For the purpose of sewage system the project area divided in to 2 parts. One is collection system including pumping station and other is sewage treatment plant.

Process Description

- The scheme involves
    - Laying of sewerage network for a total length of 1,51,525 m and construction of 5559 manholes.
    - Construction of one sewage pumping station inside STP campus.

➢ Construction of 16MLD Sewage Treatment Plantat Devakottai Road in an area of 5.81 acres. The technology proposed for STP is Extended Activated Sludge Process (EASP).

➢ The treated sewage from the Chlorine contact tank is let into the Thenar river.

- A 600 KVA DG will be provided as a standby source of power.
- The project cost is estimated to be Rs.112.53 crores.

Power Requirement

The power requirement during the operation of STP will be 750 KVA. DG sets are operated only during power failures and the D.G sets are proposed to provide 600 KVA as required suitable power backup to run the plant.

Environmental Regulatory Framework

The summary of applicable Clearance / NOC required for the proposed project is given in **Table 1.**

Table 1 Clearances / NOC Required from Competent Authority

S.No	Activity	Clearance/ NOC Required	Statutory Authority	Status
1	Land alienation for STP	Clearance for transfer of land to Karaikudi Municipality	District Collector Sivagangai	Alienation order issued in G.O.Ms.NO. 9/Revenue Dept/ Dt:10.01.2014 and the District Collector proceedings number Na.Ka.C 4/11927/2012 dt:12.06.2014
2	Establishment of Proposed STP	Consent To Establish under Air and Water Act	TNPCB	Obtained from TNPCB Vide Proceedings no:T1/TNPCB/F.0771SVG/RL/SVG/W/2018/ dated:25.06.2018 Proceedings no:T1/TNPCB/F.0771SVG/RL/SVG /A/2018/dated:25.06.2018
3	Operation of STP	Consent To Operate under Air and Water Act	TNPCB	To be obtained before operation of the project

S.No	Activity	Clearance/ NOC Required	Statutory Authority	Status
4	Disposal of Treated Sewage	No objection Certificate	PWD	Obtained on Vide Letter No. 11R/ F.66 (NOC) /2018 / JDO/dt 15.03.2018
5	Working of labour	Labour License Labour Insurance	Labour welfare board	Labour insurance Validity From 09/12/2019 to 08/06/2020

Baseline Environment Profile

A baseline survey has been conducted in and around the project site in **November 2016.**

S.No	Description	Baseline Parameters
1	Primary data- Collected from field	Water, Noise, Air, Soil, Flora, Fauna
2	Secondary data-Collected from various Departments	Social economic

The baseline data on Ambient Air, Water, Soil, Noise, Ecology and Socio Economic are given in Chapter 4 of the EIA report. All the baseline parameters on Ambient Air and Noise are under the prescribed limits.

Groundwater was sampled at 8 locations. TDS values were found to be from 360 – 660 mg/l and Total Hardness varied from 84 – 208 mg/l. This indicates that water in the study area were very hard in nature. Total alkalinity also varies from 82 to 132mg/L. The concentration of sodium in the studied samples varied from 15 to 65 mg/l. The chloride content in the studied area ranged from 31 - 136mg/l. The sulphate, nitrate and fluoride content in the ground water are found to be within the IS standards in all the samples.

Surface water was sampled at 5 locations. The pH value for all the samples in the study area during study period found to be within the limits. The Total Dissolved Solids ranges are varied between 434-760 mg/l. The sulphate content of the surface water meeting

the minimum range of 38 mg/l and maximum range of 68 mg/l. The chloride content for study area is ranges between 136 mg/l -222 mg/l.

Soil was sampled at 8 locations. The pH of the soil samples ranged from 7.68-8.43 indicating that the soils are almost neutral in nature. Conductivity of the soil samples ranged from 122-153 µS/cm. As the EC value is less than 2000 µS/cm, the soil is found to be non-saline in nature. The Moisture Content of the soil samples varied from 18.4 – 26.8 (%). Nitrogen content ranged from 0.36 to 0.46%. Phosphorous ranged from 0.28 to 0.82%. Potassium content ranges from 0.03 to 0.06 %

Environmental Impact Analysis and Management Plan

Mitigation Measures for Air Environment

a) Site clearance, excavation and earthmoving

The working area for the uprooting of shrubs or vegetation or for the removal of boulders or temporary or permanent structures shall be sprayed with water or a dust suppression chemical immediately before, during and immediately after the operation so as to maintain the entire surface wet.

b) Access road

Every main road shall be paved with concrete, bituminous materials, hardcore or metal plates, and kept clear of dusty materials; or sprayed with water or a dust suppression chemical so as to maintain the entire road surface wet.

c) Construction equipments

- All machineries to be used for construction purpose will be of highest standard of reputed make and compliance of noise pollution control norms by these equipments will be emphasized by company.
- Transport vehicles and construction equipments / machineries will be properly maintained to reduce air emissions.
- Equipments will be periodically checked for pollutant emissions against stipulated norms.

- Exhaust vent of DG set will be kept at proper height to ensure quick dispersal of gaseous emissions.

d) Excavation and earth moving

- The working area of any excavation or earth moving operation should be sprayed with water or a dusty suppression chemical immediately before, during and immediately after the operation, so as to maintain the entire surface wet.

e) Stock Piles

- All loose material either stocked or transported shall be provided with suitable covering such as tarpaulin, etc.,
- Water sprinkling shall be done at the location where dust generation is anticipated.
- Over Burden (OB) waste dumps shall be sprayed with water as they are major sources of air borne particulate matter/dust.
- OB waste dumps shall be reclaimed / afforested to bind the loose soil and to prevent soil erosion.

f) DG Set

- D.G. set should be placed in an acoustic enclosure.
- D.G. set should be placed on the wooden platform to minimize the vibration.
- The green belt development will also help in reducing noise levels in the campus.
- Any generator to be installed at the site shall meet the guidelines as laid down by Central Pollution Control Board.

Mitigation Measures for Noise Environment

- Construction activities that will generate disturbing sounds should be restricted to normal working hours.
- Workers operating equipment that generates noise should be equipped with noise protection gear. Workers operating equipment generating noise levels greater than 80 dB (A) continuously for 8 hours or more should use earmuffs. Workers experiencing prolonged noise levels of 70 – 80 dB (A) should wear earplugs.

- The construction activities will be restricted to the daytime and no construction will be planned during night.
- To reduce the impact of air and noise pollution and to provide a clean, healthy environment, it has been proposed to create and maintain a green belt within the site and along the roadsides.

Mitigation Measures for Water Environment

- Excavation to be avoided during monsoon season.
- Check dams shall be provided to prevent construction runoff from the site to the surrounding water bodies.
- Pit latrines and community toilets with temporary soak pits and septic tanks shall be constructed on the site during construction phase to prevent wastewater from entering the ground water or surrounding water bodies.
- To prevent surface and ground water contamination by oil/grease, leak proof containers shall be used for storage and transportation of oil/grease.

Mitigation Measures for Land Environment

- The soil will be collected separately and preserved in stacks with side slopes not exceeding 1:5. The topsoil (soil on the top 15 cm patch) will be preserved separately in a stack covered by tarpaulin. Efforts will be made to reinstate the soil for backfilling purposes. Topsoil will be reused for horticultural areas.
- The spillage of oil from the machinery or cement residue from concrete mixer plants might contaminate the soil if not properly collected and disposed off. Thus most stringent safety and construction management norm will be implemented at site.

Socio Economy

- Local people would also get job opportunities during construction and operation phases of the project. There is no issue of resettlement or rehabilitation as the proposed site belongs to the Municipality.

- The project will provide more than 100 Employment opportunities in Construction Phase.
- Constructional phase of the project will lead to air pollution, noise pollution in their respective areas. Dust problem will arise which may affect some people.

Health and Safety

- Construction related activities will be confined only to project site area, hence no health related impact are envisaged within the project influenced area during the construction stage and will be limited to occupant levels.
- At the project site much direct exposure to dust generation and high noise generation sources likely to cause occupant health related impact such as asthma, bronchitis and noise induced hearing loss etc. on the construction workers.

In order to offset such effects, proper drinking water, sanitation and first aid facility will be provided at the construction site, with trained shift supervisors, which will ensure minimum adverse occupational health impacts on the construction worker.

Training for Operation Staff

The staff will be trained for implementation of environmental mitigation measures and monitoring of various environmental quality parameters to perform the environmental management and monitoring and to implement the environmental monitoring plan. The environment specialist (consultant) will train the staff regarding record keeping procedures, sampling, testing, analysis and use of environmental monitoring equipments. They will also be briefed about prevailing environmental legislation and standards.

Facility for Workers

Basic facilities such as toilet, drinking water, electricity health, eye shower, first aid facility and safety gadgets, PPE (Safety Glasses, Splash-proof Goggles, Gloves, Hearing Protection, Safety Shoes or Boots and Respirators) for chemicals and sludge handling will be provided at Treatment Plant.

Rainwater Harvesting

Rainwater harvesting will be provided in STP premises for collecting and storing rainwater from rooftops and recharging ground water through pits.

Greenbelt Development

The main objective of the green belt is to provide a barrier between the source of pollution and the surrounding areas. The green belt helps to capture the emission and to attenuate the noise generated apart from improving the aesthetics. Development of green belt and other forms of greenery shall also prevent soil erosion and washing away of topsoil besides helping in stabilizing the functional ecosystem, make the climate more conducive and restore water balance. The area along the plant boundaries shall be used to plant various trees and shrubs. While making choice of plant species for cultivation in green belts, importance has to be given to the natural factor of bio-climate. It is also presumed that the selected plants will be grown as per normal horticultural (or forestry) practice given above and authorities responsible for plantation will also make adequate provision for watering and protection of the saplings. Total area of 8012 Sq.m is proposed for green belt development. The area is 15 to 20 m on each side of the proposed STP. Approximately, 575 trees can be grown in the area with a distance of 5 m between each tree. No. of saplings required would be around 570.

UNDERGROUND SEWERAGE SYSTEM FOR KARAIKUDI MUNCIPALITY

S.No	Description	Present Stage	Responsible agencies	Time frame
1	Land Issues for Pumping Stations and STP.	Construction started at pumping stations in own land of ULB	ULB / TWAD (Monitoring) / Concerned Departments & agency / Contractor	Before construction
2	Present stage of submitting general arrangements drawing	Approval from SE, TWAD was obtained for the layout plan and structural designs.	ULB / TWAD (Monitoring) / Concerned Departments & agency	Before construction

S.No	Description	Present Stage	Responsible agencies	Time frame
	and layout plan, structural designs for the STP site and stage of approval.		/ Contractor	
3	Permission for laying of pipelines	The sewer lines are proposed to be laid inside the premises, hence no permission is applicable.	ULB / TWAD (Monitoring) / Concerned Departments & agency / Contractor	Before construction
4	Consent to Establish from the Pollution Control Board	Consent to Establish obtained on 25.06.2018. Vide Proceedings no:T1/TNPCB/F.0771SVG/RL/SVG/W/2018 / dt.25.06.2018 Proceedings no:T1/TNPCB/F.0771SVG/RL/SVG/A/2018. / dt.25.06.2018	ULB / TWAD (Monitoring) / Concerned agency	Before construction
5	Consent to Operate from the Pollution Control Board	Consent to Operate will be obtained upon completion of construction work.	Contractor / TWAD	Before operation
6	Land for proposed STP	5.81 acres of land has been handed over to TWAD vide collector proceedings no. Roc. C4/11927/12 Dated:12.06.2014	TWAD / Contractor (Monitoring)	Before construction
7	Land for disposal of treated effluent	Thenar river is situated near the project site and permission obtained to let the effluent into the river. Vide Letter No.11R/F66(NOC) 2018/JDO/DT.15.03.2018.	TWAD /Contractor (Monitoring)	Before and during operation

Construction Phase Impacts & Mitigation Measures

S.No	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
1	Compensatory plantation of trees	1) The proposed site is a barren land and there are no trees at present. 2) There is no tree cutting hence there is no need of any compensatory plantation during the construction period.	Pre-construction and Construction	Contractor. Monitoring by TWAD
2	Protection of top soil & Environmental enhancing.	1. The top soil will be protected and compacted after completion of work. 2. Top soil from the STP area will be stored in stock piles and that will be used for gardening purposes at the STP site as an environmental enhancing measure.	During construction	Contractor. Monitoring by TWAD
3	Disposal of construction debris and excavated materials.	The construction debris and excavated materials will be disposed of to the low lying area which is identified and approved by the Municipality for the disposal. It will be taken care that the material does not affect natural drainage system.	During construction	Contractor. Monitoring by TWAD.
4	Pollution from Fuel and Lubricants	i. The contractor will ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refueling sites will be located at least 500 m from rivers and irrigation canal/ponds. ii. Proper stack height to be provided for DGs for proper dispersion of pollutants.	Construction and operation.	Contractor. Monitoring by TWAD.
5	Contamination of ground water quality	i. The treated sewage quality will ensure within the PCB standards for disposal in to Thenar river ii. The pipes inside the plant	During construction and operation	Contractor. Monitoring by TWAD

S.No	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
		premises will be made up of CI double flanged. The chlorinated treated sewage will disposed off to the nearest Thenar River by RCC pipes. iii. The treated sewage quality and also the ground water quality in the nearby areas will be regularly monitored and ensures within PCB standards. iv. Proper storm water drains to be provided along the STP to channelize the storm water.		
6	Water Pollution from Construction Wastes	The Contractor will take all precautionary measures to prevent the wastewater generated during construction from entering into streams, water bodies or the irrigation system.	During Construction	Contractor. Monitoring by TWAD
7	Impact of surrounding areas	**Odour:** Odour can be reduced or prevented through continuous process of the operation which can be ensured by the provision of D.G sets, regular maintenance of the operation units and greenbelt around the STP helps in controlling odour. The odour impacts to the community are expected to be minimal by providing the separation between the facility and the nearest adjacent property. Temporary odour impacts during construction are expected to be minimal and typical of construction odours. **Noise:** Installing the pumps underground and DG sets is provided by acoustic enclosures. Greenbelt around the STP helps	During Construction and Operation	Contractor. Monitoring by TWAD

S.No	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
		in controlling noise. Ear plugs will be provided for workers working in high noise areas.		
8	Informatory Signs and hoardings	The contractor will provide, erect and maintain informatory/safety signs, hoardings written in English and local language, wherever required or suggested by the Engineer.	During construction	Contractor
9	Risk from Electrical Equipment(s)	The Contractor will take all required precautions to prevent danger from electrical equipment and ensure that - i) No material shall be stacked or placed as to cause danger or inconvenience to any person or the public. ii) All necessary fencing and lights will be provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Engineer.	During construction	Contractor

S.No	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
10	Disposal of treated effluent.	i) The treated sewage quality will comply with the standards of TNPCB before letting into Thenar river. ii) Prevention of flooding in the disposal site by providing pipelines at an interval of 30m.	Pre-construction / construction and operation stage.	Contractor. Monitoring by TWAD.
11	Disposal of sludge	i) Sludge will be removed from the treatment plant. ii) The composted sludge will be used as manure at the disposal sites.	Pre-construction, construction and operation.	Contractor. Monitoring by TWAD
12	Labour camp & facilities	The contractor will guaranteed the following: i) The location, layout and basic facility provision of each labour camp will be submitted to Engineer prior to their construction. ii) The construction will commence only upon the written approval of the Engineer. iii) The Contractor will construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing. iv) Supply of sufficient quantity of potable water (as per IS) in every workplace/labor camp site at suitable and easily accessible places and regular maintenance of such facilities. v) The sewage system for the camp are designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place. Adequate water supply is provided in all toilets and urinals.	During Pre-construction and construction	Contractor. Monitoring by TWAD
13	Safety Aspects	i) Adequate precautions are taken to prevent the accidents	During construction	Contractor. Monitoring

		and from the machineries. ii) Protective footwear and protective goggles to all workers employed on mixing of materials like cement, concrete etc. ii) Welder's protective eye-shields will be provided to workers who are engaged in welding works. iv) Earplugs will be provided to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. v) Supply of safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc. are provided to workers and staffs by the contractor. The contractor complies with all the precautions as required for ensuring the safety of the workmen as per the International Labor Organization (ILO) Convention No. 62 as far as those are applicable to this contract. The contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered. The contractor will not employ any person below the age of 14 years for any work and no woman will be employed on the work of painting with products containing lead in any form.	& maintenance period.	by TWAD
14	First Aid	The contractor will arrange for the following : i) A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone	During construction & maintenance period.	Contractor. Monitoring by TWAD

		ii) Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital		
15	Institutional development & Environmental Training	i) The staff will be trained for implementation of environmental mitigation measures and monitoring of various environmental quality parameters to perform the environmental management and monitoring and to implement the environmental monitoring plan. ii) The environment specialist (consultant) will train the staff regarding record keeping procedures, sampling, testing, analysis and use of environmental monitoring equipments. iii) They will also be briefed about prevailing environmental legislation and standards.	During Operation & maintenance period	Contractor. Monitoring by TWAD

Sl.no	Activities	Management Measures	Time frame	Responsible agencies
	CONSTRUCTION STAGE			
2.	**Construction of Pumping station**			
2.1	Tree cutting	i) Try to save the trees by changing the alignment and provide adequate protection to the trees with tree guards as required. Such as Masonry tree guards, Low level RCC tree guards, Circular Iron Tree Guard with Bars, etc ii) Compensatory plantation of atleast twice the number trees felled should be done in line with competent authority guidelines	Pre-construction and Construction	PIA / Contractor
2.2	Storage of construction materials	Site for storage of construction materials to be identified, without affecting the near by the residents, traffic and other common utilities.	During construction	Contractor
2.3	Barricading site	The construction site should be barricaded at all time in a day with adequate marking, flags, reflectors etc. for safety of pedestrians	During construction	Contractor
2.4	Protection of residential / sensitive receptors.	i) Noisy construction operations in residential and sensitive areas should be done in between 7.30 am and 6.00 pm. ii) Preventive maintenance of construction equipment and vehicles to meet emission standards and to keep them with low noise. iii) Idling of delivery of vehicles will not be allowed at construction site. iv) Provision of enclosing generators and concrete mixers at site. v) Sound barriers in inhabited areas shall be installed during the construction phase.	During construction	Contractor

		vi) Adequate barricading / other measures to protect dust pollution near sensitive receptors like schools and hospital etc to be ensured.		
2.5	Disposal of silt / sludge	A suitable site should be identified for safe disposal of silt / sludge generated at the pumping / lifting station sites, which should be away from the water bodies, residential & sensitive areas, agricultural areas and etc., and got approved by the Engineer.	During construction and operation	PIA / Contractor / TWAD
2.6	Noise level	i) Noise screening by trees plantation scheme proposed as noise barriers. ii) Adequacy of measures shall be checked to control noise pollution. iii) Using of less noise generating machineries like submersible pumps at PS / LS sites to reduce the noise level. iv) Increase the height of compound wall of the PS/LS site. v) Collection well to be kept closed during the construction and operation period to avoid the accidents.	During construction	Contractor

Construction of Sewage Treatment Plant

S.No	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
1	Tree cutting &Compensatory plantation	1. The proposed site is a barren land and there are no trees at present. 2. There is no tree cutting hence there is no need of any compensatory plantation during the construction period.	Pre-construction and Construction	Contractor. Monitoring by TWAD
2	Protection of top soil	1. The top soil will be protected and compacted after	During	Contractor.

S.No	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
	& Environmental enhancing.	completion of work. 2. Top soil from the STP area will be stored in stock piles and that will be used for gardening purposes at the STP site as an environmental enhancing measure.	construction	Monitoring by TWAD
3	Disposal of construction debris and excavated materials.	The construction debris and excavated materials will be disposed off to the low lying area which is identified and approved by the Municipality for the disposal. It will be taken care that the material does not affect natural drainage system.	During construction	Contractor. Monitoring by TWAD.
4	Pollution from Fuel and Lubricants	1. The contractor will ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refueling sites will be located at least 500 m from rivers and irrigation canal/ponds. 2. Proper stack height to be provided for DGs for proper dispersion of pollutants.	Construction and operation.	Contractor. Monitoring by TWAD.
5	Contamination of ground water quality	1. The treated sewage quality will ensure within the PCB standards for disposal onto canal for irrigation use. 2. The pipes inside the plant premises will be made up of CI double flanged. The chlorinated sewage will disposed off to the Thenar River by RCC pipes. 3. The treated sewage quality and also the ground water quality in the nearby areas will be regularly monitored and ensured within PCB standards. 4. Proper storm water drains to be provided along the STP to channelize the storm water.	During construction and operation	Contractor. Monitoring by TWAD
6	Water Pollution from Construction Wastes	The Contractor will take all precautionary measures to prevent the wastewater generated during construction from entering into streams, water bodies or the irrigation system.	During Construction	Contractor. Monitoring by TWAD

S.No	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
7	Impact of surrounding areas	**Odour:** Odour can be reduced or prevented through continuous process of the operation which can be ensured by the provision of D.G sets, regular maintenance of the operation units and greenbelt around the STP helps in controlling odour. The odour impacts to the community are expected to be minimal by providing the separation between the facility and the nearest adjacent property. Temporary odour impacts during construction are expected to be minimal and typical of construction odours. **Noise:** Installing the pumps underground and DG sets is provided by acoustic enclosures. Greenbelt around the STP helps in controlling noise. Ear plugs will be provided for workers working in high noise areas.	During Construction and Operation	Contractor. Monitoring by TWAD
8	Informatory Signs and Hoardings	The contractor will provide, erect and maintain informatory/safety signs, hoardings written in English and local language, wherever required or suggested by the Engineer.	During construction	Contractor
9	Risk from Electrical Equipment(s)	The Contractor will take all required precautions to prevent danger from electrical equipment and ensure that - 1. No material shall be stacked or placed as to cause danger or inconvenience to any person or the public. 2. All necessary fencing and lights will be provided to protect the public in construction zones. 3. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Engineer.	During construction	Contractor
10	Disposal of treated effluent.	1. The treated sewage quality will comply with the standards of TNPCB before letting into Thenar river. 2. STP operations will take place only after Consent to Operate	Pre-construction / construction and operation stage.	Contractor. Monitoring by TWAD.

S.No	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
		is issued by TNPCB and treated sewage quality will meet the CPCB discharge standards 3. Performance standards will always be maintained, ensuring efficient working condition of treatment plant. 4. Prevention of flooding in the disposal site by providing pipelines at an interval of 30m.		
11	Disposal of sludge	1. Sludge will be removed from the treatment plant. The composted sludge will be used as manure at the disposal sites.	Pre-construction, construction and operation.	Contractor. Monitoring by TWAD
12	Labour camp & facilities	The contractor will guaranteed the following: 1. The location, layout and basic facility provision of each labour camp will be submitted to Engineer prior to their construction. 2. The construction will commence only upon the written approval of the Engineer. 3. The Contractor will construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing. 4. Supply of sufficient quantity of potable water (as per IS) in every workplace/labor camp site at suitable and easily accessible places and regular maintenance of such facilities. 5. The sewage system for the camp are designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place. Adequate water supply is provided in all toilets and urinals. 6.. Awareness about HIV/AIDS will be provided, grievance redressal mechanism for the camps.	During Pre-construction and construction	Contractor. Monitoring by TWAD

S.No	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
13	Safety Aspects	1. Adequate precautions are taken to prevent the accidents and from the machineries. 2. Protective footwear and protective goggles to all workers employed on mixing of materials like cement, concrete etc. 3. Welder's protective eye-shields will be provided to workers who are engaged in welding works. 4. Earplugs will be provided to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. 5. Supply of safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc. are provided to workers and staffs by the contractor. The contractor complies with all the precautions as required for ensuring the safety of the workmen as per the International Labor Organization (ILO) Convention No. 62 as far as those are applicable to this contract. The contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered. The contractor will not employ any person below the age of 14 years for any work and no woman will be employed on the work of painting with products containing lead in any form.	During construction & maintenance period.	Contractor. Monitoring by TWAD
14	First Aid	The contractor will arrange for the following : 1. A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone 2. Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital	During construction & maintenance period.	Contractor. Monitoring by TWAD

S.No	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
15	Institutional development & Environmental Training	1.The staff will be trained for implementation of environmental mitigation measures and monitoring of various environmental quality parameters to perform the environmental management and monitoring and to implement the environmental monitoring plan. 2. The environment specialist (consultant) will train the staff regarding record keeping procedures, sampling, testing, analysis and use of environmental monitoring equipments. 3. They will also be briefed about prevailing environmental legislation and standards.	During Operation & maintenance period	Contractor. Monitoring by TWAD

Environmental Enhancement measures

S.No	Environmental enhancement and special issues		Location	Implementing Agency
1	Flora and Fauna	The contractor will take reasonable precaution to prevent the workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. Clear instructions will be given to the workmen regarding the same. If any wild animal is found near the construction site at any point of time, the contractor will immediately upon discovery thereof acquaint the Engineer and carry out the Engineer's instructions for dealing with the same. The Engineer will report to the nearby forest office (range office or divisional office) and will take appropriate steps/ measures, if required in consultation with the forest officials.	Project area	Contractor
2	Chance Found Archaeological Property	All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site will be the property of the Government and be dealt with as per provisions of the relevant legislation. The contractor will take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. The contractor immediately upon identification thereof and before removal acquaint the Engineer of	Project area	Contractor

S.No	Environmental enhancement and special issues		Location	Implementing Agency
		such discovery and carry out the SC's instructions for dealing with the same, waiting which all work will be stopped. The Engineer will seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site.		
3	Monitoring of environment parameters	i) Monitoring of environment parameters are mentioned in **Table 6.1 & 6.2**. ii) Daily parameter of the effluent quality has to be monitored for which provisions have been made for setting up of laboratory.	Project area	Contractor
4	Sensitive Areas	The contractor shall undertake seasonal monitoring of air, water noise and soil quality through an approved monitoring agency. The parameter to be monitored, frequency and duration of monitoring plan has been prepared and mentioned in Table 6.1 & 6.2.	Project area	Contractor
5	Clearing of construction of camps and restoration	Contractor will prepare site restoration plans for approval by the engineer. The plan will be implemented by the contractor prior to demobilization. On completion of the works, all temporary structures will be cleared away, all rubbish cleared, excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, at the contractor's expenses, to the entire satisfaction of the engineer.	Corridor of Impact	Contractor
6	Tree Protection,	I. Masonry tree guards, Low level RCC tree guards, Circular Iron Tree Guard with Bars, use of plate compactors near trees may also be considered where necessary.	Corridor of Impact	Contractor

S.No	Environmental enhancement and special issues		Location	Implementing Agency
	Tree Planting	II. The major portion of the project road may pass through open lands, planting of trees along the entire stretch of the road is recommended as an enhancement measure. III. Growth and survival of trees planted shall be ensured and monitoring done at least for a period of 3 years .Survival status shall be reported on monthly basis to Engineer in charge.		

