

# Initial Environmental Examination

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## IND: Tamil Nadu Urban Flagship Investment Program – Coimbatore Underground Sewerage System

Prepared by Tamil Nadu Water Supply and Drainage Board on behalf of Coimbatore City Municipal Corporation of the Government of Tamil Nadu for the Asian Development Bank.

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## CURRENCY EQUIVALENTS

(as of 29 November 2017)

Currency Unit	–	Indian rupee (₹)
₹1.00	–	\$0.0155
\$1.00	=	₹64.4740

## ABBREVIATIONS

ADB	–	Asian Development Bank
CCMC	–	Coimbatore City Municipal Corporation
CMSC	–	Construction Management and Supervision Consultant
CPCB	–	Central Pollution Control Board
CTE	–	consent to establish
CTO	–	consent to operate
DWC	–	double wall corrugated
EAC	–	Expert Appraisal Committee
EHS	–	Environmental Health and Safety
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
GOI	–	Government of India
GoTN	–	Government of Tamil Nadu
IEE	–	Initial Environmental Examination
MOEFCC	–	Ministry of Environment, Forest and Climate Change
NOC	–	No Objection Certificate
PIU	–	Project Implementation Unit
PMU	–	Project Management Unit
SPS	–	Safeguard Policy Statement
STP	–	Sewage Treatment Plant
TNPCB	–	Tamil Nadu Pollution Control Board
TNUFIP	–	Tamil Nadu Urban Flagship Investment Program
TNUIFSL	–	Tamil Nadu Urban Infrastructure Financial Services Limited
TWADB	–	Tamil Nadu Water and Drainage Board
WHO	–	World Health Organization

## WEIGHTS AND MEASURES

°C	Degree Celsius
km	kilometer
lpcd	litre per capita per day
m	meter
Mgd	million gallons per day
Mld	million litre per day
mm	millimetre
nos.	numbers
km <sup>2</sup>	square kilometer

## NOTE

In this report, "\$" refers to US dollars.



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## EXECUTIVE SUMMARY

1. The Tamil Nadu Urban Flagship Investment Program (TNUFIP) will advance India's national urban flagship programs to develop priority urban and environmental infrastructure in ten cities located within strategic industrial corridors of Tamil Nadu (the State), including those within the East Coast Economic Corridor (ECEC), to enhance environmental sustainability, climate resilience, and livability. It will also strengthen the capacity of state and local institutions and improve urban governance. TNUFIP is aligned with the following impact: urban livability and climate resilience in cities of economic importance improved. TNUFIP will have the following outcomes: smart and climate resilient urban services delivered in ten cities in priority industrial corridors.

2. The TNUFIP is structured under three outputs: (i) sewage collection and drainage improved and climate-friendly sewage treatment systems introduced, (ii) access to reliable and smart drinking water services improved, and (iii) Institutional capacity, public awareness, and urban governance strengthened. TNUFIP will be implemented over an 8-year period beginning in 2018, and will be funded by Asian Development Bank (ADB). via its multitranche financing facility (MFF).

3. **The Subproject.** Coimbatore, located in the central western part of Tamil Nadu, is second largest city in the state after capital Chennai. In this subproject to be implemented under the ADB funded TNUFIP, it is proposed to provide underground sewerage system in added areas (Kuruchi and Kuniyamuthur) of Coimbatore City Municipal Corporation (CCMC). These areas are located in the southern outskirts of the city. Subproject includes the following civil works components: (i) sewer network (434.52 kilometre (km) length of sewers and 17,748 nos, manholes), (ii) 19 nos. of lift stations, (iii) 5 nos lift manholes, (iv) 11 nos. of pump stations (including 4 main pumping stations) (v) pumping mains (42.985 km), (vi) sewage treatment plant (STP) of 30 million litres per day (MLD) capacity, (vii) 2 megawatt (MW) photo voltaic solar power plant at STP site, and (viii) 69,668 house service connections.

4. **Project implementation arrangements.** The Municipal Administration and Water Supply Department (MAWS) of GoTN acting through the Tamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL) is the state-level executing agency. A project management unit (PMU) will be established in TNUIFSL headed by a Project Director and Deputy Project Director (senior official from Commissionerate of Municipal Administration, CMA), and comprising dedicated full-time staff from TNUIFSL for overall project and financial management. The implementing agencies are project