EMP cost

S.No.	Description	Capital Cost (Rs. Lakhs)	Operation Cost per annum (Rs. Lakhs)	Remarks
	Construction Phase			
1.	Stack height for DG	--	--	Included in special specification in BOQ A 27
2.	DG with acoustic enclosure	22.25	0.5	Provided in special specification in BOQ (A 27)
3.	Safety training to be provided by trained person @ Rs.3000/ training once in three months	0.70	-	Included in sanctioned estimate.
	Providing personal Protective equipments for work force during construction phase @ Rs.700/- per person for 50 persons	--	--	Included in specifications of bid document
4.	Storm water Management, rainwater harvesting	31.63	0.5	Included in bid document A17 & A19
5.	Environmental monitoring	-	0.6	Included in sanctioned estimate
6	Fire Safety Measures	1.0	0.15	Included in document BOQ A25
7.	Health monitoring for staff by trained doctors @ Rs.1000/- per person for 50 persons	0.5	0.1	Included in sanctioned estimate and in special specifications of Bid document.
8.	Insurance Charges	-	-	Included in specifications of Bid

				document
9	Informatory sign boards	0.5	-	Included in BOQ –A1 and Special Specifications of Bid document
10	Provision of compound wall	51.05	-	Provided in BOQ A22
11	Provision of internal road	19.06	-	Provided in BOQ A19
12	Pipeline covering the entire 5.81 Acres for disposal of treated effluent	87.05	2.5	Included in BOQ –A18
13	Setting up of laboratory for monitoring the daily effluent parameters	5.58	0.15	Provided in BOQ A24
14	Providing water supply arrangements	4.90	0.2	Provided in BOQ A21
15	Installation of flow meters at Parshall Fume & outlet of chlorine contact tank	16.31	0.2	Provided in BOQ A27
16	Providing Stand by non clog pump for centrifuge sludge pump	10.9	0.5	Included in BOQ (Electrical A 27)
17	Providing Stand by Sludge return non clog pump	9.83	0.5	Included in BOQ (Electrical A 27)
18	Providing walkways & railings	35.49	0.5	Included in BOQ (Mech. A23)
19.	First Aid Facility	0.54	0.2	Included in BOQ A 26
20.	Clearing of construction of camps and restoration	1.5	-	Included in Special Specifications of in BOQ
Total Cost		**298.8**	**6.6**	

Operation Phase				
1.	Training for staff in mitigation measures, process and monitoring	--	--	Included in sanctioned estimate
2.	Landscaping & Gardening (Development and Maintenance)	7.27	-	Provided in BOQ (Gardening A 20)
3.	Fire Safety Measures	1.0	0.15	Included in BOQ A 25
4.	Environmental monitoring	2.40	2.40	Included in sanctioned estimate
5.	Health monitoring for staff	0.5	0.1	Included in special specifications of BOQ
6.	First Aid Facility	0.75	0.2	Included in BOQ A26
Total Cost		**11.92**	**2.85**	
	Cost for Pipeline to the Thenar River for disposal of treated effluent.	23.45		Included in BOQ A18.

Public consultation

As per the ECSMF policy on access to information and disclosure, the proposed project attracts Public Hearing. The Public Hearing was arranged by TWAD Board officials at Karaikudi Municipality. The concerned persons having plausible stake in environment aspects were requested to attend the meeting. Information on Public Consultation are informed explicitly to the stake holders/beneficiaries concerned notifying date and time.

Implementation and Institutional Arrangements

The proposed project is to provide an Underground Sewerage Scheme to Karaikudi. This project will be implemented by TWAD at an estimating cost of **Rs.112.53 Crores**.

The project is proposed to be implemented by TWAD through contractor. The environmental management plan identified for the construction will be included in the bid documents for ensuring implementation of the environmental safeguards. Implementation of the management measures by the contractor will be ensured by TWAD Board and report on ECSMF compliance will be submitted to TNUIFSL periodically.

The management measures identified for operation phase will be taken up by the Prospective contractor up to maintenance period and beyond that by TWAD Board.

Grievance Mechanism

TWAD Board has proposed to provide Underground Sewerage Scheme to Karaikudi town and treat the Sewage in Sewage Treatment Plant of 16 MLD with technology of Extended Activated Sludge Process(EASP). The management measures identified for the operation phase will be taken up by the TWAD Board upon completion of construction activities. The TWAD Board will have Grievance Redressal mechanisms to handle the grievances of the project. A project level grievance Redressal committee will be set up and the members are as follows (preferably one of them as women).

- Executive Engineer (Projects –TWAD Board)
- Commissioner (Karaikudi Municipality)
- A person who is publicly known in the local area

TWAD Board will submit monthly reports on the status of compliance with the ECSMF requirements to TNUIFSL.

Project Benefits

The main objective of the project is to provide adequate sewage disposal facilities to the residents of Karaikudi Town. On implementation of the present project, the health and sanitation situation of the town will be improved significantly thereby reducing the incidence of waterborne diseases and associated medical expenses of the consumers. Besides, there will also be reduction in loss of productive man – days as a result of reduced incidence of health problems and subsequent improvement or economic conditions of Karaikudi Town. Due to high ground water table in Karaikudi Town, the provision of an effective sewerage system will have permanent positive impact on the ground water quality of the town.

1 INTRODUCTION

1.1 INTRODUCTION

Tamil Nadu Government made a policy announcement of providing Under Ground Sewerage Scheme in all urban local bodies in a phased manner at District head quarter towns. The Municipal Sewerage collection network systems will be implemented and the household sewage will be collected and sent to the collection chamber of STP.

The STP consists of various unit operations and processes to treat the raw sewage into the final treated sewage having the quality as per the stipulated standards.

The construction and operation phase impacts of project which have been assessed and the Environment Impact Assessment report has been prepared.

1.2 PREAMBLE

The proposed sewerage system was designed for the targeted population of about 1,06,714 people (As per 2011 Census) and 1,10,030 People (Present Status). The project has the following components:

- Sewerage network consisting of the main sewer line, branch sewer line and manholes;
- Construction of sewage pumping station;
- A sewage treatment plant

For the purpose of sewage system the project area is divided in to 2parts.One is main pumping station and other is Treatment Plant station. The scheme contains provisions for sewer line laying for a total length of 1,51,525 m and construction of 5559 manholes.

The Sewage Treatment Plant having a capacity of 16 MLD is proposed at Karaikudi Municipality, Sivagangai District, Tamil Nadu.

1.3 PROFILE OF KARAIKUDI

Karaikudi Municipality is located at a distance of 80 km from Madurai town(east). 30Km from Aranthangi (west), 34Km from Pudukottai (south) and 15.7Km from Devakottai (southeast) .The town is located at latitude 10˚02’56.64” to 10˚ 06’ 08.04”’N and longitude78˚ 45’

34.49” to 78˚47’41.39”E. Average Elevation of the town is 82m (269 ft). As per 2011 census, the population of Karaikudi is 1,06,714. Males constitute 50.35% of the population and female constitute 49.65%. Karaikudi has an average literacy rate of 81.48%.

1.4 EXISTING DRAINAGE SYSTEM

Karaikudi town does not have any underground sewerage scheme at present. Individual septic tanks are in use for collecting the night soil from toilets. However the sullage from kitchens, bathrooms, wash basins, cloth washing etc. is directly discharged into existing road side open drains.

In places where economically weaker sections of the society reside, there are no septic tanks and total waste water is discharged into road side open drains, resulting in large scale pollution of existing natural water courses i.e. major storm water drains. The discharge of raw untreated sewage into storm water drains is creating unhygienic conditions around drains,lake and posing serious hazard.

1.5 NEED FOR THE PROJECT

With the rapid growth of the population in Karaikudi town, the lack of proper drainage system and sewage treatment facility has become an ever – larger problem for public and from environmental point of view. Therefore, Tamil Nadu Government has decided to provide an Under Ground Sewerage Scheme (UGSS) with STP at Karaikudi to Devakottai road, Near Rasta, Opposite to Solid waste dumping yard. Karaikudi UGSS with STP is a part of urban development project for Karaikudi Municipality.

1.6 KARAIKUDI SEWERAGE SCHEME

The Commissioner of Municipal Administration has sanctioned Rs.112.53 Crores vide Letter Roc.No. 57044/2007/UGSS.2,dated 21.02.2014, 04.06.2014, 25.06.2014 & 25.07.2014 and Letter Roc.No. 57044/2007/UGSS.2, dated 19.08.2014. Sewerage treatment plant site was selected at near dumping yard at Karaikudi municipality. UGSS is proposed to cover the entire Karaikudi Municipality through a collection system of 151.525 Km length and treating in the sewage treatment of 16MLD capacity. The entire scheme is designed by gravity. No lift station or pumping station is proposed for the collection system. The entire sewage collected from the Municipality will be collected in the pumping station proposed within the STP

site and will be pumped to the STP for treatment. For the proposed treatment plant about 5.81 Acres of land has identified for this purpose. The underground drainage scheme plan is shown in **Figure 1-1.** The pumping Station is planned as a single zone.

Sewage from the residential area will be collected in the corresponding underground sewerage system. All the sewerage zones are interconnected with the sewerage network, ultimately collecting to the main pumping station, where sewage will be pumped to the Sewage Treatment Plant. The treatment system adopted is Extended Activated Sludge Process (EASP).

1.6.1 ZONE -I

This pumping station at Karaikudi will cover 36 wards and the length of collection system is 15,1525m. It has 30,225 domestic house service connections and 1500 commercial buildings.

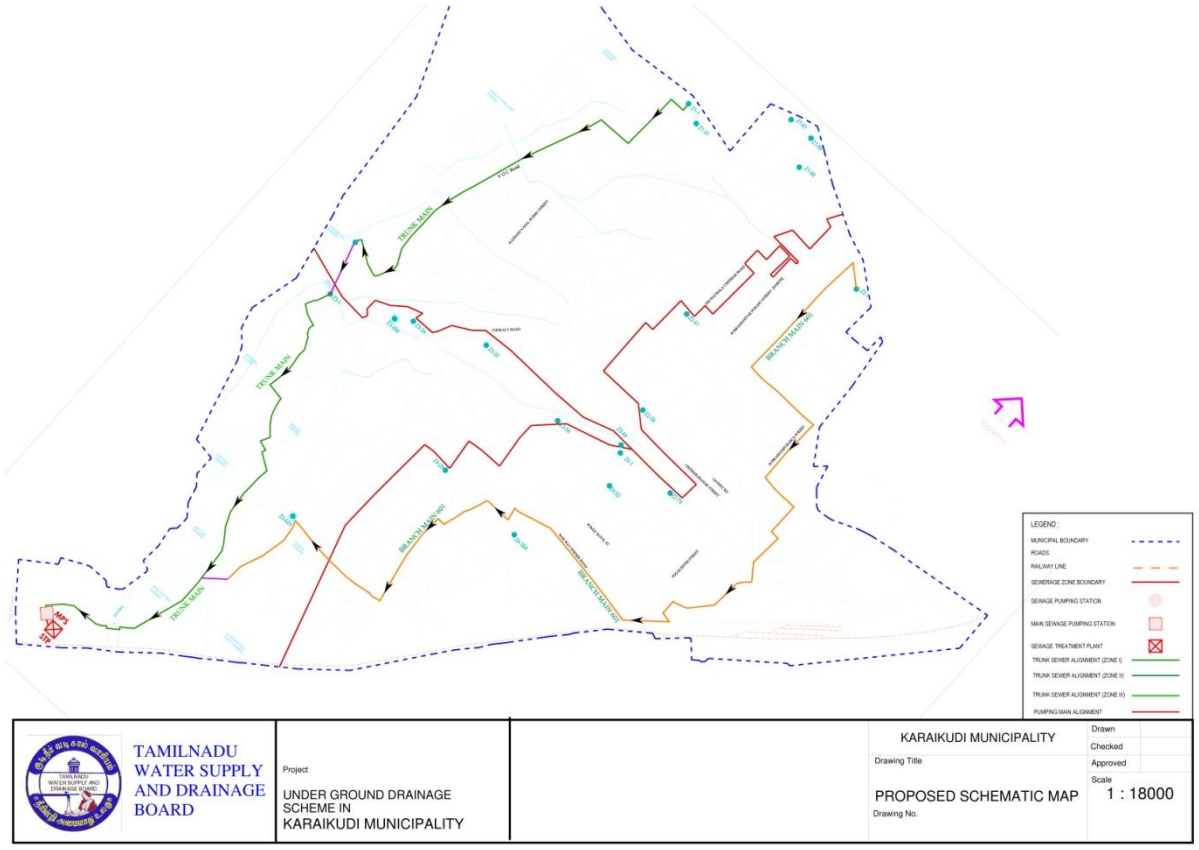

Figure 1-1Underground Sewerage Scheme Flow Diagram for Karaikudi Municipality

1.7 PROJECT BRIEF

Project Town	:	Karaikudi
Municipality	:	Karaikudi
District	:	Sivagangai
State	:	Tamil Nadu
Technology used	:	Extended Activated Sludge Process (EASP)
Capacity of the Plant	:	16 MLD

The project involves the construction of Sewage Treatment Plant with an intermediate capacity of 16.00 MLD and an Ultimate capacity of 20.24 MLD.

1.8 CATEGORIZATION OF PROJECT

The proposed project involving sewerage network, pumping station and construction of new sewage treatment plant is categorized under E1 as per the Guidelines for Environmental Categorization of Projects and S3 as per Categorization of projects based on social sensitivity, vide Environment Climate change and Social Management Framework (ECSMF) of Tamil Nadu Urban Infrastructure Financial Services Limited(TNUIFSL), Chennai.

As per the MoEF Notification S.O. 1533, dated 14th September 2006, the Underground Sewarage Scheme and Sewage Treatment Plant is not categorized in the schedule.

As per TNPCB Industrial Categorization, STP is categorized as Red Category (Code No. 1081- Common Treatment and Disposal Facilities), as per recategorization of Industries vide B.P.No. 06 dated 02.08.2016.

1.9 NEED FOR EIA

Environmental Impact Assessment (EIA) is a study of the possible impacts that a proposed project may have on the environment, which may affect natural, social and economic aspects in and around the project area.

The purpose of the assessment is to make the project proponent to enhance the environmental quality of the project site during planning and execution of the project. The

International Association for Impact Assessment (IAIA) defines an Environmental Impact Assessment as "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made."

The proposed project is **categorized under E1** as per the Guidelines for Environmental Categorization of Projects (ECSMF of Tamil Nadu Urban Infrastructure Financial Services Limited, Chennai) since it includes sewerage network, pumping station and sewage treatment plant. As per ECSMF, E1 projects require Environmental Impact Assessment to be carried out and management measures to be identified. Hence an EIA study is required for the proposed project.

This present report elucidates the existing environmental scenario of the project site and the predicted impacts due to installation of the proposed Sewage Treatment Plant. It evaluates the impacts during the pre construction, construction and operation phases of the project. Both positive and negative impacts are being considered and reported. The Environmental Management Plan (EMP) is also aimed at mitigating the possible adverse impact of the project and ensuring the existing environmental quality gets enhanced.

1.10 OBJECTIVES OF THIS REPORT

The objectives of the report are;

- To identify and assess any potential negative environmental and social impacts and to facilitate the planning of preventive and remedial measures.
- To identify possible environmental enhancements in the project setting and lay down the action plans.
- To develop a set of environmental monitoring and management plans compliant with the relevant codes, statutes & social norms.

1.11 SCOPE OF THE REPORT

- To assess the baseline quality of Ambient Air, water, land, soil and noise environment in and around the proposed site in relation to the town by collecting the samples of Ambient Air, water, soil and noise within the project influenced area and analyzing for the recognized

parameters as per local statutory regulations and prepare the baseline document to predict the potential impacts.

- To identify the environmental impacts due to UGSS with respect to wildlife/Bird sanctuaries, flora & fauna, public health, social upliftment, archeological monuments, heritage structures and suggest appropriate preventive & remedial measures without compromising the objective of UGSS.

- To develop a set of practices to be followed during preconstruction, construction and operation phases of the project in order to avoid the foreseeable negative impacts.

1.12 STRUCTURE OF THE REPORT

The structure of EIA report is given below

- EXECUTIVE SUMMARY
- Chapter 1 – Introduction
- Chapter 2 – Project Description
- Chapter 3 - Environmental Regulatory Framework
- Chapter 4 – Baseline Environmental Studies.
- Chapter 5 – Predicted Impacts & Mitigation measures
- Chapter 6 – Public Consultation
- Chapter 7 – Environmental Management Plan
- Chapter 8 –Implementation and Institutional Arrangements
- Chapter 9- Project Benefits
- Chapter 10 - Conclusion

2 PROJECT DESCRIPTION

2.1 SALIENT FEATURES

The salient features of the UGSS to Karaikudi Municipality are as below.

- House Service Connections –31725 Nos
- Total length of Collection system – 151.525 km
- Pumping Station – 1 No
- Manholes – 5559 Nos
- Sewage Treatment Plant of capacity 16 MLD with Extended Activated Sludge Process Technology.
- The treated sewage will be disposed through pipelines to Thenar River at a distance of 370m from proposed STP.

2.2 COMPONENTS OF THE PROJECT

2.2.1 COLLECTION SYSTEM

The proposed project involves the construction of pumping system for conveying the sewage collected at various locations to inlet chamber of proposed 16 MLD capacity STP at Karaikudi Municipality. The total length of the collection system is 151.525 km. The collection system consists of 31725 Nos house service connections and 5559 manholes. The treated sewage will be disposed through pipelines to Thenar River located at a distance of370 m.

2.2.1.1 LIFTING STATION

Lifting stations are not employed for pumping sewage as the elevation of the town is sufficient for gravity flow.

2.2.1.2 PUMPING STATION

Pumping stations are facilities including pumps and equipment for pumping fluids from one place to another. They are used for a variety of infrastructure systems, such as the supply of water to canals, the drainage of low-lying land, and the removal of sewage to processing sites. A pumping station is, by definition, an integral part of a pumped-storage hydroelectricity installation. The pumping stations are provided with a manual screen having 25 mm bar spacing at the entry

of inlet pipe for removing the coarse material. The screen is fitted in 0.45 m wide channel. The pumping station is provided with Diesel Generators with acoustic enclosures for backup power supply.

2.3 SEWAGE TREATMENT PLANT

The STP proposed is 16 MLD capacity with Extended Activated Sludge Process Technology at Karaikudi Municipality, Sivangangai District, Tamil Nadu.

2.3.1 PROCESS DESCRIPTION

Sewage is collected from all the sources in the receiving chamber. The sewage is sent through a series of bar screens. Materials which are greater than 20 mm in size are removed from the sewage. Screening prevents the clogging of pumps and pipelines.

First, the sewage is sent through the coarse screen chamber / mechanical coarse screen chambers. Here materials greater than 20 mm & 15 mm are removed respectively. Then the sewage is sent through operated / automatic fine screens to remove materials sized 15 mm & 10 mm.

From here the sewage is sent to the grit chamber where fine particles like sand are removed through sedimentation. The sand being heavier than sewage settles down and can be removed. From the grit chamber the sewage is sent to the Parshall flume chamber. Parshall flumes are used to check the flow in the plant. An electromagnetic flow meter will be installed in the Parshall Flume. The Screened sewage is then led to the distribution Chamber-I. The sewage from the distribution Chamber-I is then led to two Nos. of aeration tank. Biological treatment takes place in the aeration tank. Air is diffused through air blowers to oxidize organic matters. The overflow from the aeration tank is sent to distribution chamber- II and then to two Nos. of secondary clarifier. The underflow clarifier sludge is returned to the distribution Chamber- I for mixing and the excess sludge from the secondary clarifier is sent to the centrifuge for dewatering. Recirculation of the sludge will take place effectively. The digested sludge is then pumped into the centrifuge through screw pump to separate the solids from the treated effluent. The drain out from the Centrifuge is collected in the filtrate sludge sump which is then sent back to the distribution chamber-I through filtrate pump.

The overflow from the secondary clarifier is sent to distribution Chamber- III and to Chlorine Contact tank where Chlorine is dozed. The treated sewage from the Chlorine contact tank is led to the Thenar river. A 600 kVA DG will be provided as a standby source of power.

2.3.1.1 SEWAGE RECEIVER

Raw Sewage will be collected through pipe lines into a receiving chamber from where it will be taken into downstream screens. The function of the receiving chamber is to reduce the incoming velocity. Receiving chamber shall be of adequate size to meet the requirements of workability inside it. The flow from the receiving chamber will lead to screen Chamber.

2.3.1.2 PRIMARY TREATMENT

In primary treatment, a portion of the suspended solids and organic matter will be removed from the sewage. The sludge from primary treatment, often contains a large amount of suspended organic materials (about 50%). Sometimes, the preliminary as well as primary treatments are classified together, under primary treatment.

The organic solids, which are separated out in the sedimentation tanks in the primary treatment, are often stabilized by anaerobic decomposition in a digestion tank or incinerated. The residue is used for landfills or as a soil conditioner. The principal function of primary treatment is to act as a precursor to secondary treatment.

2.3.1.3 FINE SCREENING

Fine screens are to be provided for the removal of fine floating material in the sewage. One is mechanically operated and the other screen is provided as standby. The fine screens are capable to screen out most of the medium & fine floating and material such as hair, debris, weeds, paper, rags etc. which could clog the downstream units. The Fine screen will be inclined with bar screen. It will have sturdy design and the bar screen shall be of stainless steel flats. The screenings will be dropped on conveyor above the top of the screen channel. A conveyor system of suitable width will be provided which will be adjacent to the screens. The screening materials as collected will drop automatically into a wheelbarrows for its disposal.

2.3.1.4 DE-GRITTING

Screened sewage will be sent to minimum two numbers of Grit separator tank for the removal of grit and small inorganic particle matter of specific gravity above 2.65 and particle size above 150 microns. One is mechanically operated and the other is provided as standby. The Grit separator tank will be of RCC construction complete with mechanical internals and square in size. The grit separated will be properly collected and be transferred for disposal. The regritted sewage shall flow through open channels from the grit separators and confluence into a single channel of suitable width.

2.3.1.5 FLOW MEASUREMENT

A Flow measurement unit in the form of ultrasonic flow transmitter will have to be provided in the Parshall Flume and at the outlet of treated sewage, to measure the daily inlet & outfall quantity.

2.3.1.6 SECONDARY TREATMENT PROCESS

Screened, de-gritted sewage will be fed into the Activated Sludge Treatment system to meet the treated effluent quality prescribed by TNPCB. The outflow from the aeration tank will have 92% BOD reduction. The outlet of Secondary Clarifier will have 40% BOD reduction. Any problem in aeration tank will be due to diffusers provided in the tank. This can be rectified by lifting the diffusers and manually cleaning the blockages. If the blower has any problem, a standby blower is also provided in aeration tank. A part of the sludge from secondary clarifier will be returned back to the aeration tank, to maintain the MLSS concentration. For effective performance of the return sludge system, a stand by pump is essential.The cost should be included in the estimate.

2.3.1.7 TERTIARY TREATMENT

Tertiary treatment is used to further purify the water contaminants, especially pathogens. The level of tertiary treatment performed depends on the quality of effluent desired. This is determined by the size of the receiving body of water, and the intended use of that water.

2.3.1.8 CHLORINATION

This is the most widely practiced means of disinfecting water. The strong oxidizing capacity of chlorine destroys or inhibits the growth of pathogens, reduces the BOD, reduces odour, water color and oxidizes metal ions.

2.3.1.9 SLUDGE HANDLING SYSTEM

As there is no primary clarifier, only the digested sludge will be separated out in the secondary clarifiers through centrifuge house where the sludge is dewatered.

The dewatered sludge quantity generated will be around 0.96 tons/ day and it will be used as manure for raising fodder crops and balance quantity if any will be disposed off from the STP site to the nearby municipal compost yard. The filtrate from the centrifuge is again taken to the aeration tank through distribution Chamber-I for effective treatment. For proper dewatering of the sludge, a stand by centrifuge feed pump should be provided and the cost should be included in the Estimate.

The grit and waste from the screens and sludge will be used for fodder cultivation and remaining will be sent to Karaikudi Municipality compost yard at regular intervals.

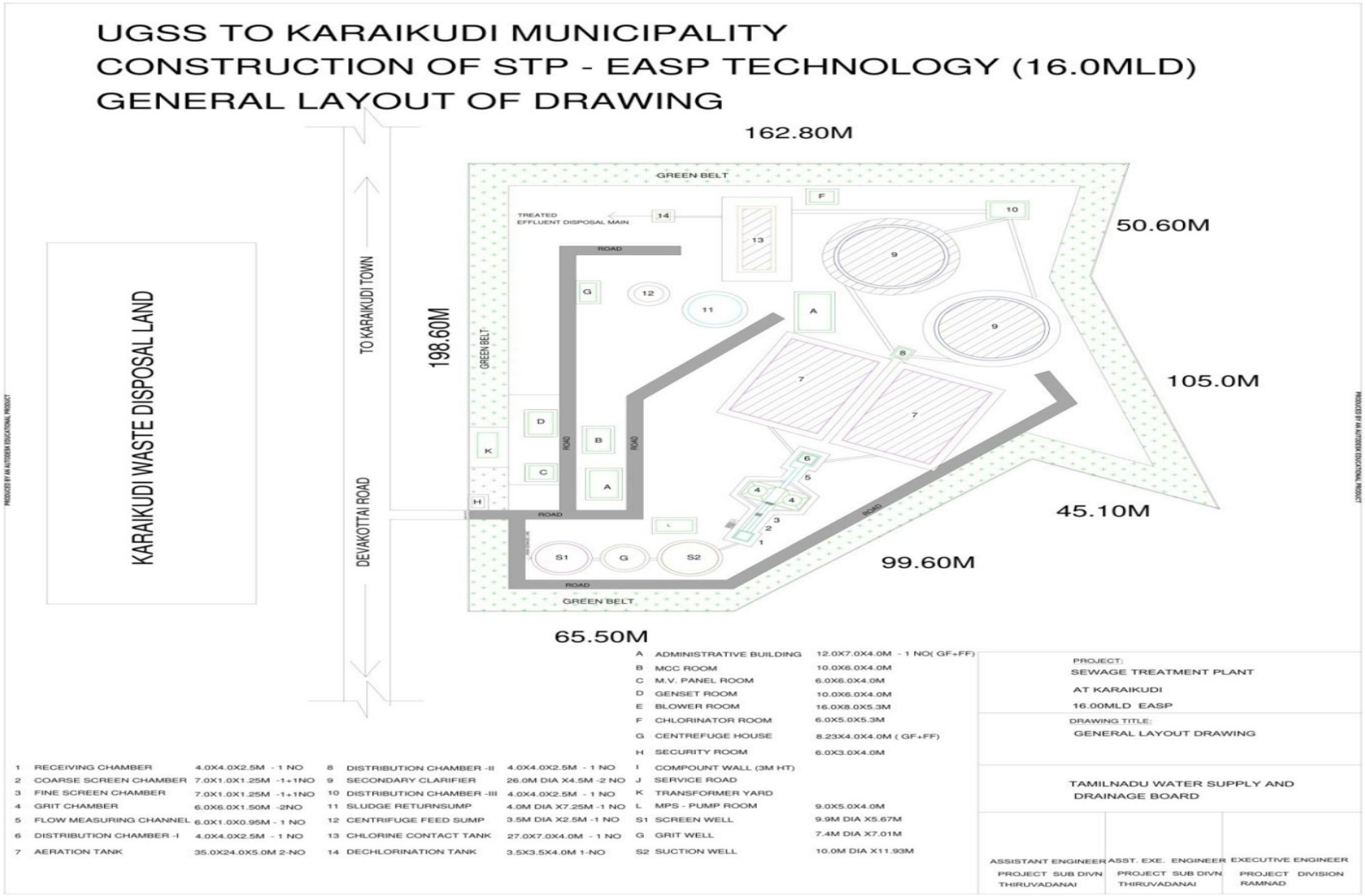

Figure 2-1STP Layout

2.4 DESIGN CONSIDERATIONS

- The STP is originally designed and sanctioned for ultimate requirement of 20.24 MLD in the original estimate as per the Managing Director's approval to Design STP for 2/3rd of ultimate (20.24 MLD) requirement as 16MLD.

- All the Primary Treatment Units have been designed for ultimate capacity of STP (20.24MLD). In secondary Treatment Units, the Aeration tank-2Nos and the Secondary Clarifier-2Nos are designed in two rows for 2/3rd of ultimate MLD (i.e.20.24 MLD) and all other units are designed for ultimate MLD.

- The STP technology to be adopted is Extended Activated Sludge Process with Extended Aeration. No primary sludge generation is involved.
- The STP is designed in series of 8 MLD each and in case of any failure/ maintenance of anyone unit; the sewage can be routed through the other row, which would ensure that sewage is treated to desired quality.
- Compound wall of 2.00m height is proposed around the STP to protect the STP.
- Independent access through SS ladders and connected access through walkway to all units are to be provided.
- Handrails in Stainless Steel will be provided on both sides of walkway for safety of the officials during Operation of the STP.
- Suitable capacity of Diesel generator is provided to operate during power failure.
- Inner access road of 3.75m width and 600m length will be provided to facilitate all season access to the STP components by men and motor vehicles.

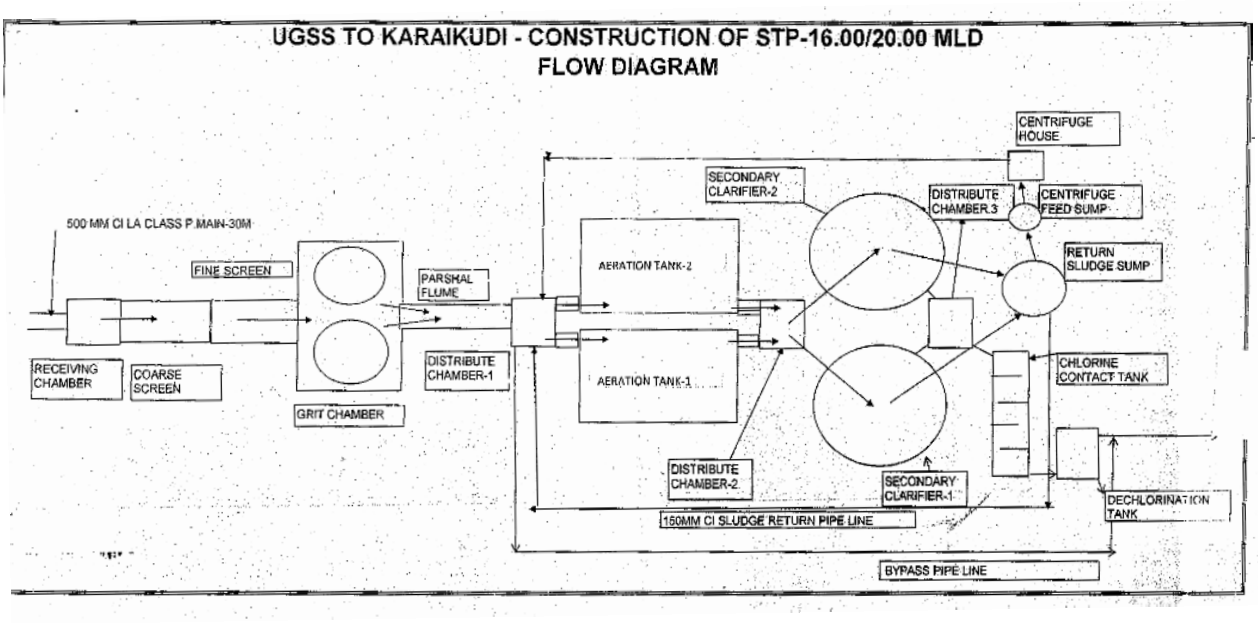

Figure2-2STP Flow Diagram

2.5 RAW SEWAGE CHARACTERISTICS

The sewage collected from various chambers is almost of same type. The domestic wastewater from the local residential area constitutes the raw sewage. The wastewater characterization is presented in **Table 2-1.**

Table 2-1Raw Sewage Characteristics

S.No	Parameter	Values	Unit of measurement
1	pH	7.58	No unit
2	Biochemical Oxygen Demand	280	Mg/l
3	Chemical Oxygen Demand	540	Mg/l
4	Total Suspended Solids	564	Mg/l
5	Total Kjeldahl Nitrogen	61	Mg/l
6	Ammoniacal Nitrogen (as N)	50	Mg/l
7	Total Phosphorous	5	Mg/l
8	Sulphate	288	Mg/l
9	Fecal Coliform	650	MPN/100ml
11	Chlorides	1799	Mg/l
12	Oil and grease	50	Mg/l

2.6 TREATEDSEWAGE QUALITY

The STP is designed in such a way that the treated sewage quality attains the limits or even better so as to attain the standards well below given by the Pollution Control Board. The parameters to be monitored and to be maintained within limits are presented in **Table 2-2.**

Table 2-2 Treated Sewage Quality

S.No	Parameter	Outlet	Limit	Unit of Measuremen
1	Biochemical Oxygen Demand	<10	<20	mg/l
2	Total Suspended Solids	<20	<30	mg/l
3	Chemical Oxygen Demand	<50	<250	mg/l
4	pH	7.1 – 7.3	5.5-9.0	-

2.7 DISPOSAL OF TREATED SEWAGE

It is proposed to dispose the treated sewage to Thenar river near the STP site at a distance of 370m.The treated sewage will be disposed through RCC pipelines to Thenar River. As per the TNPCB NOC letter, the treated sewage will be planned to use for irrigation. The letter given by the department is enclosed as **Annexure-5**.

The population of Karaikudi Municipality as per 2011 census is 1,06,714 and expected sewage generation is 7.47MLD taking into the consideration the current level of water supply (115lpcd) and sewage generation (70lpcd). The land required for raising fodder crops for next 5 years will be 900 Acres. Hence the land available surrounding to the Thenar canal is more than adequate for next few years. After 5 years the remaining lands earmarked for this purpose will be linked with suitable pipeline to dispose the treated effluent for irrigation.

2.8 LAND REQUIREMENT

The total land available for the STP is about 5.81 Acres located at S.Nos. 561,552/8, 552/9 and 545/2, Karaikudi. The proposed Sewage Treatment Plant will have an intermediate capacity of 16 MLD. Based on statistical analysis, in future, due to urbanization of

the project area, the incoming sewage will be higher. Hence the ultimate capacity will be 20.24 MLD.

The remaining land area will be occupied for storage and provision of chemicals, sludge, laboratory, office employees shed and restrooms. A part of the area will be utilized for developing green belt within the site premises. The STP layout is given in **Figure 2-1.**

i) The land transfer statement was issued on 13.08.2014 by the Tahsildar, Karaikudi Municipality, Sivagangai District, based on the proceedings by The Collector, Sivagangai District, Letter No. Roc. C4/11927/12, Letter Rc.No.B3/14395/2012 dated:12.06.2014, to The Commissioner, Karaikudi Municipality for the purpose of Under Ground Drainage System. Enclosed as **Annexure-3**.

ii) The statement for handing over of the plot to the TWAD, Karaikudiby the Commissioner, Karaikudi, Sivagangai District on 13.08.2014 for the purpose of construction of STP is enclosed as **Annexure-3**

2.9 POWER REQUIREMENT

Power requirement during the operation of STP will be 750 KVA. DG sets are operated only during power failures and the D.G sets are proposed to provide 600 KVA as required suitable power backup to run the plant.

2.10 PROJECT COST

The total cost of the project is **Rs.112.53 Crores.**

3 ENVIRONMENTAL REGULATORY FRAMEWORK

3.1 INTRODUCTION

This section reviews the policies, regulations and administrative framework within which the project works are to be implemented. The review includes the Environmental, Climate change and Social Management Framework (ECSMF) developed by TNUIFSL, Operational policies / directives of Funding Agencies through TNUIFSL, sector-specific Environmental Policies &Regulations of the Government of India and the institutional profile of various agencies such as Tamil Nadu Pollution Control Board (TNPCB) and other stakeholders associated with the project.

3.2 ENVIRONMENTAL POLICIES AND REGULATIONS

The environmental policies and regulations reviewed are broadly divided into the following four categories:

- Environmental, Climate change and Social Management Framework (ECSMF)
- Operational policies of external Funding Agencies
- Environmental Policy and Regulatory Frameworks in India
- Regulatory Framework in the State of Tamil Nadu

3.2.1 ENVIRONMENTAL, CLIMATE CHANGE AND SOCIAL MANAGEMENT FRAMEWORK (ECSMF)

From Various Funding Agencies through TNUIFSL, under which the proposed Under Ground Sewerage Scheme with STP for Karaikudi Municipality is to be funded, has formulated an exclusive Environmental and Social framework to address Environmental and Social Impacts associated with infrastructure projects. Environmental, Climate Change and Social Management Framework (ECSMF) is in line with the Environmental and Social safeguard Policies and directives of the various funding agencies through TNUIFSL.

The proposed activity is classified as **E1** as per **Environmental Categorization** of projects and S3 as per Social categorization of projects vide ECSMF**.** Hence this project requires detailed environmental impact assessment and preparation of management measures.

3.2.2 SUSTAINABILITY GUIDELINES OF KfW.

This Guideline describes principles and procedures to assess the environmental, social and climate impacts during the preparation and implementation of measures financed by KfW Development Bank. In this context, the guideline pursues the following objectives, in particular.

- To define a common binding framework to incorporate environmental, social and climate standards into the planning, appraisal, implementation and monitoring of measures financed by KfW Development Bank;
- To promote transparency, predictability and accountability in the decision-making processes of environmental and social impact assessments (ESIA) and climate change assessments;
- To improve the assessment of economic risks associated with projects by taking account of the environmental, climate and social aspects.

3.2.3 ENVIRONMENTAL POLICY AND REGULATORY FRAMEWORKS IN INDIA

The following are the key regulations in India applicable for various development projects.

- Constitutional Provisions
- The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act 2013
- Forest (Conservation) Act, 1980
- The Environment Protection Act 1986, & Notifications
- The Air (Prevention and control of pollution) Act, 1981amended in 1987
- The Water (Prevention & Control) Act 1974
- The Treasure Trove Act, 1878
- The Noise Pollution (Regulation and Control) Rules, 2000
- Manufacture, Storage and Import of Hazardous Chemical Rules, 1989
- The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013

a) Constitutional Provisions

The Constitution of India in its Article 48 provides for the protection and preservation of the environment and states that "the state will endeavor to protect and improve the environment and to safeguard forests and wild life of the country." Further Article 51-A (g) on fundamental duties emphasizes that, "It will be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures."

b) The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act 2013

This Act ensures essential infrastructural facilities and urbanization with least disturbance to the owners of the land and other affected families and provides just and fair compensation for land acquisitions. The proposed project does not have any private land acquisitions; hence this Act is not applicable for the proposed UGSS.

c) Forest (Conservation) Act, 1980

The Act pertains to diversion of forestland and felling of roadside plantation. Depending on the size of the tract to be cleared, clearances are to be obtained. Restrictions and clearance procedures proposed in the Forest (Conservation) Act apply to the natural forest areas, even incase the protected/designated forest area does not have any vegetation. The pipeline alignment of the proposed project does not cross any natural forest areas.

d) The Environment Protection Act 1986, & Notifications

In order to create national environmental legislation, the EPA articulates a policy for environmental protection covering air, water and land and provide a framework for Central Government to coordinate between Central and State Authorities established under various laws, including the Water Act and Air Act. Under this umbrella Act, the Central Government must set National Ambient and Emissions Standards, establish procedures for managing hazardous substances, regulate industrial sites, investigate and research pollution issues and establish laboratories and collect and disseminate information. Among other relevant legislation, the Public Liability Insurance Act (PLIA) of 1991 mandates that business owners operating with hazardous substances take out insurance policies covering potential liability from an accident and establish Environmental Relief Funds to deal with accidents involving hazardous substances. The National

Environmental Appellate Authority Act of 1997 requires the Central Government to establish an authority to hear appeals on restrictions where operations will not be carried out or will be carried out with certain safeguard measures.

e) The Air (Prevention and control of pollution) Act, 1981amended in 1987

This Act provides prevention, control and abatement of air pollution. With a framework similar to the Water Act, the Air Act gave the central and State Board, the authority to control air pollution from industries and other sectors. The State also prescribes emission standards for stationary and mobile sources. Since the proposed project involves operation of DG sets, the above said Act and emission standards will be complied with.

This laws seek to control pollution of air by providing emission standards for various industries and other sectors.. Under this law, it is mandatory to obtain Consent to Establish and Consent to operate even if DGs are proposed for the project. Karaikudi municipality has obtained CTE from TNPCB and the same is enclosed as **Annexure -1**.

f) The Water (Prevention & Control) Act 1974

The Water Act is the first environmental regulation that brought at the State and Central levels, Pollution Control boards to control / regulate environmental pollution due to discharge of untreated sewage / industrial effluent to land or nearby water body. The Actwas amended in 1978 and 1988. Salient features of the Act are the following:

These laws seek to control pollution of water and enhance the quality of water. Under this law, it is mandatory to obtain Consent to Establish and Consent to Operate in case of treatment or disposal of sewage /effluent. Karaikudi municipality has obtained CTE from TNPCB and the same is enclosed as **Annexure -1**.

g) The Treasure Trove Act, 1878

The Indian Treasure Trove Act, 1878 (Act No. VI of 1878) was promulgated to protect and preserve treasure found accidentally but having the archaeological and historical value. This was enacted to protect and preserve such treasures and their lawful disposal. In a landmark development in 1886, James Burgess, the then Director General succeeded in prevailing upon the Government for issuing directions forbidding any person or agency to

undertake excavation without prior consent of the Archaeological Survey and debarring officers from disposing of antiquities found or acquired without the permission of the Government.

h) The Noise Pollution (Regulation and Control) Rules, 2000

In order to curb the growing problems of noise pollution, the Government of India has enacted the noise pollution rules 2000 that includes the following main provisions:

• Standards are given by CPCB for day time and night time noise levels with respect to industrial, residential and commercial areas.

• Areas not less than 100 m around Hospitals, Educational institutions and Court is declared as silence area under these rules.

• A person found violating the provisions as to the maximum noise permissible in any particular area will be liable to be punished for it, under the provision of these rules and any other law in force.

Noise levels has to be maintained for permissible limits for this project and monitoring of noise levels has to be done at project site at frequent intervals and records to be maintained.

i) Manufacture, Storage and Import of Hazardous Chemical Rules, 1989

These rules aim at controlling the generation, storage and import of hazardous chemicals. These Rules are applicable to any industrial activity in which hazardous chemical listed in the Schedule are involved based on the quantity given. According to these rules, the user of hazardous chemicals should

- Identify the potential hazards of the chemicals and take adequate steps to prevent and control such hazards
- Develop or provide information about the chemical in the form of safety data sheets
- Label the specified information on the container of the hazardous chemical

In this project Chlorine is used as a disinfectant which is categorized as hazardous chemical vide Schedule I part II item no 119 as per MHSIC rules 1989. Total quantity of chlorine required per month is 1744 kg. Hence 3 chlorine cylinders (2 no's for process +1 no standby) are required per month for this project. Hence license is not requires for using chlorine cylinders.

(Note: On exceeding 5 no's of chlorine cylinders license from PESO under Gas Cylinders Rules to be obtained).

j) The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013

This Act aims for prohibition of employment as manual scavenger, rehabilitation of manual scavengers and their families, and for matters connected therewith or incidental thereto. The insanitary latrines should be converted to sanitary latrines. If failed to do so, the local authority shall convert the latrine and recover the cost from concern. It seeks to rehabilitate manual scavengers and provide for their alternative employment. Offences under the Bill shall be cognizable and non-bail able, and may be tried summarily though the penalty could be five years of imprisonment. In this project, no manual scavengers will be employed to clean the system.

3.2.4 PUBLIC LIABILITY INSURANCE ACT, 1991

The Act provides public liability insurance for the purpose of providing immediate relief to the persons affected by accident occurring while handling hazardous substances. Hazardous substance means any substance or preparation which is defined as hazardous substance under the Environment (Protection) Act 1986, and exceeding such quantity as may be specified by notification by the Central Government.

3.2.5 SOLID WASTE MANAGEMENT RULES, 2016

The SWM Rules, 2016 contain two schedules prescribing the details as mentioned further. These schedules should be referred for complying with the specifications and the standards prescribed therein.

Schedule – I : Specifications for Sanitary Landfills

Schedule – II : Standards for Processing and Treatment of Solid Waste

As this project involves the generation of sludge from the treatment plant, the above said Act will be complied. The sludge will be dried and used as manure for greenbelt development.

3.3 WORLD BANK POLICIES

Following are the Operation Policies & Directorates of the World Bank.

3.3.1 ENVIRONMENTAL ASSESSMENT OP/BP 4.01

This requires the borrower to screen projects upstream in the project cycle for potential impacts. Thereafter, an appropriate EA approach to assess, minimize / enhance and mitigate potentially adverse impacts is selected depending on nature and scale of project. The EA needs to be integrated in the project development process such that timely measures can be applied to address identified impacts. The policy requires consultation with affected groups and NGO's to recognize community concerns and the need to address the same as part of EA.For this project, there is no objection from the public.

3.3.2 CULTURAL PROPERTY - OP 11.03

Requirements - World Bank's Operational Policy Note 11.03 which aims at preserving and avoiding the elimination of structures having archaeological (prehistoric), paleontological, historical, religious and unique natural values. Projects that could significantly damage non-replicable cultural properties are declined for funding and the Bank will in turn assist protection and enhancement of cultural properties encountered in the project rather than leaving that protection to chance. The project does not attract this Policy.

3.3.3 NATURAL HABITATS – OP/BP 4.04

This policy sets out the World Bank's policy on supporting and emphasizing the precautionary approach to natural resource management and ensuring opportunities for environmentally sustainable development. As per this policy, projects that involve significant conversion or degradation of critical natural habitats are not supported by the Bank. The project does not attract this Policy.

3.3.4 FORESTS – OP/BP 4.36

This sets out specific policy on protection of forests through consideration of forest related impacts of all investment operations, ensuring restrictions for operations affecting critical forest conservation areas, and improving commercial forest practice through use of modern certification systems. The policy requires consultation with local people, the private sector and other stakeholders in forest area. The project does not attract this Policy.

3.3.5 PEST MANAGEMENT - OP 4.09

This policy supports environmentally sound pest management, including integrated pest management, but does not prohibit the use of highly hazardous pesticides. Pest Management is the borrower's responsibility in the context of a project's EA. The same will be taken care during the operation of the system.

3.3.6 INVOLUNTARY RESETTLEMENT - OP/BP 4.12

This policy is implemented in projects which displace people. It requires public participation in resettlement planning as part of EA for projects. It is intended to restore or improve income earning capacity of displaced populations. The project does not attract this Policy.

3.3.7 INDIGENOUS PEOPLES –OP/BP 4.20

The purpose of this policy is to ensure indigenous peoples benefit from Bank financed developed and to avoid or mitigate adverse affects on indigenous peoples. It applies to projects that might adversely affect indigenous peoples or when they are targeted beneficiaries, requires participation of indigenous peoples in creation of "indigenous people development plans". The project does not attract this policy.

3.3.8 CLEARANCES/ NOC REQUIRED FROM COMPETENT AUTHORITY

The summary of applicable Clearance / NOC required for the proposed project is given in **Table 3-1**below.

Table 3-1Clearances / NOC Required from Competent Authority

S.No	Activity	Clearance/ NOC Required	Statutory Authority	Status
1	Land alienation for STP			Alienation order issued in G.O.Ms.NO. 9/Revenue Dept/ Dt:10.01.2014.
2	Establishment of Proposed STP	Consent To Establish under Air and Water Act	TNPCB	Obtained from TNPCB Vide Proceedings no:T1/TNPCB/F.0771SVG /RL/SVG/W/2018/dt.25.06.2018 Proceedings no:T1/TNPCB/F.0771SVG/RL/SVG/

S.No	Activity	Clearance/ NOC Required	Statutory Authority	Status
				A/2018.dt.25.06.2018
3	Operation of STP	Consent To Operate under Air and Water Act	TNPCB	To be obtained before operation of the project.
4	Disposal of Treated Sewage	No objection Certificate	PWD	Obtained on Vide Letter No. 11R/ F.66 (NOC) /2018 / JDO/dt 15.03.2018
5	Working of labour	Labour License Labour Insurance	Labour welfare board	Labour insurance Validity From 09/12/2019 to 08/06/2020

4 BASELINE ENVIRONMENTAL STATUS

4.1 METHODOLOGY

The baseline environmental status with respect to various environmental components like Ambient Air, noise, water, land, flora & fauna and socio-economic, being integral part of an EIA, forms the basis for predicting / assessing the environmental impacts of the proposed project. Field monitoring at site was performed. Various environmental components were monitored and samples were analyzed. Apart from this, additional data were also collected from secondary sources like Government/Non-Governmental Agencies, Universities, Irrigation Department, India Meteorology Department, Ground Water Board, etc.,

4.2 BRIEF DESCRIPTION OF THE PROJECT SITE

Karaikudi Municipality is located at a distance of 80 Km from Madurai town (East) and area of Karaikudi Municipality is 13.75 Sq.km. The Google view and the current status of the project site are shown in **Figure 4-1** and **Figure 4-2** respectively. With the rapid expansion and urbanization of Karaikudi Town, an underground sewerage scheme has been formulated for the town and the collection system works are ready to progress. The final sewage from the main pumping will be redirected to the proposed Sewage Treatment Plant for final treatment and the treated sewage will be redirected to the Thenar River (Permission letter Enclosed).

The sewage treatment plant covers an area of 5.81 acres. The STP with selected modern technology has a capacity of 16 MLD. The location of STP is shown in **Figure 4-3**.

Figure 4-1 Google View of Project Site

Figure 4-2 Current Status of the STP Site

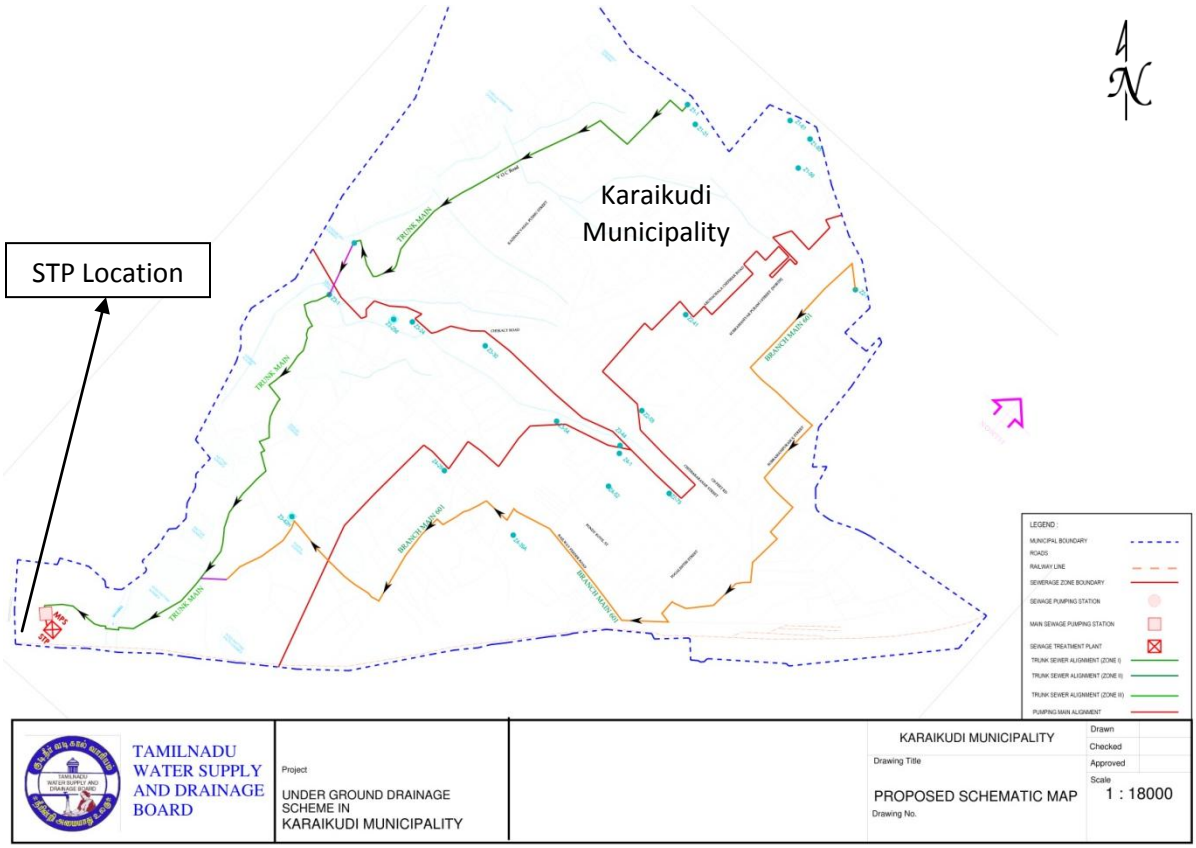

Figure 4-3 UGSS for Karaikudi Municipality and Location of STP

The satellite imagery of 10 Km radius is shown in **Figure 4-4.** The nearby residences are located with a distance of about 5 km from the site. The surrounding features in and around the project site is shown in **Table 4-1**.

Table 4-1 Project Site surrounding features

S.NO	Surrounding Features	Distance from Project Site (5 Km)
1	Devakottai Road Railway Station	*200m*
2	SIDCO	*0.67Km*
3	Saradha College	*3.20 Km*
4	Reserve Forest	*2.55 Km*
5	Karaikudi Railway Junction	*4.65 Km*
6	Alagappa University	*5.30 Km*

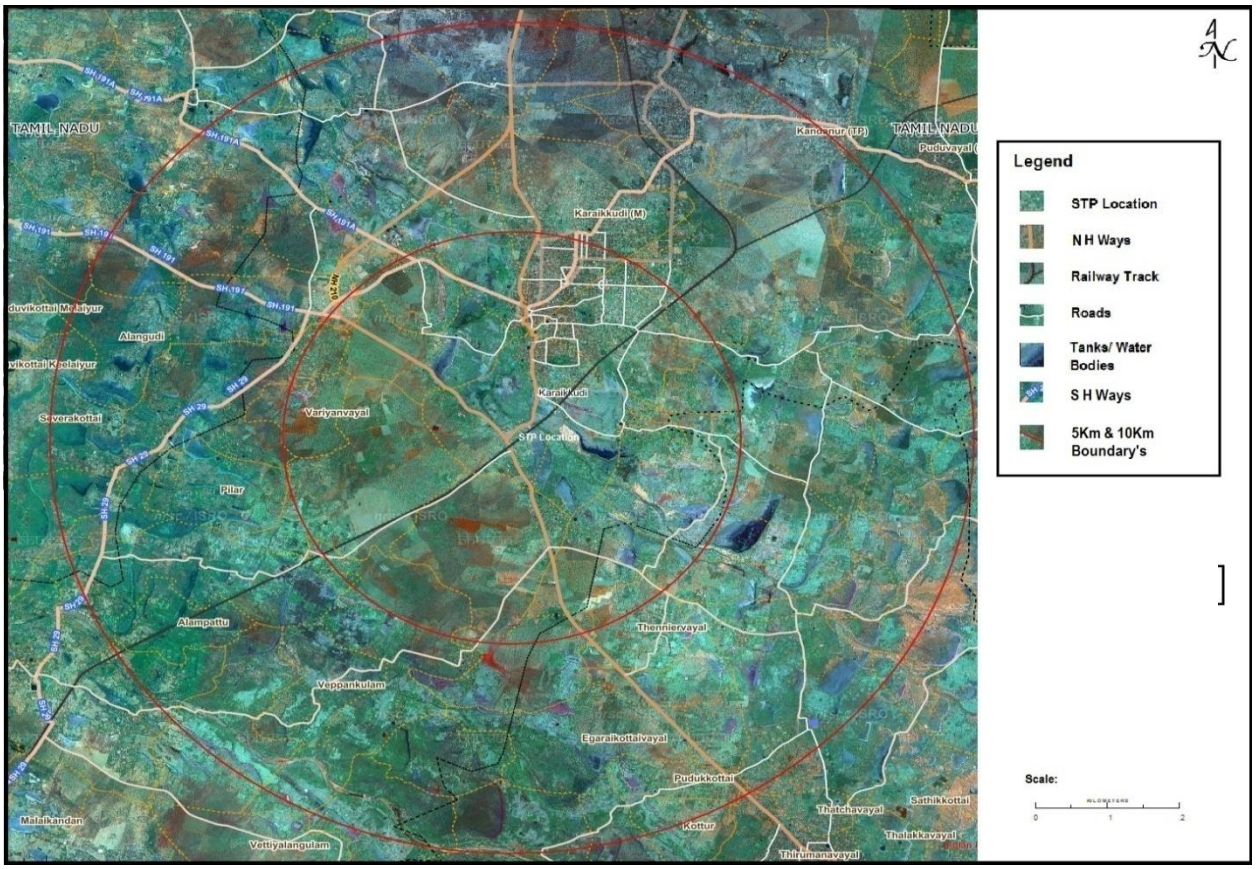

Figure 4-4Satellite Image of Study Area - 10 Km Radius

4.3 CONNECTIVITY

Airport - The nearest airport to the town is in Madurai at a distance of 77 km.

Railway – Karaikudi Railway Junction is 4.6 Km and Devakottai railway station is 0.50 Km from the STP site. The town is well connected with Railways. It serves as a railway station for Chennai, Rameshwaram and Trichy.

Roads:

National Highways	State Highways
NH 226 – Madurai- Sivagangai – 3 Km	SH 34/ SH Ramanathapuram–Trichy - 3 Km
NH 85 Cochin- Madurai-Thondi – Adjacent to site	-

4.4 LAND USE

Existing land use in Karaikudi municipality, as per Master Plan 1991 and 2001, is given in the **Table 4-2.**

Table 4-2Existing land use of Karaikudi Municipality

S.No	Land Use	Area (in Sq.Km)	Area percentage
1	Residential	6.15	44.73
2	Commercial	0.41	2.98
3	Industrial	0.11	0.8
4	Education	0.11	0.8
5	Public and Semi-Public	0.16	1.17
6	Transportation (Roads and Rails)	1.67	12.17
7	Water bodies	1.39	10.1
8	Agricultural Wet	0.69	5.05
9	Dry Land + Vacant Area	3.05	22.2
	Total Area	**13.75**	**100.00**

In 1991, residential areas constitute 38.84 percent of the total area and it is increased to 44.73 percent in the 2001 land use plan.

4.5 RAINFALL & CLIMATE

Generally, the region is of hot climate. Average maximum temperature is about 34.2˚C and average minimum temperature is about 23.7˚C. Average Annual Temperature is 28.9˚C. Temperature is low during the month of January; the lowest mean daily temperature is 17ºC. The hottest month in the district is May during which period the maximum temperature is 40.2º C. The annual average rainfall in Karaikudi is about 69.84 mm (As per IMD data).

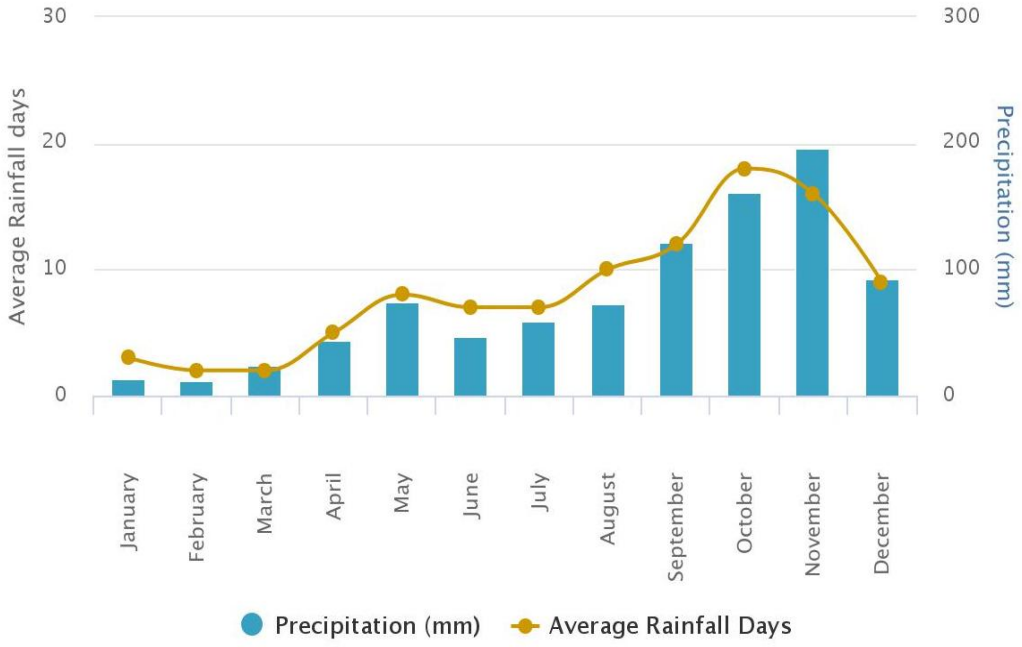

Figure 4-5– Average Annual Rainfall of Karaikudi

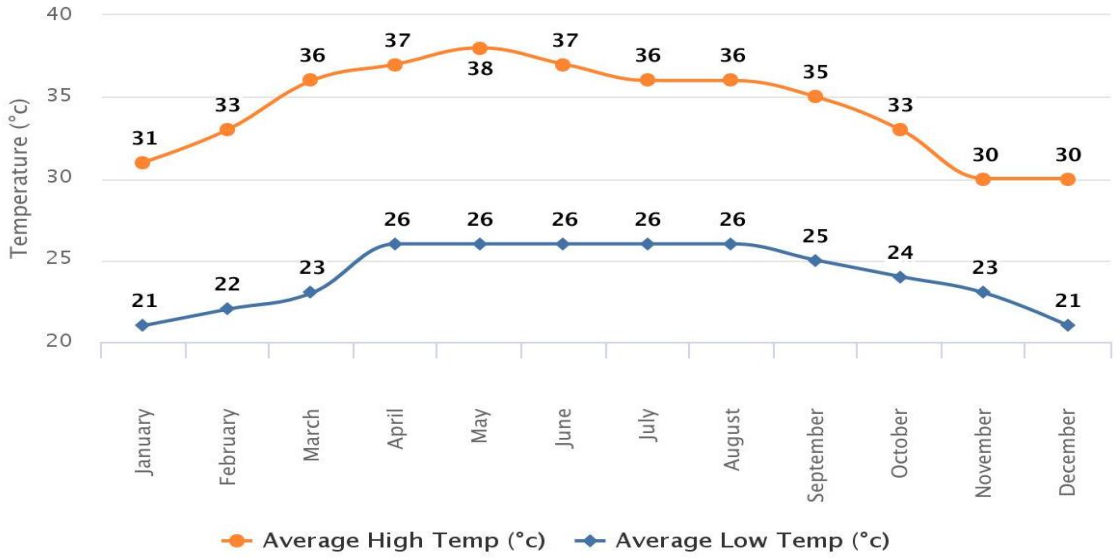

Figure 4-6– Average Annual Temperature of Karaikudi

Table 4-3Season wise Rainfall Distribution in Sivagangai District (in mm)

Season	70 years average (1910-1979)	10 years average (1996-2005)	2001	2002	2003	2004	2005
Winter (Jan-Feb)	45.9	34.5	14.3	124.3	1.0	-	34.4
Summer (March-May)	135.8	135.5	114.1	188.3	106.0	206.2	223.7
South-west monsoon (June-Sep)	309.3	290.5	279.1	156.2	327.9	367.3	263.3
North-East Monsoon (Oct-Dec)	413.7	454.0	407.2	420.8	250.7	499.2	786.7
Total	**904.7**	**914.5**	**814.7**	**889.6**	**687.6**	**1072.7**	**1308.1**

Table 4-4Y ear wise (2004 – 2013) Rainfall Distribution in Sivagangai District (in mm)

Month	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
JAN	0	0	20.5	1.4	0.9	1.4	4.1	6.0	5.7	13.2
FEB	0	24.10	0	4.1	51	0.0	0.0	11.7	0.3	46.0
MAR	6.3	28.5	70.2	1.3	255.9	0.6	0.0	3.1	2.4	52.7
APR	30.6	144.7	61.2	83.2	43.8	74.4	21.3	67.4	30.4	0.6
MAY	156	89.6	52.7	90.0	21.1	48.10	93.5	35.9	68.5	78.3
JUN	22.10	30.3	57.7	93.3	66.4	19.10	76.8	15.6	6.0	34.2
JUL	50.40	78.3	19.2	19.7	66.3	13.50	91.9	122.6	51.8	21.0
AUG	51.80	79.3	68.2	115.2	147.8	149.50	82.0	88.7	83.4	177.9
SEP	292.9	75.8	95.0	45.3	52.3	151.40	245.3	140.7	87.3	36.3
OCT	281.6	310.7	257.3	117.7	246.5	34.30	203.8	248.0	258.4	146.5
NOV	182.5	258.8	239.6	101.0	166.8	315.40	236.3	256.7	35.3	57.3
DEC	29	169.10	24.3	214.4	59	90.40	98.5	22.3	9.5	60.8
TOTAL	**1104**	**1289.20**	**965.9**	**886.6**	**1176.8**	**898.1**	**1153.50**	**1018.70**	**639.0**	**724.8**

4.6 GEOLOGY

Karaikudi Municipality, Sivagangai district falls within the Cauvery sub-basin, trending SE-NW between Devakottai in SE and Thirumayam in NW. The area is occupied by hard crystalline rocks of Arachaean age of its northern and northwestern parts. The formations are capped by thick laterite at places.

Major soil of this area is Red Soil. The terrain of Karaikudi is predominantly flat. The principal crop of Karaikudi is paddy. The other crops that are grown are millets, cereals, pulses, sugar cane and groundnut. The local varieties of paddy Nutipathu and Kuliparichan are drought tolerant.

Source:http://cgwb.gov.in/District_Profile/TamilNadu/Sivaganga.pdf

4.7 AIR ENVIRONMENT

Identification of different pollutants, which are expected to be released into the atmosphere and having significant impact on the neighborhood, is an essential component in impact assessment of the air environment. Since the proposed project is development of Under Ground Sewerage Scheme and a Sewage Treatment Plant, baseline data were collected in **November 2016** within 10 Km radius from the proposed site. The ambient air quality status of the study area within 10 km radial distance from the proposed STP Site will form the baseline information. The locations were selected based on the wind direction, taking into the consideration of few locations in the up wind direction and few locations in the down wind direction. In all the locations the observed values of PM_{10}, $PM_{2.5}$,CO, SO_2, & NO_X are within the prescribed limits of CPCB. The Sampling locations are listed in **Table 4-5**and the detailed air quality data is given in the **Table 4-6.**

Table 4-5 Ambient Air Quality Monitoring Locations

S.No	Location	Location Code	Distance in Km	Direction	Coordinates
1	Project Site Karaikudi STP	AAQ1	-	-	10° 3'16.37"N 78.45’44.97"E
2	Karaikudi RFR	AAQ2	2.55	NNW	10° 3'16.37"N 78°44'37.49"E
3	Shanmuganathapuram	AAQ3	5.83	SSE	09°59'51.58"N 78°47'32.12"E
4	Amaravathi	AAQ4	2.28	SE	10° 1'15.89"N 78°46'23.21"E
5	Sethurenganathpattanam	AAQ5	6.29	SSW	09°59'29.37"N 78°43'57.78"E
6	SR patinnam	AAQ6	5.38	SW	09°59'43.54"N 78°44'31.11"E
7	Kalluppatti	AAQ7	5.33	SSW	09°59'31.31"N 78°45'6.80"E
8	VisalayanKottai	AAQ8	7.10	SW	09°58'48.02"N 78°44'23.37"E

Table 4-6Ambient Air Quality Monitoring Results

S.No	Locations	SO2 (µg/m3)	NO2 (µg/m3)	PM2.5 (µg/m3	PM10 (µg/m3	Pb (µg/m3)	CO (mg/m3)	O3 (µg/m3)	NH3 (µg/m3)	Benzen (mg/m3)	Benzo (a) pyrene (ng/m3)	Arsenic(As) (ng/m3)	Nickel (Ni) (ng/m3)
1	Project Site Karaikudi STP	13.41	24.7	23.63	52.18	BDL(DL 0.05)	0.011	11.63	6.1	BDL (DL 1)	BDL (DL 1)	BDL (DL 2)	BDL (DL 10)
2	Karaikudi RFR	8.27	17.54	16.1	39.25	BDL(DL 0.05)	BD (DL 0.005)	BDL (DL 10)	BDL (DL 5)	BDL (DL 1)	BDL (DL 1)	BDL (DL 2)	BDL (DL 10)
3	Shanmuganathapuram	10.6	19.74	18.47	42.05	BDL(DL 0.05)	BD(DL 0.005)	BDL (DL 10)	BDL (DL 5)	BDL (DL 1)	BDL (DL 1)	BDL (DL 2)	BDL (DL 10)
4	Amaravathi	7.6	15.09	14.74	36.78	BDL(DL 0.05)	BD(DL 0.005)	BDL (DL 10)	BDL (DL 5)	BDL (DL 1)	BDL (DL 1)	BDL (DL 2)	BDL (DL 10)
5	Sethurenganathpattanam	9.42	20.8	19.84	43.7	BDL(DL 0.05)	BD(DL 0.005)	BDL (DL 10)	BDL (DL 5)	BDL (DL 1)	BDL (DL 1)	BDL (DL 2)	BDL (DL 10)
6	SR patinnam	8.1	16.49	15.27	37.09	BDL(DL 0.05)	BD(DL 0.005)	BDL (DL 10)	BDL (DL 5)	BDL (DL 1)	BDL (DL 1)	BDL (DL 2)	BDL (DL 10)
7	Kalluppatti	7.4	13.4	12.59	35.17	BDL(DL 0.05)	BD(DL 0.005)	BDL(DL 10)	BDL (DL 5)	BDL (DL 1)	BDL (DL 1)	BDL (DL 2)	BDL (DL 10)
8	VisalayanKottai	9.7	17.09	15.75	40.33	BDL(DL 0.05)	BD(DL 0.005)	BDL(DL 10)	BDL (DL 5)	BDL (DL 1)	BDL (DL 1)	BDL (DL 2)	BDL (DL 10)

Note: BDL (Below detectable limit), DL (Detectable limit)

Maximum concentrations of PM_{10}, $PM_{2.5}$, SO_2, NOx, CO, Pb, O_3, NH_3 , C_6H_6, C_{20} H_{12}, As & Ni are well within the National Ambient Air Quality Standards for Industrial, Commercial and Residential areas at all monitoring locations during the study period.

4.8 NOISE ENVIRONMENT

Noise levels were monitored at eight locations within the project study area in November 2016. Noise readings were taken for day time and night time. The main objective of noise monitoring in the study area is to establish the baseline noise levels and assess the impact of the total noise generated by the operation of the proposed project activities around it. The noise level has been monitored from 06.00 Am to 09.00 Pm and 09.00 Pm to 06.00AM hours. The Sampling locations and their results are shown in **Table4-7** and **Table4-8**.

Table 4-7Noise Level Monitoring Locations

Sl.No	Location	Location Code	Distance (≈Km)	Direction	Coordinates
1	Project Site Karaikudi STP	N1	-	-	10° 3'16.37"N 78.45’44.97"E
2	Karaikudi RFR	N2	2.55	NNW	10° 3'16.37"N 78°44'37.49"E
3	Shanmuganathapuram	N3	5.83	SSE	09°59'51.58"N 78°47'32.12"E
4	Amaravathi	N4	2.28	SE	10° 1'15.89"N 78°46'23.21"E
5	Sethurenganathpattanam	N5	6.29	SSW	09°59'29.37"N 78°43'57.78"E
6	SR patinnam	N6	5.38	SW	09°59'43.54"N 78°44'31.11"E
7	Kalluppatti	N7	5.33	SSW	09°59'31.31"N 78°45'6.80"E
8	VisalayanKottai	N8	7.10	SW	09°58'48.02"N 78°44'23.37"E

4.8.1 OBSERVATIONS

It is observed that the day equivalent and night equivalent noise levels at all locations are within prescribed CPCB standards.

- Day equivalent noise levels (L_d) ranged between 72.0 dB(A) to 54.0 dB (A)
- Night equivalent noise levels (L_n) ranged between 61.0 dB (A) to 44.0 dB (A).

The field observations during the study period indicate that the ambient noise levels were within the limit prescribed by MoEF&CC.

Table 4-8Noise Level Monitoring Results

S. No	Location	Location Code	CPCB Standard		Noise level in dB(A) Leq		Environmental Setting
			Day	Night	L_{day} (L_d)	L_{Night} (L_n)	
1.	Project Site Karaikudi STP	N1	65	55	62	52	Commercial
2.	Karaikudi RFR	N2	55	45	54	42	Residential
3.	Shanmuganathapuram	N3	75	65	70	61	Industrial Area
4.	Amaravathi	N4	75	65	72	60	Industrial Area
5.	Sethurenganathpattanam	N5	55	45	58	44	Residential
6.	SR patinnam	N6	55	45	56	46	Residential
7.	Kalluppatti	N7	55	45	57	48	Residential
8.	VisalayanKottai	N8	55	45	55	44	Residential

4.9 WATER ENVIRONMENT

Surface water plays major role in irrigation when compared to the ground water source. There is no major perennial river system within the 2 Km radius of the STP site. The

assessment of present status of water quality within the study area was conducted by collecting water samples from ground water sources (Hand Pumps/Bore wells) during the period of November 2016. The sampling locations have been identified on the basis of their importance.

Details of ground water sampling locations with their distance from the STP site are presented in **Table 4-8.**

Kodi Kattan Kanmoi is located at about 600m distance East side, Kozhikanmoi is located 1.4Km distance from the STP site and Ariyakudi Kanmoi is located 2.30Km from the STP site. The treated water is disposed through near Thenar River and it's used by the nearby farmers for agriculture.

The locations were selected based on the vicinity of the treatment plant, to establish the existing base line water quality.

There is no surface water in Thenar River, so there is no possibility for surface monitoring quality. Thenar river photos are enclosed as **Figure4-7.**

Figure 4-7Treated sewage discharging point

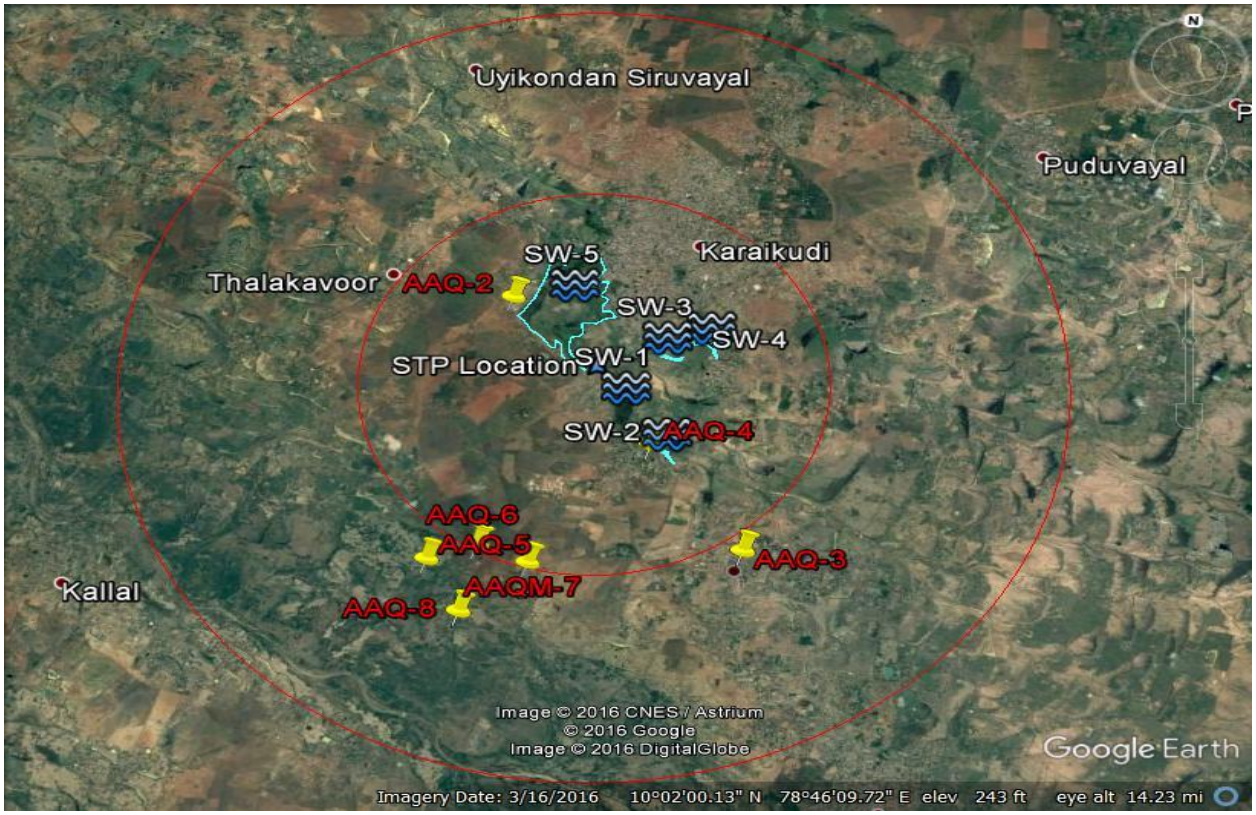

Figure 4-8Satellite Imagery Showing Ambient Air &Water Sampling Locations

Table 4-9Ground Water Sampling Location

S.No	Location	Location Code	Distance in Km	Direction	Coordinates
1	Project Site Karaikudi STP	GW1	--	--	10° 3'16.37"N 78.45’44.97"E
2	Karaikudi RFR	GW2	2.55	NNW	10° 3'16.37"N 78°44'37.49"E
3	Shanmuganathapuram	GW3	5.83	SSE	09°59'51.58"N 78°47'32.12"E
4	Amaravathi	GW4	2.28	SE	10° 1'15.89"N 78°46'23.21"E
5	Sethurenganathpattanam	GW5	6.29	SSW	09°59'29.37"N 78°43'57.78"E

S.No	Location	Location Code	Distance in Km	Direction	Coordinates
6	SR patinnam	GW6	5.38	SW	09°59'43.54"N 78°44'31.11"E
7	Kalluppatti	GW7	5.33	SSW	09°59'31.31"N 78°45'6.80"E
8	VisalayanKottai	GW8	7.10	SW	09°58'48.02"N 78°44'23.37"E

Table 4-10Surface Water Sampling Locations

Sl.No	Location Code	Distance in Km	Direction	Coordinates
1	SW1	0.78	SE	10° 1'59.90"N 78°46'7.03"E
2	SW2	2.25	SE	10° 1'22.53"N 78°46'38.09"E
3	SW3	1.66	NE	10° 2'45.35"N 78°46'32.85"E
4	SW4	2.57	NE	10° 2'55.85"N 78°47'2.74"E
5	SW5	2.21	NW	10° 3'26.94"N 78°45'24.22"E

The samples were analyzed for selected physico-chemical parameters to establish the existing water quality of the study area.

Table 4-11Ground Water Sampling Results

S.No	Parameters	UNIT	Drinking water Standard (IS 10500: 2012) Permissible Limit	Drinking water Standard (IS 10500: 2012) Acceptable Limit	Project Site Karaikudi STP (GW1)	Karaikudi RFR (GW2)	Shanmuganathapuram (GW3)	Amaravathi (GW4)	Senthurengunathpattanam (GW5)	SR patinnam (GW6)	Kallupatti (GW7)	Visalayan Kottai (GW8)
1.	Source	-	-	-	Hand Pump	Hand Pump	Hand Pump	Hand Pump	Bore Well	Hand Pump	Bore Well	Hand Pump
2.	Colour	Hazen	15	5	Hazen	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)
3.	pH at 25°C	-	NR	6.5 – 8.5	6.88	7.38	6.8	7.92	7.68	7.78	7.32	7.42
4.	Conductivity	Micromhos/cm	-	-	938	842	844	636	648	884	1064	804
5.	Turbidity	NTU	5	1	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
6.	Total Dissolved Solids	mg/l	2000	500	562	472	478	360	372	530	660	398
7.	Total Hardness as $CaCO_3$	mg/l	600	200	108	98	102	84	86	130	148	208

S.No	Parameters	UNIT	Drinking water Standard (IS 10500: 2012) Permissible Limit	Drinking water Standard (IS 10500: 2012) Acceptable Limit	Project Site Karaikudi STP (GW1)	Karaikudi RFR (GW2)	Shanmuganathapuram (GW3)	Amaravathi (GW4)	Senthurengunathpattanam (GW5)	SR patinnam (GW6)	Kallupatti (GW7)	Visalayan Kottai (GW8)
8.	Total Alkalinity as $CaCO_3$	mg/l	600	200	91	90	94	82	84	132	120	102
9.	Chloride as Cl	mg/l	1000	250	136	117	135	96	51	31	119	134
10.	Sulphate as SO_4	mg/l	400	200	72	57	51	42	29	19	49	42
11.	Fluoride as F	mg/l	1.5	1	0.42	0.44	0.3	0.28	0.36	0.36	0.32	0.14
12.	Nitrate as NO_3	mg/l	NR	45	8.6	6.5	8.5	5	4.88	3.56	11	16
13.	Dissolved Iron	mg/l	NR	0.3	0.24	0.31	0.23	0.3	0.12	0.1	0.14	0.06
14.	Sodium as Na	mg/l	-	-	65	56	65	46	25	15	56	65
15.	Potassium as K	mg/l	-	-	8	4	5	3	2	1	6	5
16.	Calcium as Ca	mg/l	200	75	24	30	32	22	18	28	34	38

S.No	Parameters	UNIT	Drinking water Standard (IS 10500: 2012) Permissible Limit	Drinking water Standard (IS 10500: 2012) Acceptable Limit	Project Site Karaikudi STP (GW1)	Karaikudi RFR (GW2)	Shanmuganathapuram (GW3)	Amaravathi (GW4)	Senthurengunathpattanam (GW5)	SR patinnam (GW6)	Kallupatti (GW7)	Visalayan Kottai (GW8)
17.	Magnesium as Mg	mg/l	100	30	16	14	13	9.8	8.4	14	18	24
18.	Cyanides as CN	mg/l	NR	0.5	BDL DL(0.01)	BDL DL(0.01)	BDL DL(0.01)	BDL DL(0.01)	BDL DL(0.01)	BDL DL(0.01)	BDL DL(0.01)	BDL DL(0.01)
19.	Zinc	mg/l	15	5	0.003	0.005	0.002	0.003	0.001	0.018	0.011	0.021
20.	Chromium as Cr	mg/l	NR	0.5	BDL DL (0.01)	BDL DL (0.01)	BDL DL (0.01)	BDL DL (0.01)	BDL DL (0.01)	BDL DL (0.01)	BDL DL (0.01)	BDL DL (0.01)
21.	Copper as Cu	mg/l	1.5	0.05	0.008	BDL DL(0.01)	BDL DL(0.01)	0.007	BDL DL(0.01)	BDL DL(0.01)	0.002	BDL DL(0.01)
22.	Manganese as Mn	mg/l	0.3	0.1	BDL DL (0.01)	BDL	BDL	BDL	BDL	BDL	BDL	BDL
23.	Cadmium as Cd	mg/l	NR	0.003	BDL DL(0.01)	BDL DL(0.01)	BDL DL(0.01)	BDL DL(0.01)	BDL DL(0.01)	BDL DL(0.01)	BDL DL(0.01)	BDL DL(0.01)
24.	Lead as Pb	mg/l	NR	0.01	BDL DL(0.	BDL DL(0.	BDL DL(0.01)	BDL DL(0.01)	BDL DL(0.01)	BDL DL(0.0	BDL DL(0.0	BDL DL(0.

S.No	Parameters	UNIT	Drinking water Standard (IS 10500: 2012) Permissible Limit	Drinking water Standard (IS 10500: 2012) Acceptable Limit	Project Site Karaikudi STP (GW1)	Karaikudi RFR (GW2)	Shanmuganathapuram (GW3)	Amaravathi (GW4)	Senthurengunathpattanam (GW5)	SR patinnam (GW6)	Kallupatti (GW7)	Visalayan Kottai (GW8)
					01)	01)				1)	1)	01)
25.	Selenium as Se	mg/l	NR	0.01	BDL DL (0.005)	BDL DL (0.005)	BDL DL (0.005)	BDL DL (0.005)	BDL DL (0.005)	BDL DL (0.005)	BDL DL (0.005)	BDL DL (0.005)
26.	Phosphate	mg/l	-	-	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)
27.	Nickel as Ni	mg/l	NR	0.02	BDL DL (0.01)	BDL DL (0.01)	BDL DL (0.01)	BDL DL (0.01)	BDL DL (0.01)	BDL DL (0.01)	BDL DL (0.01)	BDL DL (0.01)

Note:*BDL - Below Detection Limit; DL – Detection Limit; BLQ – Below Limit of Quantification; LOQ – Limit Of Quantification; NR – No Relaxation*

Summary of Ground Water analytical results

- The ground water results of the study area indicate that the average pH range varied between 6.8-7.92,
- The Total Dissolved Solids range varied between 360 mg/l -660 mg/l for the ground water and its meets the permissible limits of IS 10500: 2012
- The desirable limit of the chloride content is 250 mg/l and permissible limit is 1000 mg/l. The chloride content in the ground water for study area is ranges between 31 mg/l -136 mg/l meeting the desirable limit of IS 10500:2012.
- The desirable limit of the sulphate content is 200mg/l and permissible limit is 400mg/l. the sulphate content of the ground water of the study area is varied between 19 mg/l -72 mg/l meeting the desirable limit of the IS 10500: 2012.
- The Total hardness ranges is between 84-208 mg/l for ground water its meeting the permissible limit of the IS 10500:2012.

Table 4-12Surface Water Sampling Results

S.No	Parameters	Units	SW-1	SW-2	SW-3	SW-4	SW-5
1	Colour	Hazen	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)
2	pH at 25°C	-	6.88	7.32	7.11	7.86	7.62
3	Turbidity	NTU	1.4	1.2	1.6	1.8	1.4
4	Conductivity	Micromhos/cm	1432	832	746	724	824
5	Dissolved Oxygen	mg/l	6.4	6.2	6.3	6.3	6.4
6	BOD, 3 Days @27°C	mg/l	3	4	2	3	2
7	COD	mg/l	6	8	6	8	6
9	Total Dissolved Solids	mg/l	760	448	444	434	460
10	Total Hardness as $CaCO_3$	mg/l	184	132	136	137	142
11	Total Alkalinity as $CaCO_3$	mg/l	210	128	132	140	154
12	Chloride as Cl	mg/l	222	136	140	139	138
13	Sulphate as SO_4	mg/l	48	38	42	68	78

S.No	Parameters	Units	SW-1	SW-2	SW-3	SW-4	SW-5
14	Fluoride as F	mg/l	0.24	0.46	0.62	0.3	0.62
15	Nitrate as NO_3	mg/l	8	3	6.4	8	5.2
16	Dissolved Iron	mg/l	0.04	0.03	0.05	0.04	0.08
17	Sodium as Na	mg/l	107	65	67	67	66
18	Potassium as K	mg/l	8	9	10	11	12
19	Calcium as Ca	mg/l	48	38	38	42	44
20	Magnesium as Mg	mg/l	16	12	12	18	18
21	Cyanides as CN	mg/l	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
22	Zinc	mg/l	0.005	0.004	0.003	0.002	0.003
23	Chromium as Cr	mg/l	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
24	Copper as Cu	mg/l	BLQ(LOQ 0.01)	0.02	BLQ(LOQ 0.01)	0.01	BLQ(LOQ 0.01)
25	Manganese as Mn	mg/l	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)
26	Cadmium as Cd	mg/l	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)

S.No	Parameters	Units	SW-1	SW-2	SW-3	SW-4	SW-5
27	Lead as Pb	mg/l	BLQ(LOQ 0.005	BLQ(LOQ 0.005	BLQ(LOQ 0.005	BLQ(LOQ 0.005	BLQ(LOQ 0.005
28	Selenium as Se	mg/l	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
29	Phosphate	mg/l	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)	BLQ(LOQ 0.02)
30	Nickel as Ni	mg/l	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)

Table 4-13Surface water Standards (IS 2296:1992)

S.No	Parameters	Unit	A	B	C	D	E
1	Colour	Hazen	10	300	300	---	---
2	Turbidity	NTU	---	---	---	---	---
3	pH	--	8.5	8.5	8.5	8.5	8.5
4	Conductivity	µS/cm	---	---	---	1000	2250
5	Total Dissolved Solids	mg/l	500	---	1500	---	2100
6	Alkalinity as CaCO3	mg/l	---	---	---	---	---
7	Total Hardness as CaCo3	mg/l	300	---	---	---	---
8	Calcium as Ca	mg/l	80.10	---	---	---	---
9	Magnesium as Mg.	mg/l	24.28	---	---	---	---
10	Sodium Na	mg/l	---	---	---	---	---
11	Potassium	mg/l	---	---	---	---	---
12	Chloride as Cl	mg/l	250	---	600	---	600
13	Sulphate as SO4	mg/l	400	---	400	---	1000
14	Phosphate	mg/l	---	---	---	---	---
15	Nitrate as NO3	mg/l	20	---	50	---	---
16	Fluorides as F	mg/l	1.5	1.5	1.5	---	---
17	Cyanide	mg/l	0.05	0.05	0.05	---	---
18	Arsenic	mg/l	0.05	0.2	0.2	---	---
19	Cadmium	mg/l	0.01	---	0.01	---	---
20	Chromium, Total	mg/l	0.05	0.05	0.05	---	---
21	Copper	mg/l	1.5	---	1.5	---	---
22	Iron	mg/l	0.3	---	50	---	---
23	Lead	mg/l	0.1	---	0.1	---	---

S.No	Parameters	Unit	A	B	C	D	E
24	Zinc	mg/l	15	---	15	---	---
25	Manganese	mg/l	0.5	---	---	---	---
26	Selenium	mg/l	0.01	---	0.05	---	---
27	Mercury	mg/l	0.001	---	---	---	---
28	Dissolved Oxygen	mg/l	6	5	4	4	---
29	COD	mg/l	---	---	---	---	---
30	BOD	mg/l	2	3	3	---	---

Class A – Drinking water without conventional treatment but after disinfection.

Class B –Water for outdoor bathing.

Class C – Drinking water with conventional treatment followed by disinfection.

Class D – Water for fish culture and wild life propagation.

Class E – Water for irrigation, industrial cooling and controlled waste disposal

Summary of analytical results

- In the surface water the pH varied between 6.88-7.86which is meeting the IS: 2296 1992 for inland surface water. The pH value for all the samples in the study area during study period found to be within the limits.
- The Total Dissolved Solids ranges is varied between 434-760 mg/l for the surface water The TDS value for all the samples meeting the class E standards of IS: 2296 1992.
- The Class A limit for chloride content is 250mg/l The chloride content in the ground water for study area is ranges between 136 mg/l -222 mg/l meeting the Class A standards.
- The sulphate content of the surface water meeting the minimum range of 38 mg/l and maximum range of 68 mg/l. The surface water samples meeting the class A standard of IS: 2296 1982 (400 mg/)l.
- The Total hardness ranges is between 132 – 184 mg/l for ground water its meeting the Class A standards of IS2296:1992 (300 mg/l).

4.10 SOIL QUALITY

The soil sampling locations were identified to assess the fertility and agricultural characteristics of the soil. The sampling locations were selected within 10 Km around the project site. The identification of the sampling stations is based on the sensitivity of the location, distance and direction with respect to the proposed project site. The samples collected from all locations are homogeneous representative of each location. At random, 8 locations were identified and at each location soil was dug from 30 cm below the surface in November 2016. It was uniformly mixed to homogenize the soil samples. The samples were filled in polythene bags, labeled in the field with number and site name. The soil samples collected were transported to laboratory for further analysis.

Table 4-14Soil Sampling Locations

Sl.No	Location	Location Code	Distance in Km	Direction	Coordinates
1	Project Site Karaikudi STP	S1	-	-	10° 3'16.37"N 78.45’44.97"E
2	Karaikudi RFR	S2	2.55	NNW	10° 3'16.37"N 78°44'37.49"E
3	Shanmuganathapuram	S3	5.83	SSE	09°59'51.58"N 78°47'32.12"E
4	Amaravathi	S4	2.28	SE	10° 1'15.89"N 78°46'23.21"E
5	Sethurenganathpattanam	S5	6.29	SSW	09°59'29.37"N 78°43'57.78"E
6	SR patinnam	S6	5.38	SW	09°59'43.54"N 78°44'31.11"E
7	Kalluppatti	S7	5.33	SSW	09°59'31.31"N 78°45'6.80"E
8	VisalayanKottai	S8	7.10	SW	09°58'48.02"N 78°44'23.37"E

Table 4-15Soil Quality Monitoring Results

Sl.No	Parameters	Units	Project Site Karaikudi STP(S1)	Karaikudi RFR(S2)	Shanmuganathapuram(S3)	Amaravathi(S4)	Senthurengunathpattanam(S5)	SR patinnam(S6)	Kalluppatti(S7)	Visalayan Kottai(S8)
1.	Textural Class	-	Brownish Dark Sand	Brownish Dark Sand	Brownish Dark Sand	Brownish Dark Sand	Brownish Dark Sand	Brownish Dark Sand	Brownish Dark Sand	Brownish Dark Sand
2.	Silt & Clay	%	42	43	39.8	41.7	37.7	35.8	36	37.2
3.	Sand	%	58	57	60.2	58.3	62.3	64.2	64	62.8
4.	pH of 10% Solution	-	7.86	7.68	8.12	8.06	8.28	8.22	8.43	8.17
5.	Bulk Density	g/cc	1.412	1.01	1.016	1.012	1.021	1.024	1.016	1.024
6.	Conductivity	Ohm/cm	124	122	142	132	146	140	148	153
7.	Water holding Capacity	%	28	32	36	34	36	35	38	36
8.	Moisture Content	%	23.6	21.2	26.8	25.8	23.6	24.2	24.8	18.4
9.	Organic matter	%	2.3	2.5	2.8	2.5	2.7	2.8	2.4	2.6
10.	Nitrogen	%	0.42	0.4	0.36	0.42	0.42	0.4	0.4	0.46
11.	Phosphorus	%	0.28	0.31	0.3	0.82	0.36	0.3	0.31	0.34
12.	Potassium	%	0.06	0.04	0.03	0.04	0.06	0.06	0.06	0.05

Summary of analytical results:

- The pH of the soil samples ranged from 7.68-8.43 indicating that the soils are almost neutral in nature.
- Conductivity of the soil samples ranged from 122-153 µS/cm. As the EC value is less than 2000 µS/cm, the soil is found to be non-saline in nature
- The Moisture Content of the soil samples varied from 18.4 – 26.8 (%).
- Nitrogen content ranged from 0.36 to 0.46%
- Phosphorous ranged from 0.28 to 0.82%
- Potassium content ranges from 0.03 to 0.06 %

4.11 SOCIO-ECONOMIC DATA

Information about demography and socio-economic profile was collected from the District Census Hand book (2011) (District - Sivagangai, Tamil Nadu). The census data available for different blocks, taluks and towns have been analyzed with respect to demographic profile, community structure, educational facilities, occupation structure and infrastructure facilities.

4.11.1 DEMOGRAPHY

The population details in the study area with male & female classification and SC, ST population as per 2011 census are shown in **Table 4-15.** Children populations are shown in**Table 4-16.**

Table 4-16Study Area Population Statistics

S.No	Taluks	Total Population	Male	Female	SC	ST	General
1	Tirupathur	17154	8589	8565	3326	5	13823
2	Karaikkudi	190493	94842	95651	18779	164	171550
3	Devakottai	157,631	79,606	78,025	34,224	282	12362
Total		**365,278**	**183,037**	**182,241**	**56,329**	**451**	**197735**

Table 4-17Study Area Children Details

S.No	Taluks	Total Children	Male	Female
1	Tirupathur	1816	915	901
2	Karaikkudi	19078	9745	9333
3	Devakottai	14817	7540	7277
Total		**35,711**	**18,200**	**17,511**

4.11.2 LITERACY

The number of literates and Illiterates of the study area is given in **Table 4-18**.

Table 4-18Study Area Literacy Statistics

S.No	Taluks	Literate	Illiterate
1	Tirupathur	12003	5151
2	Karaikkudi	151558	38935
3	Devakottai	116665	40966
Total		**176011**	**48912**

4.11.3 LAND USE PATTERN

The total geographical area of the study area was 318 Sq. Km. Cropped area accounts for 30.98% of the total area. Forest cover is accounting for about 9.71% of the total area. A significant portion of the land falls under the category of 'non agriculture' and 'fallow lands'. Land use Pattern of the project study area given in **Table4-19.**

Table 4-19Land use Pattern during 2005-06

S.No	Description	Percentage	Area (Sq.Km)
1	Cropland	30.98	98.53
2	Fallow land	26.73	85.01
3	Reservoirs/ Lakes/ Ponds	12.2	38.8
4	Forest Plantation	9.71	30.88
5	Urban	7.46	23.71
6	Plantation	5.52	17.49
7	Rural	4.27	13.58
8	Scrub land	1.71	5.44
9	River/ Stream/ Canals	0.72	2.36
10	Salt affected land	0.51	1.6
11	Scrub Forest	0.19	0.6
	Total	**100**	**318**

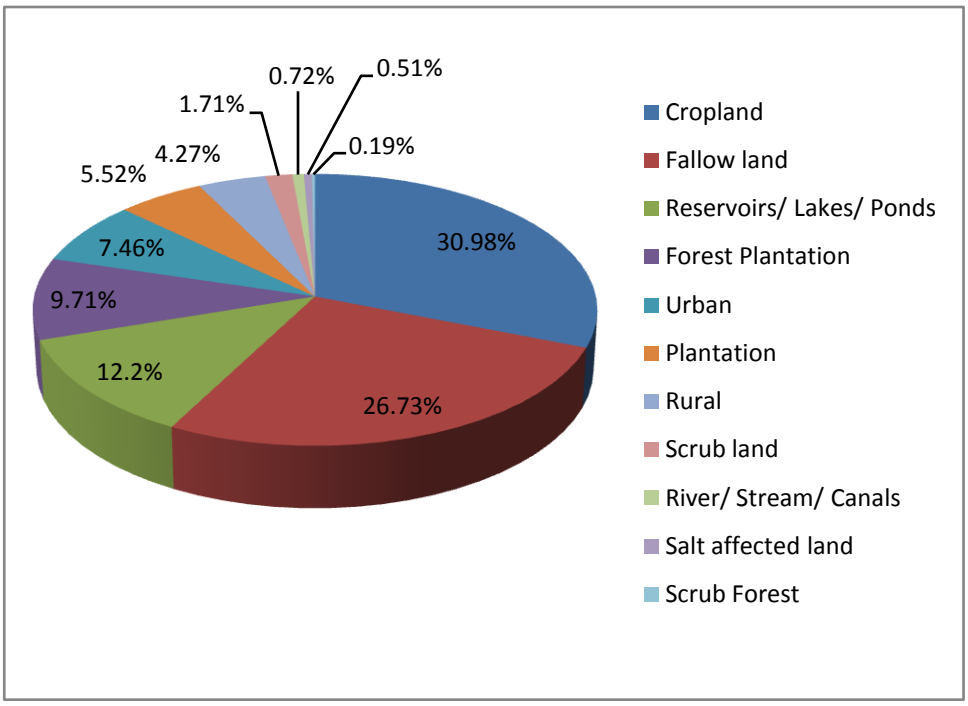

Figure 4-9Land Use Pattern of Project Study Area

4.11.4 AGRICULTURE

Since the district is under the hot and dry climatic conditions, the dry land crop is best suited. Agriculture in the district depends on monsoon rains. The average rainfall of the District is below 920 mm. Paddy (69.67% of cultivable area) and Cereals (69.80% of cultivable area) are mainly cultivated in this district. There are ample opportunities to promote new crop varieties and new technologies such as precision farming and system of rice intensification as the farmers are now educated on these aspects and willing to adopt the new varieties and technologies.

Table 4-20Area under principal crops during 2011-12 in Hectares.

Net Cultivated Area	201.03Sq.Km	100%
Paddy	140.06	69.67%
Cereals	140.32	69.80%

4.11.5 IRRIGATION

The main sources of irrigation in Karaikudi municipality are Tanks and Wells. The main contribution for irrigation in this region is Tanks, there are 148 tanks and the area under the Tanks irrigation is 20,103 Ha. There is no coastline in this area.

4.11.6 ANIMAL HUSBANDRY AND FISHERIES

In agricultural economy, the contribution by Animal Husbandry and fisheries sector is laudable as it goes parallel and depends on agriculture. Of late, cattle development has taken place through setting up of an intensive cattle development project. Apart from the cattle and buffaloes, goats, sheep and pigs are other important livestock found in the district. The livestock census, 2012 is shown in**Table 4-21**.

Table 4-21Livestock Census 2012 – Sivagangai District

S.No	Livestock	Quantity (No's)
1	Cattle - Cross bread	97,522
	Cattle – Indigenous	1,48,891
2	Buffaloes	5,088
3	Sheep	2,16,577
4	Goat	3,45,071
5	Poultry	10,11,055

4.11.7 MINERAL RESOURCES

Graphite ore is available in this district; it is used for refractory bricks, expanded graphite, and crucible and carbon brushes.

4.11.8 INDUSTRIES

The district has limited number of Industries. A list of large scale industries in Sivagangai district is given in the table below.

Table 4-22Industries in the District

S.No.	Name of Industry	Location	Activity	Employed
1	M/s. Sri Nachammai Cotton Mills Limited,	L.F. Road, Chettinad, Karaikudi Taluk.	Cotton Yarn	700
2	M/s. SreeSnehavalli Textiles Limited,	Sankarapuram, Karaikudi Taluk.	Cotton yarn	250
3	M/s. Malar Solvent Extraction (P) Limited,	Karunavalkudi Village, Puduvayal, Karaikudi Taluk.	Rice Bran Oil	45
4	M/s.SriAnnamalaiyar paper Mills	Kottaiyur, Karaikudi	Paper	-

4.11.9 EDUCATION

The literacy level of Karaikudi Municipality according to 2011 census is 81.48%.A total literate in Karaikudi Municipality is 86975 as of census 2011. The information on the list of educational institutions is given in **Table 4-23.**

Table 4-23Lists of Educational Institutions in the Study Area Blocks

S.No	Block name	PUPS	PUMS	MUPS	MUUS	AID-PS	Aid-MS	HS/ Aid-Hs	HSS/Aid-HSS
1	Tirupattur	56	11	-	-	10	5	10	4
2	Kallal	71		2	-	-	-	1	1
3	Sakkottai	46	16	7	7	19	3	-	-
4	Devakottai	51	9	4	3	9	11	5	5
5	Kannan Kudi	42	-	-	-	-	-	-	-
Total		**266**	**36**	**13**	**10**	**38**	**19**	**16**	**10**

PUPS: Primary/Upper Primary School, **PUMS:** Primary/.Upper Primary/Middle School, **MUPS:** Municipal Primary School, **MUUS:** Municipal Upper Primary School, **Aid-PS:** Aided Primary School, **Aid-MS:** Aided Middle School, **HS**: High School, **HSS:** Higher Secondary School (Source: www.ashanet.org).

4.11.10 WORKFORCE

Table 4-24&**Table4-25** presents details on workforce in the Study area taluk's. While the rural workers are employed in agriculture and allied activities, the urban workforce is employed in industries.

Table 4-24Workforcesin the Study Area

Taluks	Total Workers	Main Workers	Main Workers				Marginal Workers	Non Workers
			Cultivators	Agri.Labours	Household Industries	Other workers		
Tirupathur	8889	6198	1621	2946	88	1543	2691	8265
Karaikudi	72006	59096	2950	1748	1767	52631	12910	118487
Devakottai	7913	5362	1704	1403	88	2167	2551	9363
Total	**88808**	**70656**	**6275**	**6097**	**1943**	**56341**	**18152**	**136115**

Table 4-25Gender wise Work Force Details

Taluk	Total	Male	Percentage	Female	Percentage
Tirupathur	8889	5338	60.05	3551	39.95
Karaikudi	72009	54105	75.14	17904	24.86
Devakottai	7913	5263	66.51	2650	33.49
Total	**88808**	**64706**	**72.86**	**24105**	**27.14**

(Source: Census 2011)

4.11.11 MEDICAL AND HEALTH FACILITIES

Table 4-26presents the medical & health care facilities in the district.

Table 4-26Health care facilities in the Study Area

S.No	Description	Counts
1	District Hospitals	1
2	Sub divisional Hospitals	3
3	CHC's, Women's Health	2
4	Primary Health Centre's	19
5	Health Sub Centre's	
6	Medical College	1
7	Nursing Homes	9
8	Siddha Hospitals	3
9	ESI Hospital	1
10	UPHC	2
11	Siddha- PHC	3

(Source: www.tnhealth.org)

5 PREDICTED IMPACTS AND MITIGATION MEASURES

5.1 INTRODUCTION

The potential impacts of proposed underground sewerage system and Common Sewage Treatment Plant on the existing environment is given in this chapter. Construction of sewer line with sewage treatment plant and there after operation of this system, if undertaken without a proper understanding of the relationships inherent in environmental function, can be accompanied by disruptions to the environment, from which it may take a long time to regain equilibrium. In human terms, this may mean that generations must function in a debilitated environment and suffer many possible associated socio-economic hardships and financial losses.

Some of the major environmental impacts of sewerage system include damage to local ecosystems, loss of productive agricultural lands, demographic change, accelerated urbanization, and introduction of disease. The need of development and growth in the area must be matched with the conservation of the existing natural resources.

In general, construction of a new sewage treatment plant will have a positive environmental impact on the town. It is expected to produce a long term improvement in public health of the residents, as well as to significantly reduce a source of chronic water pollution of an ecologically valuable portion if the water body where the sewage drains.

5.2 IMPACT EVALUATION

5.2.1 AIR QUALITY

This section presents an assessment of air quality impacts associated with the construction and operation of the proposed STP activity at Karaikudi Municipality, Sivagangai, TamilNadu. Major sources of air pollution have been identified namely construction dust emission and road traffic emissions. The sources of air pollutants at the different phases of the development are categorized as follows;

Construction Phase

Impacts

- Dust emissions from excavation work, digging, stacking of soils, filling, handling of construction material, transportation of material.
- Emission due to movement of vehicles and plying of heavy construction machinery.
- Gaseous emissions from operation of diesel generators for power requirement during construction phase.
- Vehicular movement at the site and also increase in traffic volume on the connecting roads will rest in increase in vehicular emissions.
- The dust levels in the STP and pumping station areas are expected to be increased substantially during construction.
- Traffic movement at the site and also increase in traffic volume on the connecting roads will rest in increase in vehicular emissions.

Operation Phase

Impacts

- The key potential air quality impact during the operational phase of the treatment plant would be the emissions arising from the operation of D.G. Sets.
- The use of D.G sets is anticipated only during power failure and hence is temporary and requires standard measures.
- Sewage treatment plant produces a large amount of gaseous emission (CO_2, CH_4& N_2O) to atmosphere.
- Movement of vehicles for loading and unloading of chemicals.
- Leakage of chlorine gas used for disinfection process in STP.

5.2.2 NOISE QUALITY

The noise quality around the proposed site is under the permissible limit.

Construction Phase

Impacts

- Use of heavy machineries and vehicles during construction of Pumping station and Sewage Treatment Plant.
- The Construction works will however present a short term noise to the public.

It is envisaged that operation of these construction activity will generate noise levels between 75 – 80 dB (A). The combined effect of these noise sources may cross 90 dB (A) at the construction site, however noise dissipates as it spreads in area beyond the study area.

Operation Phase

Impacts

- Pumping will be done for 23 hours per day at the Pumping Stations.
- Movement of vehicles and noise of motors, including other machineries like air blowers result in increase of ambient noise levels and have adverse impact on the sensitive receptors.
- Improper handling and irregular maintenance of operating machines including pumps, generators, air diffusers, etc may lead to increased noise pollution during operation activity.
- The use of D.G set in STP and Pumping stations during power failure may lead to increase in noise levels.

5.2.3 WATER QUALITY

Construction phase

Impacts

- Runoff from construction sites such as STP and Pumping station during rainy season may pollute the surface water bodies by increasing turbidity level.
- Spillage of oil and grease from the vehicles from vehicles washing, workshop etc.
- Dumping of construction debris, accidental spill of materials in nearby water bodies.
- Generation of waste water from the site during construction activities.

Operation phase

Impacts

- Wastewater arising out of toilets in operation phase for the laborers at site.
- Temporary flooding of adjacent areas due to accidental leakages/bursts and also due to blockages and backlogging of lines.
- Water pollution and possibility of mixing with water supply line due to leakages/overflows from the sewer lines.
- Water quality in the source/water bodies.
- Wastage of water due to leakage or indiscriminate use.
- Pipe corrosion due to acidity or alkalinity.

5.2.4 ODOUR PROBLEM

- The process of wastewater collection, conveying or treatment has the potential to generate and release odour to the surrounding area. However, odour problems mainly occur in the collection system, in treatment facilities and in solids handling facilities.

5.2.5 SOLID WASTE HANDLING

- **Construction Phase -** Solid waste generated during site preparation and construction work would include cut vegetation and typical construction waste (e.g. wasted concrete, steel, wooden scaffolding and forms, bags, waste earth materials, etc,). This waste would negatively impact the site and surrounding environment if not properly managed and disposed of at an approved dumpsite.

- **Operation Phase –** Grit, screenings and the sludge generated from the treatment plant will be the major source of solid waste.

5.2.6 CULTURAL AND SOCIO-ECONOMIC IMPACTS

- Local people would also get job opportunities during construction and operation phases of the project. There is no issue of resettlement or rehabilitation as the proposed site belongs to the municipality. The project will provide Employment opportunities to more than 100 people during Construction phase. Constructional Phase of the project will lead to air pollution, noise pollution in their respective areas. Dust problems will arise which may affect some people.
- Communication and power supply facilities are likely to get affected in the areas during construction. Improper planning of construction activities may lead to traffic jam, diversion of traffic and related problems cause trouble to public movement. Potential road safety risks from construction vehicles and trucks delivering material to the construction sites. Maintain speed limit construction and laying area.

- The construction of proposed sewage treatment plant is a mark beneficial socio-economic aspect since it leads to safe and hygienic disposal of the treated effluent.

- It enhances the existing environment as the raw sewage disposal will be ceased.

- Also, the project will provide employment to the people during the constructional and operational phase hence creating a positive impact due to this project.

Thus the project is expected to contribute to the overall development of the area.

5.2.7 OUTFALL LOCATION AND DESIGN

The treated sewage will be disposed to the Thenar River near to the site.

- As the sewage is discharged after treatment, the treated sewage quality will be within the standards prescribed by TNPCB.
- Since the quantity of treated sewage is huge, there can be flooding of the nearest Thenar river.

5.3 PROPOSED MITIGATION MEASURES

5.3.1 AIR QUALITY

- The fugitive emissions and dust from the proposed site during construction phase can be reduced by sprinkling of water.
- The power requirement during the operation of STP will be 750 KVA. DG sets are operated only during power failures and the D.G sets are proposed to provide 600 KVA as required suitable power back up to run the plant. The emissions from the D.G sets will have marginal impact on the existing air quality, however adequate Stack height of 5m will be provided as per the CPCB norms to combat the effect on the air quality and also to facilitate proper dispersion.
- Steps will be taken to create environmental awareness for the commuters so that the vehicles will be maintained properly in turn will not have any impact due to the vehicular emissions.

5.3.2 NOISE QUALITY

a) Collection System and Pumping Stations

Operation of pumps and motors and diesel generators is a major source of noise. The Pump sets proposed are submersible with the maximum capacity of 25 HP. As the pumping station is located at ~150mfrom the residential areas, noise generated from pumping station can have continuous negative impacts on the surrounding population. Internal noise level in a room measured at a distance of 1m from these pump sources typically will be in the range of 80 dB(A) to 100 dB(A).

- Procure good quality latest technology high pressure pumps that guarantee controlled noise at a level of around 80 dB(A) at a distance of 1meter.

- Use appropriate building materials and construction techniques for sewage pumping stations which can absorb sound rather than reflect noise.
- Procure only CPCB approved generators to meet air emission and noise level requirements.
- Provide sound mufflers for ventilators in the plant rooms; and sound proof doors
- Provide ear plugs designated for noise reduction to workers. Those working in enclosed areas or adjacent to continuous running equipment should be provided with proper noise attenuating equipment.

b) Sewage Treatment Plant

- It can be mitigated by restricting the vehicular movement only during the day time.
- Noise problems shall be reduced to normally acceptable levels by incorporating low-noise equipment in the design and/or locating such mechanical equipment in properly acoustically lined buildings or enclosures.
- Acoustic enclosures will be provided for DG.
- Greenbelt is proposed along the periphery of the site which helps in reducing the noise levels.
- Adequate care will be taken to maintain the noise levels within the prescribed limits by providing ear muffs to the workers.
- The nearest residential development is about 0.5 km from the periphery of the STP and the sensitive areas such as temple and school are located at a distance of more than 2 km. The attenuation by the proposed greenbelt will be more than the adequate to maintain the noise level well within the prescribed standards by CPCB/TNPCB.

5.3.3 ODOUR PROBLEMS

a) PUMPING STATIONS:

The pumping stations is ~150m from the residences / Sensitive receptors. Measures proposed for odour control from Lifting stations/Pumping stations:

- Continuous operation with power back up.
- Every day removal of Grit and screens.
- Green belt around the Pumping stations.
- In addition to the above odour monitoring will be carried out during Operation and Maintenance and if need arises other odour control measures like Mechanical methods will be examined and be provided.

b) Sewage Treatment Plant

- Odor can be reduced or prevented through continuous process of the operation. The grit and screenings will be cleaned twice a day to facilitate normal flow of the water. The sludge developed in secondary clarifier will be removed and partly re-circulated to maintain the MLSS around 3000 mg/L as per field requirements.
- Surplus sludge will be pumped to the Sludge digester and to the Centrifuge for making Sludge cakes and subsequent disposal to the Compost yard.
- Storage of sludge in the STP site will be avoided.
- Thick shrubs and the trees along the periphery and in between the STP units will help in mitigating the odor from the site.
- Fly and Mosquito breeding is not envisaged since there will not be any stagnation of water inside the plant area.
- The odour impacts to the community are expected to be minimal. There is no significant habitation around the proposed site and there will not be any impact.

5.3.4 WATER QUALITY AND DISPOSAL

a) Network and Pumping Stations

- Adequate care will be taken to avoid leakages in the plant and leak proof joints are already proposed for the construction.
- All the structure constructed will be with M30 concrete which is leak proof.
- Continuous operation will be ensured to prevent overflow at Pumping stations.
- All earthworks be carried out during the dry season to prevent the problem of soil/silt run-off during rains
- Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; do not stock earth/material close to water bodies
- Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, only designated disposal areas shall be used;
- Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;
- Place storage areas for fuels and lubricants away from any drainage leading to water bodies; these should be at least 100 m away from water bodies and groundwater wells
- Store fuel, construction chemicals etc., on an impervious floor, also avoid spillage by careful handling; provide spill collection sets for effective spill management
- Dispose any wastes generated from construction activities in designated sites
- Conduct surface water quality inspection according to the Environmental Management Plan (EMP).

b) Sewage Treatment Plant

- Adequate care will be taken to avoid leakages in the plant and leak proof joints are already proposed for the construction.

- All underground-buried piping will be protected by the application of hot coal tar enamel and fiberglass wrapping. The coating will consist of one coal tar primer one coat, wrapping of fiber glass one more coat of enamel and the final wrap of enamel impregnated fiber glass.
- All sanitary piping will be of UPVC class 4 suitably buried below the ground with a sand cushion of 20 cm all round. The pipes will painted with two coats of anticorrosive bit mastic paint.
- The drained water will be sent back to the inlet for treatment through pipelines.
- Administrative building, chlorine tonner and centrifuge house are provided with rain water harvesting facilities. Pipe culverts will be provided at road crossings for storm water drainage of the area at the required number of places.
- There will not be any impact on the nearby drainage canal downstream usage. However as mentioned above the quality of the treated effluent will meet the standards prescribed by the Central and State Pollution Control Boards.
- KodiKattan Kanmoi is located at about 600m towards East of site, Kozhikanmoi is located 1.4Km from the STP site and Ariyakudi Kanmoi is located 2.30Km from the STP site.There will not be any impact due to the proposed STP. To prevent flooding of the disposal to canal, the pipeline should be conveyed at different locations of the site, covering the entire area with an approximate interval of 500m within the disposal site. This will ensure proper dispersion of water and prevent flooding.
- Since the soil is red lateritic and the prevailing weather condition of the site is hot dry, with evaporation rate of 5.5mm per day, there will not be any flooding of the site.
- During operation phase the sewage form administration building will be taken to septic tank which will be cleaned regularly.

5.3.5 SOIL QUALITY

- Top soils shall be stockpiled to a height of 400 mm in pre – designated areas for preservation and shall be reapplied to site during plantation of the proposed vegetation.
- Top soil shall be separated from sub-soil debris and stones larger than 50 mm diameter. So that, the soil erosion can be prevented and proper construction procedure will be done.
- Heavy meal analysis should be done for disposal site once in 3 months.

5.3.6 SOLID WASTE HANDLING

- Grit and screenings will be immediately removed and taken to municipal solid waste dump site in consultation with the municipality.
- The sludge from the Treatment Plant will be collected in a sludge sump where it is aerated continuously for mixing. The aerated sludge will be treated through mechanical dewatering system by aeration, digestion and thickening.
- Before dewatering, the sludge will be aerated and polyelectrolyte added for best settlement of sludge.
- The sludge cake from the centrifuge pump will be moved to the composting yard through trucks.
- During transportation sludge cake will be covered in tarpaulin sheets.
- The sludge cake will be removed at frequent intervals in order to avoid accumulation inside the site.

5.4 CONCLUDING REMARKS

The Environment Impact Assessment gives the following facts.

➢ The proposed activity will not result in any significant negative impact to Environment. Instead, various beneficial impacts have been envisaged.

➢ Any adverse impacts of proposed unit will be fully mitigated by the Environment Management Plans (which is elaborated in chapter 7).

6 PUBLIC CONSULTATION

As part of the UGSS to Karaikudi Municipality, STP of capacity 16 MLD (base year) is proposed at Devakottai to Karaikudi road, Opposite to solid waste dumping yard.

There was agitation from local people and a case was filed by Mr.S.Santhiyagu, S/o Soosai at National Green Tribunal (NGT) and status quo issued by NGT to stop the work on 18.03.2016. From 18.03.2016 the entire UGSS works was held up and there was no activity till 05.05.2017.Even after Dismiss of NGT case on 05.05.2017 the public around Devakottai rastha (STP site) agitated for the construction of STP.

For that purpose a Public Consultation was conducted to get the public opinion on utilization of treated water in their land and their opinion on establishment of STP site at Karaikudi.

Based on this Public Consultation was held on 25.11.2015, at Karaikudi Municipality, Karaikudi.

List of Participants:

1. The Revenue Divisional Officer, Devakottai
2. The Municipal Commissioner, Karaikudi
3. TWAD Board Engineers
4. Tahsildar Karaikudi
5. Karaikudi surrounding village farmers

A meeting for the consultation was convened by the Revenue Divisional Officer, Devakottai, with farmers of Thenar river ayacut. The Municipal Commissioner, Tashildar and TWAD board engineers were present in the meeting. In the meeting, the farmers were advised for reuse the treated water for their agricultural purpose.

The farmers refused to let out treated sewage in their irrigation land vide letter no. F.Karaikudi UGSS/JDO/2015/dt. 26.11.2015(enclosed as Annexure - 4).

But they have objected to construction of STP at Karaikudi – Devakottai Road, opposite solid waste dumping yard, near Rasthaa. The site for construction of STP was finalized at Karaikudi to Devakottai Road, Opposite to Solid waste dumping yard, Karaikudi Municipality. But, a place for receiving and utilizing the let out treated sewage was

necessitated. By the direction of the District Collector, Sivagangai, it was proposed to reuse the treated sewage effluent for irrigation. Thenar River has identified by Revenue Authorities near the STP site, in compliance with the conditions of TNPCB issue the NOC to reuse the treated sewage for irrigation, enclosed as an **Annexure 4.**

7 ENVIRONMENTAL MANAGEMENT PLAN

7.1 INTRODUCTION

Environmental Management Plan (EMP) is aimed at mitigating the possible adverse impact of a project and ensuring the existing environmental quality. The EMP converse all aspects of planning, construction and operation of the project relevant to environment. It is essential to implement the EMP right from the planning stage continuing throughout the construction and operation stage. Therefore the main purpose of the Environmental Management Plan (EMP) is to identify the project specific activities that would have to be considered for the significant adverse impacts and the mitigation measure required.

7.2 EMP DURING CONSTRUCTION PHASE

The environmental impact during the construction phase will be of short term and reversible nature and will gradually eliminate after the construction activity is over. Further the area of the unit is small in size. Still the following measures will be considered on priority basis to minimize the impacts.

7.2.1 MITIGATION FOR MODIFICATION OF DRAINAGE PATTERN

- Rainwater harvesting prevents the flooding of low-lying areas in the project premises.
- A basic surface drainage system can be provided for the site to avoid water runoff on to the surrounding properties and roads, especially during the monsoon months.
- If during excavation, water accumulates in the excavated areas, then it should be pumped out and disposed off into recharge soak pits of dry bore wells.

7.2.2 MITIGATION FOR MATERIALS TRANSPORTATION

- All fine earth materials must be covered during transportation to the site to prevent spillage and dusting.
- The cleanup of spilled earth and construction material on the main roads should be the responsibility of the contractor and should be done in a timely manner (say within 4 hours) so as not to inconvenience or endanger other road users. These

requirements should be included as clauses within contracts made with relevant sub-contractors.

- The transportation of lubricants and fuel to the site should only be done in the appropriate vehicles and containers, i.e. fuel tankers and sealed drums.
- As far as possible, transportation of construction materials should be scheduled during off-peak traffic hours. This will reduce the risk of traffic congestion and of road accidents on the access roads to the site.

7.2.3 MITIGATION FOR MATERIALS STORAGE

- The stockpiling of construction materials should be properly managed and controlled. Fine grained materials (sand, marl, etc.,) should be stockpiled away from surface drainage channels and features.
- Low beams should be placed around the piles and/or tarpaulin used to cover open piles of stored materials to prevent them from being washed away during rainfall.
- Safe storage areas should be identified and retaining structures constructed prior to the arrival of material.
- Hazardous chemicals (e.g. fuels) should be properly stored in appropriate containers and these should be safely locked away. Conspicuous warning signs (e.g. 'No Smoking') should also be posted around hazardous waste storage and handling facilities.

7.2.4 AIR ENVIRONMENT

a) Site clearance, excavation and earthmoving

- The working area for the uprooting of shrubs or vegetation or for the removal of boulders or temporary or permanent structures shall be sprayed with water or a dust suppression chemical immediately before, during and immediately after the operation so as to maintain the entire surface wet.

b) Access road

- Every main haul road shall be paved with concrete, bituminous materials, hardcore or metal plates, and kept clear of dusty materials; or sprayed with water or a dust suppression chemical so as to maintain the entire road surface wet.

c) Construction equipments

- All machineries to be used for construction purpose will be of highest standard of reputed make and compliance of noise pollution control norms by these equipments will be emphasized by company.
- Transport vehicles and construction equipments / machineries will be properly maintained to reduce air emissions.
- Equipments will be periodically checked for pollutant emissions against stipulated norms.
- Exhaust vent of DG set will be kept at proper height to ensure quick dispersal of gaseous emissions.

d) Excavation and earth moving

- The working area of any excavation or earth moving operation should be sprayed with water or a dusty suppression chemical immediately before, during and immediately after the operation, so as to maintain the entire surface wet.

e) Stock Piles

- All loose material either stocked or transported shall be provided with suitable covering such as tarpaulin, etc.,
- Water sprinkling shall be done at the location where dust generation is anticipated.
- Over Burden (OB) waste dumps shall be sprayed with water as they are major sources of air borne particulate matter/dust.
- OB waste dumps shall be reclaimed / afforested to bind the loose soil and to prevent soil erosion.

f) DG Set

- D.G. set should be placed in an acoustic enclosure.
- D.G. set should be placed on the wooden platform to minimize the vibration.
- The green belt development will also help in reducing noise levels in the campus.
- Any generator to be installed at the site shall meet the guidelines as laid down by Central Pollution Control Board.

7.2.5 MITIGATION MEASURES FOR NOISE ENVIRONMENT

- Construction activities that will generate disturbing sounds should be restricted to normal working hours.
- Workers operating equipment that generates noise should be equipped with noise protection gear. Workers operating equipment generating noise levels greater than 80 dB (A) continuously for 8 hours or more should use earmuffs. Workers experiencing prolonged noise levels of 70 – 80 dB (A) should wear earplugs.
- The construction activities will be restricted to the daytime and no construction will be planned during night.
- Greenbelt will be provided around the construction site to confine noise within the site.
- To reduce the impact of air and noise pollution and to provide a clean, healthy environment, it has been proposed to create and maintain a green belt within the site and along the roadsides.

7.2.6 MITIGATION MEASURES FOR WATER ENVIRONMENT

- Excavation to be avoided during monsoon season.
- Check dams shall be provided to prevent construction runoff from the site to the surrounding water bodies.
- Pit latrines and community toilets with temporary soak pits and septic tanks shall be constructed on the site during construction phase to prevent wastewater from entering the ground water or surrounding water bodies.

- To prevent surface and ground water contamination by oil/grease, leak proof containers shall be used for storage and transportation of oil/grease.

7.2.7 MITIGATION MEASURES FOR BIOLOGICAL ENVIRONMENT

- The dust emissions will be suppressed by spraying water and then the activities will be carried out.
- Emissions from D.G sets and vehicles will be minimized by proper maintenance and by avoiding use of adulterant fuels and will be maintained below the standard limits prescribed by competent authority.
- Important species of trees will be identified and marked and will be merged with landscape plan.

7.2.8 CONSTRUCTION WASTE DISPOSAL

- A site waste management plan will be prepared by the contractor prior to commencement of construction work. This will include the designation of appropriate waste storage areas, collection and removal schedule, identification of approved disposal site, and a system for supervision and monitoring. Preparation and implementation of the plan must be made the responsibility of the building contractor with the system being monitored independently.
- Special attention will be given to minimizing and reducing the quantities of solid waste produced during site preparation and construction. To reduce organic waste, softer vegetation may be composted onsite and used for soil amendment during landscaping.
- Most of the construction materials like soil, bricks, concrete will be reused in the backfilling, road construction, sub-grade reparation etc. works. Metals, wood scraps & bitumen junks will be recycled either within site or outside with help of the local authority. The measures like reusing materials on-site and /or donating /selling salvaged items reduces waste, virgin material use and disposal cost.
- Vegetation and combustible waste will not be burnt at site.

- Excavated sand will be stockpiled away from drainage features and used for in filling where necessary.
- Unusable construction waste, such as damaged pipes, formwork and other construction material, will be disposed to an approved dumpsite.

7.2.9 MITIGATION MEASURES FOR LAND ENVIRONMENT

- The soil will be collected separately and preserved in stacks with side slopes not exceeding 1:5. The topsoil (soil on the top 15 cm patch) will be preserved separately in a stack covered by tarpaulin. Efforts will be made to reinstate the soil for backfilling purposes. Topsoil will be reused for horticultural areas.
- The spillage of oil from the machinery or cement residue from concrete mixer plants might contaminate the soil if not properly collected and disposed off. Thus most stringent safety and construction management norm will be implemented at site.

7.2.10 HEALTH & SAFETY MEASURES DURING CONSTRUCTION PHASE

- Construction related activities will be confined only to project site area, hence no health related impact are envisaged within the project influenced area during the construction stage and will be limited to occupant levels.
- At the project site much direct exposure to dust generation and high noise generation sources likely to cause occupant health related impact such as asthma, bronchitis and noise induced hearing loss etc. on the construction workers. In order to offset such effects, proper drinking water, sanitation and first aid facility will be provided at the construction site, with trained shift supervisors, to ensure minimum adverse occupational health impacts on the construction worker.

7.3 EMP DURING OPERATION PHASE

During the operation phase, the plant will contribute to environmental pollution in the following manner:

- Atmospheric emission
- Noise Pollution
- Solid Waste Disposal

7.3.1 MANAGEMENT OF ATMOSPHERIC EMISSIONS AND NOISE POLLUTION

There is no source of air or noise pollution except the DG sets to be used as standby only. In addition there may be release of volatile compounds from the aeration tank. The emissions from the D.G sets will have marginal impact on the existing air quality, however adequate Stack height of 5m is provided as per the CPCB / TNPCB norms to combat the effect on the air quality and also to facilitate proper dispersion. Proper acoustic enclosure will be provided so that there will not be any vibrations and incremental noise in significant level. The Process does not involve any activities to generate heavy noise levels. The essential features of the EMP are as follows:

- A Stack of height 5m will be provided for generator.
- Acoustic enclosure designed for meeting the ambient noise standards for DG will be provided.
- Good housekeeping is the easiest and often the cheapest way to reduce waste by keeping work area as clean environment.
- Improve inventory procedures by procuring suitable specification materials.
- Designate protected storage area for chemicals used in treatment and hazardous waste storage areas without spill containment. Keep the areas clean.
- Conduct periodic inspections of tanks, tank liners, and other equipment to avoid failures. Repair the malfunctioning units when they are identified immediately. Inspection logs are to be updated regularly.
- In order to bring down the noise level to its permissible values a multiple strategy shall be used:
    - Control of noise at the source.
    - Use of personal protection devices.

7.3.2 SLUDGE MANAGEMENT

The main source of solid waste is sludge generated during operational activity.

- The digested sludge from the Secondary Clarifier shall be treated through mechanical dewatering system by aeration, digestion and thickening.
- Before dewatering, the sludge will be aerated and polyelectrolyte added for best settlement of sludge.
- The sludge cake from the centrifuge pump will be moved to the composting yard through trucks.
- During transportation sludge will be covered in tarpaulin sheets.
- The sludge will be removed at frequent intervals in order to avoid accumulation inside the site.

7.3.3 TRANSPORTATION AND STORAGE OF HAZARDOUS CHEMICALS

Guidelines and procedures in Motor Vehicle Act 1986 for Transportation, Manufacture, Storage and import of Hazardous Chemicals Rules 1989 to be followed for storage and handling of Hazardous chemicals: Insurance covers to be taken for accidents and cost of clean-up operations.

7.3.4 OTHER MANAGEMENT MEASURES AT SITES

- Providing equipment like ear plugs to workers near the noise source.
- Providing PPEs for safe working of personnel in critical areas like chlorination plant will be ensured.
- Display boards on safety measures and emergency measures to be installed.
- Regular training for the staffs operating the PS and STP with various aspects of maintaining sewage quality and safety.
- Regular maintenance of the greenbelt and landscaping made at the project sites by watering, manuring, pruning etc.

7.3.5 TRAINING FOR STAFF

Periodical training would be provided to the staffs and operators involved in the project O&M for chemical handling, emergency, line maintenance, valve operations, electrical & mechanical operations.

7.3.6 SEWAGE TREATMENT PLANT

- Adequate road facility has been proposed inside of treatment plant for movement vehicles and heavy vehicles for unloading of chemical.
- Rain water harvesting will be provided for recharging ground water through pit.
- Display boards on safety measures and emergency measures to be installed.
- Regular training for the staffs operating the units of PS and STP with various aspects of maintaining safety.
- Providing equipment's like earplugs to workers near the noise source.
- Provide flow measurement devises at inlet and outlet, and maintain flow records.
- Provision of appropriate training and personal protection equipment to the workers and staff.
- Conduct periodic testing of dried sludge / compost to check presence of heavy metals and confirming the concentrations to use as compost.
- Monitor regularly and ensure that there is no illegal discharge through manholes or inspection chambers, conduct public awareness programs in co ordination with TNPCB. No wastewater from industrial premises (including domestic wastewater) shall be allowed to dispose into municipal sewers.

7.3.7 ENVIRONMENTAL MONITORING

- The water, Ambient Air, noise and soil quality will be monitored periodically.
- The treated sewage quality will be monitored before discharging to the river.
- Monitoring of noise levels will be carried out at Pumping station and STP.
- Detailed monitoring record will be maintained. Periodical report will be send to the Engineer. The frequency and parameters for Environmental Monitoring detail is given in **Table 7-2** of the EIA report.

7.3.8 DISPOSAL OF TREATED WASTE WATER

- STP operations will take place only after Consent to Operate is obtained from TNPCB and treated water quality will meet the CPCB discharge standards.

- Performance standards will always be maintained, ensuring efficient working condition of treatment plant.

7.3.9 ODOUR MANAGEMENT

- Tree plantation will be provided in STP and Pumping station to control and reduce odour in nearby localities.
- Inlet sump, primary treatment units in STP will be maintained clean by suitably disposing off all generated grit waste on daily basis.
- Tree plantation would be provided to control and reduce odour in STP, Pumping station and nearby localities.
- Pumping station sumps will be closed by lid and vent pipe will be provided for 1m height for gas ability to move gases and air out of the tank when it fills up with waste and liquid volume.

7.3.10 HANDLING OF CHEMICALS

- The unit will be provided with necessary safety measures for the storage of coagulant (Alum or polyelectrolyte) & Chlorine cylinders and provide emergency repair kit and personal safety kit like full body cover, face mask, body shower etc at the site.

7.3.11 SAFETY ASPECTS OF O&M

- The STP and pumping station are provided with compound wall of height 3.0m.
- The structures will be provided with easy access ladders and handrails, interconnections between all units with proper safe walkway platforms for movement to avoid falling of human and materials. Electrical cables are laid in cable trenches. Open spaces at height will be covered with parapet walls and handrails.
- Educate local communities to report immediately to municipality whenever they notice any malfunction of the sewerage system.
- Regular inspection of the entire sewer system to check fo blockages/vandalism etc. This should be followed by regular repairs and servicing of the plant whilst addressing cause of failure.
- Label all inflammable materials and store them appropriately.
- Provision of adequate firefighting equipment cable of fighting all classes of fire.

- Put “No Smoking Signs” in areas where inflammables are stored.
- Train workers on the use of firefighting equipment.

7.4 GREEN BELT DEVELOPMENT

With a view to mitigate the adverse environmental effect on surroundings and to provide an environmental cover from emissions, green belts are developed in and around the project site.

The main objective of the green belt is to provide a barrier between the source of pollution and the surrounding areas. The green belt helps to capture the emission and to attenuate the noise generated apart from improving the aesthetics. Development of green belt and other forms of greenery shall also prevent soil erosion and washing away of topsoil besides helping in stabilizing the functional ecosystem, make the climate more conducive and restore water balance. The area along the plant boundaries shall be used to plant various trees and shrubs. While making choice of plant species for cultivation in green belts, importance has to be given to the natural factor of bio-climate. It is also presumed that the selected plants will be grown as per normal horticultural (or forestry) practice given above and authorities responsible for plantation will also make adequate provision for watering and protection of the saplings. Total area of 8012 Sq.m is proposed for green belt development. The area is 15 to 20 m on each side of the proposed STP. Approximately, 575 trees can be grown in the area with a distance of 5 m between each trees. No. of saplings required would be around 570.The main purpose of green belt development is to contribute to the following factors:

- To attenuate noise level generated from the plant;
- To improve the aesthetics of the plant area;
- To trap the vehicular and fugitive dust emissions;
- To act as a pollution sink for gaseous emissions;
- To maintain ecological balances;
- To prevent soil erosion and to protect the natural vegetation;
- To utilize the treated effluents

Table 7-1Trees proposed for green Belt Development

S.No	Botanical Name	Family	Common Name	Vern. Name	Habitat	Tree Height
	Trees					
1.	*Acacia auriculiformis*	Mimosaceae	Australian Wattle	Pencil maram	Evergreen	15-30 m
2.	*Azardirachtainidca*	Meliaceae	Neem	Vembu	Semi Deciduous	15-20 m
3.	*Bambusbambos*	Poaceae	Bamboo	Moongil	Evergreen	30 m
4.	*Mimusopselengi*	Sapotaceae	Maulsari	Magizhamaram	Evergreen	9-18 m
5.	*Pongamiapinnata L.*	Leguminaceae	-	Pongai	Evergreen	-
6.	*Araucaria araucana*	Araucariaceae	Monkey Puzzle tree	-	Evergreen	30-40m
7.	*Ficus benjamina*	Moraceae	Weeping Fig	-	-	30m
8.	*Tectona grandis*	Lamiaceae	Teak	Theku	Deciduous	40m
9.	*Ravenala madagascariensis*	Strelitziaceae	Traveller's palm	-	-	30m
10.	*Roystonea regia*	Arecaceae	Cuban royal palm	-	-	20-30m
11.	*Allamanda cathartica*	Apocynaceae	Golden trumpet	-	-	20m
12.	*Thespesia populnea*	Malvaceae	Portia tree	Poovarasu	-	-
	Shrubs (Ornamental plants)					
1.	*Hibiscus rosasinensis*	Malvaceae	Rose mallow	Sembaruthi	-	-
2.	*Ixorasingaporensis*	Rubiaceae	Singapore rangan	-	-	-

3.	*Nerium oleander*	Apocynanceae	Oleander	Arali	-	-
4.	*Clerodendrum*	Lamiaceae	Glorybower	-	-	1-12m
5.	*Ocimumtenuiflorum*	Ocimumtenuiflorum	Tulasi	-	-	-

7.5 INSTITUTIONAL DEVELOPMENT AND ENVIRONMENTAL TRAINING

The staff will be trained for implementation of environmental mitigation measures and monitoring of various environmental quality parameters to perform the environmental management and monitoring and to implement the environmental monitoring plan.They will also be briefed about prevailing environmental legislation and standards.

7.6 SAFETY TRAINING & HEALTH MONITORING

Safety training will be given to the O & M staffs to rectify the problems arise during the operation of STP.

The following safety training will be provided for the workers:

- Workers should wash their hands with anti-bacterial soap frequently.
- Open cuts or wounds should be protected.
- Always wear rubber gloves and protective clothing when working with wastewater.
- Do not wear contaminated or soiled clothing, wash clothes regularly to remove contaminants.
- Workers need to be able to identify and deal with hazards associated with confined spaces.
- Separate space to be provided for Chemical storage and Handling process.
- Smoke and leak alarm will be provided
- To train them how to use the personal flotation device (PFD) during drowning.
- Regulatory requirements to be applied while traffic hazards occur.
- Proper techniques to be given for trenching and shoring while digging.

- Good housekeeping practices to be given for removing slipping or tripping hazards.
- The staff will be given training on awareness & first aid to save during electrocution or mechanical hazards.
- All facilities available to be utilized properly during emergencies. Proper preplanning can save lives and property.
- Periodical medical facilities to be arranged for health check up.

7.7 PERMISSIONS FROM VARIOUS DEPARTMENTS WITH PRESENT STATUS

The present stage of Land, Implementation and Procurement related issues till date are tabulated as below in **Table 7-2.**

Table 7-2 **Clearances / NOC Required from Competent Authority**

S.No.	Description	Present Stage	Responsible agencies	Time frame
1	Land used for Pumping Stations and STP.	Construction started at pumping stations in own land of TWAD	ULB / TWAD (Monitoring)/ Concerned Departments & agency / Contractor	Before construction
2	Present stage of submitting general arrangements drawing and layout plan, structural designs for the STP site and stage of approval.	Approval from SE, TWAD was obtained for the layout plan and structural designs.	ULB / TWAD (Monitoring)/ Concerned Departments & agency / Contractor	Before construction
3	Permission laying of pipelines	The sewer lines are proposed to be laid inside the premises, hence no permission is applicable.	ULB / TWAD (Monitoring)/ Concerned Departments & agency / Contractor	
4	Consent to Establish from the Pollution Control Board	Consent to Establish obtained on 25.06.2018. vide Proceedings no. T1/TNPCB/F.0771SVG/RL/SVG/ W/2018 dt: 25.06.2018 Proceedings no:T1/TNPCB/F.0771SVG/RL/SVG /A/2018/dt: 25.06.2018.	ULB / TWAD (Monitoring)/ Concerned agency	Before construction
5	Consent to Operate from the Pollution Control Board	Consent to operate will be obtained upon completion of construction work.	Contractor / TWAD	Before operation

S.No.	Description	Present Stage	Responsible agencies	Time frame
6	Land for proposed STP	5.81 acres of land has been handed over to TWAD vide collector proceedings no. Roc. C4/11927/12 Dated:12.06.2014	TWAD / Contractor (Monitoring)	Before construction
7	Land for disposal of treated effluent	Thenar river is situated near the project site and permission obtained to let the effluent into the river. Vide Letter No. 11R / F.66 (NOC)/2018/JDO/dt.15.03.2018	TWAD /Contractor (Monitoring)	Before and during operation

Table 7-3 Construction of Sewer Mains and Pumping Station

Sl.no	Activities	Management Measures	Time frame	Responsible agencies
	CONSTRUCTION STAGE			
1.	**Construction of Sewer Mains**			
1.1	Shifting of common utilities	Ensure community consensus and minimum impact to common utilities like telephone cable, electric cables, electric poles, water taps and etc., Proper clearance to be obtained from the concerned authorities and sent to the PIA before commencement of works.	Pre-construction & construction phase	Concerned departments / PIA
1.2	Compensatory plantation of	Compensatory plantation of atleast twice the number of trees felled should be done in line with competent authority guidelines.	Pre-construction and	Contractor / PIA

Sl.no	Activities	Management Measures	Time frame	Responsible agencies
	trees		Construction	
1.3	Disposal of construction debris and excavated materials.	The contractor shall identify the sites for debris disposal and should be finalized prior to start of the earthworks; taking into account the following (a) The dumping does not impact natural drainage courses (b) no endangered / rare flora is impacted by such dumping (c) Settlement area located at least 1.0 km away from the site. (d) Should be located in non residential areas located in the down wind side (e) located at least 100m from the designated forest land. (f) avoid disposal on productive land. (g) should be located with the consensus of the local community , in consultation with the engineer and shall be approved by the highways department Minimize the construction debris by balancing the cut and fill requirements.	Pre-construction and Construction	Contractor / PIA
1.4	Planning for Temporary Traffic Diversions	Before taking up of construction activity, a Traffic Control Plan shall be devised and implemented to the satisfaction of the Engineer. Construction shall be taken phase –wise so that sections are available for traffic. Temporary diversion will be provided with the approval of the		PIA / Contractor

Sl.no	Activities	Management Measures	Time frame	Responsible agencies
		engineer. The Detailed traffic control plans prepared and submitted to the engineers for approval one week prior to commencement of works shall contain details of temporary diversion, details of arrangements for construction under traffic, details of traffic arrangement after cessation of wok each day, SIGNAGES, safety measures for transport of hazardous materials and arrangement of flagmen. The arrangement for the temporary diversion of the road shall ensure to minimize the environmental impacts, like loss of vegetation, productive lands etc., prior to the finalization of diversion and detours. Special consideration will be given to the preparation of the traffic control plan for safety of pedestrians and workers at night. The contractor will ensure that the diversion / detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. He shall inform local community of changes to traffic routes, conditions and pedestrians access arrangements. This plan will be periodically reviewe d with respect to site conditions. The temporary traffic detour will be kept free of dust by frequent application of water.		
1.5	Protection of top soil	The top soil to be protected and compacted after completion of work, where the pipelines run, including open lands and agricultural lands.	During construction	Contractor

Sl.no	Activities	Management Measures	Time frame	Responsible agencies
1.6	Laying of sewer system	Adequate precautions should be taken while laying the sewer lines to avoid the possibility of cross connection with water supply lines.	During construction	Contractor
1.7	Flooding in the low lying areas	Low lying areas in the project site can get flooded during monsoon period, to prevent the situation proper drainage arrangements has to be planned.	During construction	Contractor / PIA
1.8	Temporary flooding due to excavation.	Proper drainage arrangements to be made, to avoid the overflowing of existing drains due to excavation during the laying of sewer mains.	During construction	Contractor / PIA
1.9	Temporary water supply interruptions	i) Establish coordination with the concerned department to avoid or minimize the interruption of regular supply of drinking water to the residents. ii) Proper alternative arrangements to be planned when interruption of drinking water supply to the near by residents.	Pre-construction and Construction	Contractor / PIA
1.10	Using of modern machineries	Using of modern machineries such as JCBs, backhoes etc, shall be used to minimize the construction period, it will reduce the construction period impacts to the near by residents.	During construction	Contractor
1.11	Traffic diversion	i) Temporary traffic arrangements to be planned during construction. This plan shall be periodically reviewed with respect to site condition. ii) Detail traffic control plans will be prepared and submitted to the engineers / police department for approval, before commencement of works. The traffic control plans shall contains details of temporary diversion, details of road closings, details of	During pre-construction and construction	Contractor / PIA

Sl.no	Activities	Management Measures	Time frame	Responsible agencies
		arrangements for construction under traffic and details of traffic arrangement after cessation of wok each day. iii) Special consideration will be given to the preparation of the traffic control plan for safety of pedestrians and the sensitive receptors like schools and hospitals. iv) This plan will be periodically reviewed with respect to site conditions.		
1.12	Prevention of accidents	Prevention of accidents involving human beings, animals or vehicles falling or accidents due to open trenches/manholes during construction period. This needs to be ensured with proper barricading, signage boards and lighting etc.	During construction	Contractor
1.13	Barricading site	The construction site should be barricaded at all time in a day with adequate marking, flags, reflectors etc. for safety of general traffic movement and pedestrians.	During construction	Contractor
1.14	Dust Pollution near settlements	i) All earth work will be protected in manner acceptable to the engineer to minimize generation of dust. Area under construction shall be covered & equipped with dust collector. ii) Construction material shall be covered or stored in such a manner so as to avoid being affected by wind direction. iii)Unpaved haul roads near / passing through residential and commercial areas to be watered thrice a day. iv) Trucks carrying construction material to be adequately covered	During construction	Contractor

Sl.no	Activities	Management Measures	Time frame	Responsible agencies
		to avoid the dust pollution and to avoid the material spillage.		
1.15	Protection of residential / sensitive receptors.	i) Noisy construction operations in residential and sensitive areas should be done only between 7.30 am and 6.00 pm. ii) Preventive maintenance of construction equipment and vehicles to meet emission standards and to keep them with low noise. iii) Provision of enclosing generators and concrete mixers at site. iv) Sound barriers in inhabited areas shall be installed during the construction phase. v) Adequate barricading / other measures to protect dust pollution near sensitive receptors like schools and hospital etc to be ensured.	During construction	Contractor / PIA
1.16	Vehicular noise pollution at residential / sensitive receptors.	i) Idling of temporary trucks or other equipment should not be permitted during periods of loading / unloading or when they are not in active use. The practice must be ensured especially near residential / commercial / sensitive areas. ii) Stationary construction equipment will be kept at least 500m away from sensitive receptors. iii) All possible and practical measures to control noise emissions during drilling shall be employed. The PIA may direct to take adequate controls measures depending on site conditions.	During construction	Contractor / PIA
1.17	Noise from vehicles, plants and	iv) Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found	During construction	Contractor / PIA

Sl.no	Activities	Management Measures	Time frame	Responsible agencies
	equipments	defective will be replaced. v) Maintenance of vehicles, equipment and machinery shall be regular and up to the satisfaction of the Engineer to keep noise levels at the minimum.		
1.18	Storage of construction materials	Site for storage of pipes and construction materials to be identified, without affecting the traffic and other common utilities.	During construction	Contractor
1.19	Labour camp & facilities	Setting up of labour camps needs to be done as per the procedures. Adequate potable water facilities, sanitation and drainage etc., in conformity with the Indian labour laws shall be ensured. The contractor shall also guarantee the following: i) The location, layout and basic facility provision of each labour camp will be submitted to Engineer prior to their construction. ii) The construction will commence only upon the written approval of the Engineer. iii) The Contractor shall construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing. iv) Supply of sufficient quantity of potable water (as per IS) in every workplace/labor camp site at suitable and easily accessible places and regular maintenance of such facilities. v) The sewage system for the camp are designed, built and operated in such a fashion that no health hazards occurs and no	Pre-construction and construction	Contractor / PIA

Sl.no	Activities	Management Measures	Time frame	Responsible agencies
		pollution to the air, ground water or adjacent water courses take place. Ensure adequate water supply is to be provided in all toilets and urinals.		
1.20	Waste Disposal	i) The contractor shall provide garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Engineer. ii) Unless otherwise arranged by local sanitary authority, arrangements for disposal of night soils (human excreta) suitably approved by the local medical health or municipal authorities or as directed byEngineerwill have to be provided by the contractor.	During Construction	Contractor
1.21	Clearing of construction camps and restoration	i) Contractor to prepare site restoration plans, the plan is to be implemented by the contractor prior to demobilization. ii) On completion of the works, all temporary structures will be cleared away, all rubbish cleared, excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, at the contractor's expenses, to the entire satisfaction of the engineer.	After completion of the project	Contractor
1.22	Pollution from Fuel and Lubricants	i) The contractor shall ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refueling sites shall be located away from rivers and irrigation canal/ponds. ii) Contractor shall ensure that all vehicle/machinery and	construction and operation	PIA / Contractor

Sl.no	Activities	Management Measures	Time frame	Responsible agencies
		equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. iii) Contractor shall arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to Engineer) and approved by the Engineer. All spills and collected petroleum products will be disposed off in accordance with MoEF and state PCB guidelines. iv) Engineer will certify that all arrangements comply with the guidelines of PCB/ MoEF or any other relevant laws.		
1.23	Pollution from Construction Wastes	The Contractor shall take all precautionary measures to prevent the wastewater generated during construction (e.g. during the testing of pipeline) from entering into streams, water bodies or the irrigation system. All waste arising from the project is to be disposed off in the manner that is acceptable by the Engineer. The engineer shall certify that all liquid wastes disposed off from the sites meet the discharge standard.	During Construction and post-construction	Contractor / PIA
1.24	Risk from Electrical Equipment(s)	The Contractor shall take all required precautions to prevent danger from electrical equipment and ensure that - i) No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. ii) All necessary fencing and lights will be provided to protect	During construction	Contractor

Sl.no	Activities	Management Measures	Time frame	Responsible agencies
		the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Engineer.		
1.25	Safety Aspects	i)Adequate precautions shall be taken to prevent the accidents and from the machineries. All machines used shall confirm to the relevant Indian standards Code and shall be regularly inspected by the PIA. ii) Where loose soil is met with, shoring and strutting shall be provided to avoid collapse of soil. iii) Protective footwear and protective goggles to all workers employed on mixing of materials like cement, concrete etc. iii)Welder's protective eye-shields shall be provided to workers who are engaged in welding works. iv) Earplugs shall be provided to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. v) The contractor shall supply all necessary safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc to workers and staffs. The contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labor Organization (ILO) Convention No. 62 as far as those are applicable to this contract. The contractor will make sure that during the construction	During construction	Contractor

Sl.no	Activities	Management Measures	Time frame	Responsible agencies
		work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to. The contractor shall not employ any person below the age of 14 years for any work and no woman will be employed on the work of painting with products containing lead in any form.		
1.26	First Aid	The contractor shall arrange for: i) A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone ii) Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital	During construction	Contractor

Sl.no	Activities	Management Measures	Time frame	Responsible agencies
	CONSTRUCTION STAGE			
2.	**Construction of Pumping station**			
2.1	Tree cutting	i) Try to save the trees by changing the alignment and provide adequate protection to the trees with tree guards as required. Such as Masonry tree guards, Low level RCC tree guards,	Pre-construction and Construction	PIA / Contractor

Sl.no	Activities	Management Measures	Time frame	Responsible agencies
		Circular Iron Tree Guard with Bars, etc ii) Compensatory plantation of atleast twice the number trees felled should be done in line with competent authority guidelines		
2.2	Storage of construction materials	Site for storage of construction materials to be identified, without affecting the near by the residents, traffic and other common utilities.	During construction	Contractor
2.3	Barricading site	The construction site should be barricaded at all time in a day with adequate marking, flags, reflectors etc. for safety of pedestrians	During construction	Contractor
2.4	Protection of residential / sensitive receptors.	i) Noisy construction operations in residential and sensitive areas should be done in between 7.30 am and 6.00 pm. ii) Preventive maintenance of construction equipment and vehicles to meet emission standards and to keep them with low noise. iii) Idling of delivery of vehicles will not be allowed at construction site. iv) Provision of enclosing generators and concrete mixers at site. v) Sound barriers in inhabited areas shall be installed during the construction phase. vi) Adequate barricading / other measures to protect dust pollution near sensitive receptors like schools and hospital etc to be ensured.	During construction	Contractor
2.5	Disposal of silt	A suitable site should be identified for safe disposal of silt /	During	PIA / Contractor

Sl.no	Activities	Management Measures	Time frame	Responsible agencies
	/ sludge	sludge generated at the pumping / lifting station sites, which should be away from the water bodies, residential & sensitive areas, agricultural areas and etc., and got approved by the Engineer.	construction and operation	/ TWAD
2.6	Noise level	i) Noise screening by trees plantation scheme proposed as noise barriers. ii) Adequacy of measures shall be checked to control noise pollution. iii) Using of less noise generating machineries like submersible pumps at PS / LS sites to reduce the noise level. iv) Increase the height of compound wall of the PS/LS site. v) Collection well to be kept closed during the construction and operation period to avoid the accidents.	During construction	Contractor

Construction of Sewage Treatment Plant

S.No	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
1	Tree cutting &Compensatory plantation	1. The proposed site is a barren land and there are no trees at present. 2. There is no tree cutting hence there is no need of any compensatory plantation during the construction period.	Pre-construction and Construction	Contractor. Monitoring by TWAD
2	Protection of top soil & Environmental	1. The top soil will be protected and compacted after completion of work.	During construction	Contractor. Monitoring by

S.No	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
	enhancing.	2. Top soil from the STP area will be stored in stock piles and that will be used for gardening purposes at the STP site as an environmental enhancing measure.		TWAD
3	Disposal of construction debris and excavated materials.	The construction debris and excavated materials will be disposed off to the low lying area which is identified and approved by the Municipality for the disposal. It will be taken care that the material does not affect natural drainage system.	During construction	Contractor. Monitoring by TWAD.
4	Pollution from Fuel and Lubricants	1. The contractor will ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refueling sites will be located at least 500 m from rivers and irrigation canal/ponds. 2. Proper stack height to be provided for DGs for proper dispersion of pollutants.	Construction and operation.	Contractor. Monitoring by TWAD.
5	Contamination of ground water quality	5. The treated sewage quality will ensure within the PCB standards for disposal onto canal for irrigation use. 6. The pipes inside the plant premises will be made up of CI double flanged. The chlorinated sewage will disposed off to the Thenar River by RCC pipes. 7. The treated sewage quality and also the ground water quality in the nearby areas will be regularly monitored and ensured within PCB standards. 8. Proper storm water drains to be provided along the STP to channelize the storm water.	During construction and operation	Contractor. Monitoring by TWAD
6	Water Pollution from Construction Wastes	The Contractor will take all precautionary measures to prevent the wastewater generated during construction from entering into streams, water bodies or the irrigation system.	During Construction	Contractor. Monitoring by TWAD

S.No	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
7	Impact of surrounding areas	**Odour:** Odour can be reduced or prevented through continuous process of the operation which can be ensured by the provision of D.G sets, regular maintenance of the operation units and greenbelt around the STP helps in controlling odour. The odour impacts to the community are expected to be minimal by providing the separation between the facility and the nearest adjacent property. Temporary odour impacts during construction are expected to be minimal and typical of construction odours. **Noise:** Installing the pumps underground and DG sets is provided by acoustic enclosures. Greenbelt around the STP helps in controlling noise. Ear plugs will be provided for workers working in high noise areas.	During Construction and Operation	Contractor. Monitoring by TWAD
8	Informatory Signs and Hoardings	The contractor will provide, erect and maintain informatory/safety signs, hoardings written in English and local language, wherever required or suggested by the Engineer.	During construction	Contractor
9	Risk from Electrical Equipment(s)	The Contractor will take all required precautions to prevent danger from electrical equipment and ensure that - 1. No material shall be stacked or placed as to cause danger or inconvenience to any person or the public. 2. All necessary fencing and lights will be provided to protect the public in construction zones. 3. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Engineer.	During construction	Contractor
10	Disposal of treated effluent.	5. The treated sewage quality will comply with the standards of TNPCB before letting into Thenar rive r.	Pre-construction / construction and	Contractor. Monitoring by

S.No	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
		6. STP operations will take place only after Consent to Operate is issued by TNPCB and treated sewage quality will meet the CPCB discharge standards 7. Performance standards will always be maintained, ensuring efficient working condition of treatment plant. 8. Prevention of flooding in the disposal site by providing pipelines at an interval of 30m.	operation stage.	TWAD.
11	Disposal of sludge	2. Sludge will be removed from the treatment plant. The composted sludge will be used as manure at the disposal sites.	Pre-construction, construction and operation.	Contractor. Monitoring by TWAD
12	Labour camp & facilities	The contractor will guaranteed the following: 6. The location, layout and basic facility provision of each labour camp will be submitted to Engineer prior to their construction. 7. The construction will commence only upon the written approval of the Engineer. 8. The Contractor will construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing. 9. Supply of sufficient quantity of potable water (as per IS) in every workplace/labor camp site at suitable and easily accessible places and regular maintenance of such facilities. 10. The sewage system for the camp are designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place. Adequate water supply is provided in all toilets and urinals. 6.. Awareness about HIV/AIDS will be provided, grievance	During Pre-construction and construction	Contractor. Monitoring by TWAD

S.No	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
		redressal mechanism for the camps.		
13	Safety Aspects	4. Adequate precautions are taken to prevent the accidents and from the machineries. 5. Protective footwear and protective goggles to all workers employed on mixing of materials like cement, concrete etc. 6. Welder's protective eye-shields will be provided to workers who are engaged in welding works. 4. Earplugs will be provided to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. 5. Supply of safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc. are provided to workers and staffs by the contractor. The contractor complies with all the precautions as required for ensuring the safety of the workmen as per the International Labor Organization (ILO) Convention No. 62 as far as those are applicable to this contract. The contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered. The contractor will not employ any person below the age of 14 years for any work and no woman will be employed on the work of painting with products containing lead in any form.	During construction & maintenance period.	Contractor. Monitoring by TWAD
14	First Aid	The contractor will arrange for the following : 4. A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as	During construction & maintenance	Contractor. Monitoring by TWAD

S.No	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
		per the Factories Rules in every work zone 5. Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital	period.	
15	Institutional development & Environmental Training	1.The staff will be trained for implementation of environmental mitigation measures and monitoring of various environmental quality parameters to perform the environmental management and monitoring and to implement the environmental monitoring plan. 2. The environment specialist (consultant) will train the staff regarding record keeping procedures, sampling, testing, analysis and use of environmental monitoring equipments. 6. They will also be briefed about prevailing environmental legislation and standards.	During Operation & maintenance period	Contractor. Monitoring by TWAD

Table 7-4Environmental Enhancement measures

S.No	Environmental enhancement and special issues		Location	Implementing Agency
1	Flora and Fauna	The contractor will take reasonable precaution to prevent the workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. Clear instructions will be given to the workmen regarding the same. If any wild animal is found near the construction site at any point of time, the contractor will immediately upon discovery thereof	Project area	Contractor

S.No	Environmental enhancement and special issues		Location	Implementing Agency
		acquaint the Engineer and carry out the Engineer's instructions for dealing with the same. The Engineer will report to the nearby forest office (range office or divisional office) and will take appropriate steps/ measures, if required in consultation with the forest officials.		
2	Chance Found Archaeological Property	All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site will be the property of the Government and be dealt with as per provisions of the relevant legislation. The contractor will take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. The contractor immediately upon identification thereof and before removal acquaint the Engineer of such discovery and carry out the SC's instructions for dealing with the same, waiting which all work will be stopped. The Engineer will seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site.	Project area	Contractor
3	Monitoring of environment parameters	1. Monitoring of environment parameters are mentioned in **Table 6-1 &6-2.** 2. Daily parameter of the effluent quality has to be monitored for which provisions have been made for setting up of laboratory.	Project area	Contractor
4	Sensitive Areas	The contractor shall undertake seasonal monitoring of air, water noise and soil quality through an approved monitoring agency. The parameter to be monitored, frequency and duration of	Project area	Contractor

S.No	Environmental enhancement and special issues		Location	Implementing Agency
		monitoring plan has been prepared and mentioned in **Table 6-1 &6-2.**		
5	Clearing of construction of camps and restoration	Contractor will prepare site restoration plans for approval by the engineer. The plan will be implemented by the contractor prior to demobilization. On completion of the works, all temporary structures will be cleared away, all rubbish cleared, excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, at the contractor's expenses, to the entire satisfaction of the engineer.	Corridor of Impact	Contractor
6	Tree Protection, Tree Planting	1. Masonry tree guards, Low level RCC tree guards, Circular Iron Tree Guard with Bars, use of plate compactors near trees may also be considered where necessary. 2. The major portion of the project road may pass through open lands, planting of trees along the entire stretch of the road is recommended as an enhancement measure. 3. Growth and survival of trees planted shall be ensured and monitoring done at least for a period of 3 years .Survival status shall be reported on monthly basis to Engineer in charge.	Corridor of Impact	Contractor

Table 7-5Safety Measures for the operation of the STP

S.No	Components	Dos	DONTs
1.	Bar Screen	1. Wear gloves, safety shoes. 2. Use rakes for cleaning	Avoid using bare hands
2.	Grit Chamber	1. Use safety shoes, gloves and tools 2. Replace with original spares 3. Clean regularly 4. Inspect regularly. 5. Perform routine maintenance	1. Do not attempt any maintenance during operational modes. 2. Do not use bare feet or hands.
3	Aeration tank	1. Use ear muffs/ safety shoes and required tools 2. Frequent inspections and maintenance of the pump 3. Use aerator pump of required capacity specifications	1. Do not attempt repairs during operation. 2. Do not operate beyond process specifications.
4	Clarifiers	1. Use safety gloves and shoes. 2. Use original spare parts. 3. Have spare/alternative drive motor. 4. Conduct frequent inspections/ maintenance	Do not attempt maintenance during operations
5	Sludge holding tank	1. Wear safety gloves and shoes. 2. Clean the tank regularly. 3. Frequent inspections and maintenance to be performed.	1. Do not allow excess dosing of polyelectrolyte 2. Do not leave valves open

S.No	Components	Dos	DONTs
6	Screw pump	1. Perform routine maintenance. 2. Replace faulty parts 3. Conduct inspections 4. Inspect for leaks. Perform regularly maintenance of pump	1. Do not attempt maintenance during operations 2. Do not let objects flow into pump.
7	Centrifuge	2. Perform frequent cleaning of the centrifuge. 3. Control the speed as per the operational conditions. 4. Check for damage of the vessel regularly. 5. Monitor the quality of the sludge as it should not corrode the centrifuge. 6. Frequently lubricate their spares, bearing etc.	1. Do not let the quantity of sludge beyond its capacity. 2. Do not allow the speed beyond its capacity. 3. Do not let the sludge after centrifuge in the container for a long time.
8	Chlorination tank	**2.** Check the tanks for leaks **3.** Perform routine maintenance of pumps **4.** Inspect the pipes. **5.** Use good quality pipes and equipments **6.** Fire Department responds to all chlorine leak alarms immediately remedied by shutting the gas off and tightening the fitting. **7.** Safety equipment, like gas masks, rubber gloves, aprons shall be housed in easily accessible (unlocked)	1. Do not use excess chlorine than necessary 2. Only skilled personnel are permitted to enter. 3. Never apply heat to pipes or container valves, containers unless they have been thoroughly purged of chlorine. 4. Never assume a container is empty and therefore non-hazardous even though it may weigh empty

S.No	Components	Dos	DONTs
		cupboard placed outside the chlorination room. **8.** First aid box and eye wash fountain shall be provided outside chlorinator room.	
9	Electrical panel & piping	2. Wear safety gloves and shoes. 3. Do frequent inspections 4. Use acoustic enclosures for DG sets 5. Take anti rusting precautions for pipes	1. Do not perform repairs during operations. 2. Do not touch live wires. 3. Do not use low quality electrical spares.
10.	D.G rooms	2. Check fuel level 3. Check lube oil level and quality 4. Check coolant level 5. Check for any leakage 6. Check for any loose connections 7. Check electrolyte level in Battery 8. Check the battery terminals 9. Check fan belt tension 10. Check battery charger working 11. Drain the water from the fuel tank, weekly during winters 12. Please check all the Nuts, Bolts, Engine/alternator foundation bolts and 13. loose cable connections tightening at the time of	1. If the DG set is with AMF panel please do not touch live wire as mains also flow from AMF panel even if DG SET IS OFF. 2. Do not check coolant level, while DG is running. 3. Do not change any wiring or modify wiring it may attract void of Warranty 4. Please do not get the DG set repaired and serviced by any unauthorized person. It may attract void of warranty. It should be done by the manufacturer

S.No	Components	Dos	DONTs
		commissioning and then monthly. 14. Always use K-oil to avail two year warranty 15. Purchase all spare parts from dealer	

Table 7-6Steps to be taken during Trouble shooting

S.No	Components	Daily Activities	Issues or Problems	How to Attend
1.	Bar Screen	1. To clean the bar screen every one hour 2. Screenings have to be disposed to the bed.	1. Choking 2. Built up of sewage	1. Cleaning regularly
2.	Grit Chamber	1. To check the operation of grit chamber in every shift. 2. To check for overload. 3. Dispose grit regularly to municipalauthority.	1.Drive failure 2. Clogging of grit material	1. Stop operations. Use the backup drive or standby. Repair or replace the faulty drive manually. 2.Operate the standby grit unit until the rectification.
3	Aeration tank	1. To check sludge index volume every	1. Excessive foaming.	1. Use deforming agent to suppress

S.No	Components	Daily Activities	Issues or Problems	How to Attend
		day. 2. To check pH, MLSS, MLVSS, BOD, COD <u>Blower</u> 3. To check the oil level in the blower. 4. To check the safety valve is released. 5. To check for excessive noise 6. To change the silencer filter cloth 7. To check the pressure <u>Diffuser</u> To check for excessive bubbles. To check for worn out diffusers	2.Aeration pump failure 3. Noise due to malfunctioning in blower	the form. 2. Stop aeration and use standby blower. 3. Remove the diffuser, clean and refix manually. 4. Shut down the blower, rectify and replace.
4	Clarifiers	1. To check the drive for overloading 2. To clean the overflow launder	1. Choking in the launder due to dry leaves. 2. Drive failure	1. Clean the launder 2. Replace the faulty part.

S.No	Components	Daily Activities	Issues or Problems	How to Attend
		3. To transfer excessive sludge into sludge holding tank		
5	Sludge holding tank	1. Sludge has to be aerated 2. Sludge has to be regularly removed for dewatering unit. 3. To check for poly electrolyte dosing.	1. Clogging of drains 2. Cracks and leaks in the tank 3. Overflowing 4. Less sludge retention time	1. Clean the drains and pipes 2. Seal the cracks. 3. Check the valves and pipes. Control the inlet flow 4. Control the outlet flow. Allow more retention time. Check for leaking valves.
6	Screw pump	1. To check the oil level 2. To check for excessive heating in the motor end. 3. To check for leak in sectional cleaning operational valves. 4. To check for abnormal vibrations stroke excessive	1. Pump failure 2. Inefficient pumping 3. Leaks. 4.Malfunctioning	1. Stop operations Repair/ replace faulty pump. 2. Seal the leaks. Replace faulty parts. Replace the pump. 3. Stop operation. Use alternate pump and repair the

S.No	Components	Daily Activities	Issues or Problems	How to Attend
		sounds.		malfunctioning pump. 4. Stop operations. Reduce flow rate or use pump of apt capacity
7	Centrifuge	1. Regular operation of centrifuge 2. Empty the sludge after removing the cakes from the centrifuge. 3. Dispose the sludge after dewatering.	1. Clogging of centrifuge 2. Leaks in centrifuge 3. Overflow	1. Reduce the load 2. Check the leak part and replace 3. Reduce inlet flow into centrifuge.
8	Chlorination tank	1. Wear safety glasses. 2. To check for operation booster pump. 3. To check chlorine solution level in tank 4. To check for chlorine level in cylinders 5. To check for	1. Pump failure. 2. Excessive chlorine dosing 3. Cracked pipes or tanks 4. Chlorine leaks	1. Stop operations Repair or replace faulty pumps. 2. Stop the flow of chlorine being dosed into tank. 3. Seal cracks. Replace cracked pipes 4. Alarm throughout the

S.No	Components	Daily Activities	Issues or Problems	How to Attend
		arrangement of valves in booster pump.		plant. Necessary arrangements to be made for stopping the leakage.
9	Electrical panel & piping	1. Local on/off check. 2. Check for leaks and cracks in valves	1. Short circuiting 2. Power outages 3. Cracked pipes 4. Malfunctioning electrical circuits 5. Fires due to electrical short circuit.	1. Switch off mains and repair the source of circuiting 2. Use DG sets. 3. Seal the cracks or replace pipes 4. Turn off mains. Replace faulty switch boards 5. Turn off mains. Extinguish fire. Replace faulty electric components
10.	D.G rooms	1. Check fuel level 2. Drain water fuel tank (especially during winter season) 3. Check coolant level	1. Engine does not start 2. No power & misfiring of Engine 3. Engine emits	-Check fuel , vent fuel system - Charge batteries - Change lamp, heat up piping, change filter - open cock

S.No	Components	Daily Activities	Issues or Problems	How to Attend
		4. Check water level in the radiator 5. Check for any leakage 6. Check for any loose connections 7. Check for Battery conditions 8. Check lube oil level and quality	4. Engine grows excessively hot, high fuel consumption, low oil pressure 5.Increase in lube oil 6. Unbalance voltage 7.Excessive vibration 8 Smokes, spark or flames	- Clean fuel tank, fill in clean fuel replace filter - Inspect & replace - Set correct, start fuel - let engine to heat up in open - Tighten or replace V belts - Perform electrical check up of temperature controller - Check fuel injection system or replace air filter or solenoid valve - Replace paper filter cartridge - check for leakage or brand of oil - Inspect & replace or tighten - Inspect piping,

S.No	Components	Daily Activities	Issues or Problems	How to Attend
				filters & ducts for tightness - Correct the load - Tighten the loose connection - Check winding resistance & rewind if wind - Replace the coupling & check the alignment Reset the speed to the nominal - Check and correct the load, rewind the stator - Stop the gen-set immediately.

7.8 ENVIRONMENTAL MONITORING PROGRAM

Regular monitoring of all significant environmental parameters is essential to check the compliance status as per the environmental laws and regulation. The objectives of the monitoring will be as follows:

a. To verify the results of the impact assessment study with respect to the proposed project.

b. To study the trend of concentration values of the parameters, which have been, identified as critical.

c. To check and assess the efficacy of pollution control equipment.

d. To ensure that any additional parameters, other than those identified in the impact, do not become critical.

To implement the EMP, a structured Environmental Management Cell (EMC) interwoven with the existing management system will be created. EMC will undertake regular monitoring of the proposed pollution control system and conduct yearly audit of the environmental performance of the system. It will also check that the stipulated measures are being satisfactorily implemented and operated.

To monitor the extent of environmental impact of the proposed project, the contractor will periodically monitor the environmental quality along the proposed project area. The monitoring requirement for the different environmental components is presented below in **Table 7-1.**

Apart from the mentioned monitoring requirements, any major accidents / spillage during bulk transport of hazardous materials, depending on the type of spillages / accidents the parameters will be monitored and is decided by the engineer and will be carried out by the contractor through approved monitoring agencies and supervised by the Implementing agency.

7.8.1 AIR POLLUTION MONITORING

The Stack emissions from the DG Set will be monitored on monthly basis for PM, NO_x & SO_2 and CO. The ambient air at the plant site shall be monitored at regular intervals for all the 12 parameters as per NAAQ standards.

7.8.2 TREATED SEWAGE MONITORING

The quantity of treated sewage generated from STP will be regularly measured using flow meters. Treated sewage samples will be collected and analyzed for critical parameters like pH, BOD, COD, Total Suspended Solids, Oil and Grease. The frequency of monitoring will be at regular intervals.

7.8.3 SOIL QUALITY MONITORING

Since the treated sewage is disposed in the river nearby, the soil quality of the river bed has to be checked periodically for basic parameters & heavy metals.

7.8.4 SLUDGE MONITORING

Solid waste generated from the plant will be monitored at regular intervals for heavy metals.

Table 7-7 Environmental Monitoring During Construction Phase and Collection system

S. No	Particulars	Monitoring Frequency	Duration of Sampling	Monitoring Parameters
	Collection System			
	Inlet	Once in 3 month	Grab Sampling	Ph, BOD, COD, Oil and Grease
	Outlet	Once in 3 month	Grab Sampling	Ph, BOD, COD, Oil and Grease
1	**Ambient Air Quality Monitoring**			
a	Project site	Once a Month	24 hr continuously	All 12 parameters as per NAAQS
2	**Stack Monitoring (If DG used for construction)**			
a	DG Set – Stack	Once a Month	30 min	SOx, NOx, SPM, CO, CO_2, Temperature, Flow rate & Velocity of the gas
3	**Ambient Noise Level**			
a	Near DG set	Once a Month	24 hr Continuously	Noise level in dB(A)
b	Site boundary	Once a Month	24 hr continuously	Noise level in dB(A)
4	**Water Quality Monitoring**			
a	Ground Water – at project site	Once in 3 Months	Grab Sampling	Parameters specified under IS:10500:2012
5	**Soil Quality Monitoring**			
a	At Site	Once in 3 Months	Samples were collected from three different	pH, texture, electrical conductivity, organic matter, nitrogen, phosphate, sodium, calcium, potassium and magnesium.

S. No	Particulars	Monitoring Frequency	Duration of Sampling	Monitoring Parameters
			depths viz., 30cm, 60cm, and 90cm below thesurface	

Table 7-8Environmental Monitoring During Operational Phase

S. No	Particulars	Monitoring Frequency	Duration of Sampling	Monitoring Parameters
1	**Ambient Air Quality Monitoring**			
a	Project site	Once a Month	24 hr continuously	All the 12 parameters as per NAAQ standards,
2	**Stack Monitoring**			
a	DG Set – Stack	Once a Month	30 min	SO_X, NOx, SPM, CO, CO_2, Temperature, Flow rate & Velocity of the gas
3	**Ambient Noise Level**			
a	Near DG set	Once a Month	24 hrs continuously	Noise level in dB(A) both day and night time
b	Site boundary	Once a Month	24 hrs continuously	Noise level in dB(A) both day and night time
c	Near pump/ blower room	Once a Month	24 hrs continuously	Noise level in dB(A) both day and night time
4	**Water Quality Monitoring**			
a	Ground Water –at project site	Once in 3 Months	Grab Sampling	BOD and other parameters specified under IS:10500:2012
b	Surface Water –	Once in 3	Grab Sampling	BOD and other parameters

S. No	Particulars	Monitoring Frequency	Duration of Sampling	Monitoring Parameters
	Thenar River	Months		specified under IS:10500:2012
5	**Sewage Quality Monitoring**			
a	STP Inlet	Daily(by own lab) Once in a Month (external agency)	Grab Sampling	Physical, Chemical & Biological Parametersspecified underCPCB standards
b	STP Outlet	Daily(by own lab) Once in a Month (external agency)	Grab Sampling	Physical, Chemical &Biological Parameters specified under CPCB standards
6	**Soil Quality**			
a	At the green belt area	Once in 3 Months	Samples to be collected from three different depths viz., 30cm, 60cm, and 90cm below the surface	pH, texture, electrical Conductivity, organic matter, nitrogen, phosphate, sodium, calcium, potassium and Magnesium, heavy metals
b	Near Sludge Disposal area	Once in 3 Months	Samples were collected from three different depths viz., 30cm, 60cm, and 90cm below the surface	pH, texture, electrical conductivity, organic matter, nitrogen, Phosphate, sodium, calcium, potassium and Magnesium.

S. No	Particulars	Monitoring Frequency	Duration of Sampling	Monitoring Parameters
c	At 7 locations of treated sewage disposal river	Once in 3 Months	Samples were collected from three different depths viz., 30cm, 60cm, and 90cm below the surface	pH, texture, electrical conductivity, organic matter, nitrogen, phosphate, sodium, calcium, potassium, Free chlorine Magnesium and heavy metals
7	**Sludge Quality**			
a	Composite Sludge	Once in a month	Grab sample	pH, Phosphorus, COD,BOD, Heavy metals, Phosphate, sodium, potassium, Total coli forms

Table 7-9Cost for Environmental Monitoring

CONSTRUCTION PHASE				
S.No.	**Components**	**No of locations**	**UnitCost/Sample (Rs)**	**Total Cost/year (Rs)**
1	Ambient Air quality	1	2500	30,000
2	Ground water quality	1	2000	8000
3	Noise quality monitoring	2	500	12,000
4	Soil Quality Monitoring	1	2500	10,000
	Total Cost			**60,000**

OPERATION PHASE				
1	**Air quality Monitoring**			
	Ambient Air	1	2500	30,000
	Stack emission	1	2500	30,000
2	**Water quality Monitoring**			
	Groundwater	1	2000	8000
	Surface water	1	2000	8000
	Sewage	2	500	48,000
3.	**Noise monitoring**	3	500	18,000
4	**Soil Quality Monitoring**			
	Site	2	2500	20,000
	Disposal area	7	3500	98,000
5	**Sludge Monitoring**	1	3000	36,000
6	**Collection system Monitoring**	2	3100	12400
	Total Cost			**3,08,400**

Recurring cost @ 12% is INR 37008 /-

7.9 BUDGETARY ALLOCATION FOR IMPLEMETATION OF ENVIRONMENTAL ASPECTS DURING THE CONSTRUCTION & OPERATION PHASE OF THE PROJECT

The environmental monitoring and other mitigation measures as proposed in the above sections shall be implemented during the construction and operation period. For this same budget has been allocated. A cost break up which will be required to be included in the project cost towards the environmental protection, control & mitigation measures and implementation of the EMP given in **Table 7-10.**

The cost to be incurred for various activities for the proposed project to safeguard the environment is detailed below.

Table 7-10 Budget Allocation for Implementation

S.No.	Description	Capital Cost (Rs. Lakhs)	Operation Cost per annum (Rs. Lakhs)	Remarks
	Construction Phase			
1.	Stack height for DG	--	--	Included in special specification in BOQ A 27
2.	DG with acoustic enclosure	22.25	0.5	Provided in special specification inBOQ (A 27)
3.	Safety training to be provided by trained person @ Rs.3000/ training once in three months	0.70	-	Included in sanctioned estimate.
	Providing personal Protective equipments for work force during construction phase @ Rs.700/- per person for 50 persons	--	--	Included in specifications of bid document
4.	Storm water Management, rainwater harvesting	31.63	0.5	Included in bid documentA17 & A19
5.	Environmental monitoring	-	0.6	Included in sanctioned estimate
6	Fire Safety Measures	1.0	0.15	Included in document BOQ A25
7.	Health monitoring for staff by trained doctors @ Rs.1000/- per person for 50 persons	0.5	0.1	Included in sanctioned estimate and in special specifications of Bid document.
8.	Insurance Charges	-	-	Included in specifications of Bid document
9	Informatory sign boards	0.5	-	Included in BOQ –A1 and Special

S.No.	Description	Capital Cost (Rs. Lakhs)	Operation Cost per annum (Rs. Lakhs)	Remarks
				Specifications of Bid document
10	Provision of compound wall	51.05	-	Provided in BOQ A22
11	Provision of internal road	19.06	-	Provided in BOQ A19
12	Pipeline covering the entire 5.81 Acres for disposal of treated effluent	87.05	2.5	Included in BOQ – A18
13	Setting up of laboratory for monitoring the daily effluent parameters	5.58	0.15	Provided in BOQ A24
14	Providing water supply arrangements	4.90	0.2	Provided in BOQ A21
15	Installation of flow meters at Parshall Fume & outlet of chlorine contact tank	16.31	0.2	Provided in BOQ A27
16	Providing Stand by non clog pump for centrifuge sludge pump	10.9	0.5	Included in BOQ (Electrical A 27)
17	Providing Stand by Sludge return non clog pump	9.83	0.5	Included in BOQ (Electrical A 27)
18	Providing walkways & railings	35.49	0.5	Included in BOQ (Mech. A23)
19.	First Aid Facility	0.54	0.2	Included in BOQ A 26
20.	Clearing of construction of camps and restoration	1.5	-	Included in Special Specifications of Bid document.
Total Cost		**298.80**	**6.60**	
Operation Phase				
1.	Training for staff in mitigation measures, process and monitoring	--	--	Included in sanctioned estimate

S.No.	Description	Capital Cost (Rs. Lakhs)	Operation Cost per annum (Rs. Lakhs)	Remarks
2.	Landscaping & Gardening (Development and Maintenance)	7.27	-	Provided in BOQ (Gardening A 20)
3.	Fire Safety Measures	1.0	0.15	Included in BOQ A 25
4.	Environmental monitoring	2.40	2.40	Included in sanctioned estimate
5.	Health monitoring for staff	0.5	0.1	Included in special specifications of BOQ
6.	First Aid Facility	0.75	0.2	Included in BOQ A26
Total Cost		**11.92**	**2.85**	
	Cost for Pipeline to the Thenar River for disposal of treated effluent.	23.45		Included in BOQ A18.

8 IMPLEMENTATION AND INSTITUTIONAL ARRANGEMENTS

The proposed project is to provide an Underground Sewerage Scheme to Karaikudi. This project will be implemented by TWAD under the scheme of at an estimating cost of **Rs.112.53 Crores**.

The project is proposed to be implemented by TWAD through contractor. The environmental management plan identified for the construction is included in the bid documents for ensuring implementation of the environmental safeguards. Implementation of the management measures by the contractor will be ensured by TWAD Board and report on ECSMF compliance will be submitted to TNUIFSL periodically.

The management measures identified for operation phase will be taken up by the contractor up to maintenance period and beyond that by TWAD Board.

8.1 GRIEVANCE MECHANISM

TWAD Board has proposed to provide Underground Sewerage Scheme to Karaikudi town and treat the Sewage in Sewage Treatment Plant of 16 MLD using Extended Activated Sludge Process. The management measures identified for the operation phase will be taken up by the TWAD Board upon completion of construction activities. The TWAD Board will have grievance redressal mechanisms to handle the grievances of the project. A project level grievance redressal committee will be set up and the members are as follows (preferably one of them as women).

• Executive Engineer (Projects –TWAD Board)

• Commissioner (Karaikudi Municipality)

• A person who is publicly known in the local area

TWAD Board will submit monthly reports on the status of compliance with the ECSMF requirements to TNUIFSL.

8.1.1 GRIEVANCE REDRESSEL COMMITTEE

The GRC shall convene meetings of the committee as necessary at such place or places in the Project Implementation Agency as he considers appropriate; and

Conduct the proceedings in an informal manner as he considers appropriate with the object to bring an amicable settlement between the parties.

Step by step approach will be followed for redressing grievances. First, the aggrieved project affected person to approach the GRC in the first stage and the grievance committee will look into the grievances and resolve the issues. The proceedings of GRC will be documented. If not satisfied with the resolution provided by GRC, then the complainants can appeal to the grievance redressal mechanisms available at the office of Executive Engineer at Karaikudi.

The complaints will be acknowledged to the complainant. Efforts will be made by TWAD to ensure closure of complaint within a maximum period of 30 days from the date of its receipt. Serious issues shall be attended as early as possible. If not satisfied with the resolution provided by GRC, the complaints shall be handled at higher level i.e, Chief engineer of TWAD.

If there is any grievance, it involves a process of consultation and negotiation with the committee. The grievances relating to the problem will be recorded and each step in the resolution process also will be recorded. The elected representative will be involved in representing the issue and act as communication link between the persons involved. When the problems are identified, it will be taken to the personnel who respond and pass the information to the committee immediately. It is then the role of the committee to investigate and consult with the persons to evaluate the seriousness of the issues and work with the management to resolve the problem. TWAD shall submit monthly reports on the status of compliance with the ECSMF requirements to TNUIFSL.

9 PROJECT BENEFITS

The main objective of the project is to provide adequate sewage disposal facilities to the residents of Karaikudi Town. On implementation of the present project, the health and sanitation situation of the town will be improved significantly thereby reducing the incidence of waterborne diseases and associated medical expenses of the consumers. Besides, there will also be reduction in loss of productive man – days as a result of reduced incidence of health problems and subsequent improvement or economic conditions of Karaikudi Town. Due to high ground water table in Karaikudi Town, the provision of an effective sewerage system will have permanent positive impact on the ground water quality of the town.

- Hygiene of the Karaikudi Town will be improved
- Mixing of Sewage water into Land, Canals, Lakes & Ponds will be reduced
- Ground Water degradation will be reduced
- Soil contamination will be reduced
- Sewage odour can be reduced in the open area .Overall Water pollution and soil pollution due to Sewage will be reduced and the safe environment will be improved in and around the project area i.e., Karaikudi Town.

10 CONCLUSION

- The impact on environment will be minimum and can be further reduced by implementing various mitigating measures and regular monitoring programs.
- The proposed sewage treatment Plant have beneficial impacts in terms of hygienic and safe disposal of treated effluent with incidental benefits like employment opportunities both in the construction stage and operation stage. Also the modernized installation will facilitate greater level of operating safety.
- Due to the proposed project the socio economic activities will be developed in and around the project area.
- The monitoring program on various environmental parameters will be undertaken for the continual improvements towards protecting the environment to achieve the above requirements.
- Proper methods have been planned to safe and secured disposal of treated effluent and handling of solid waste. Hence the project has been strongly recommended.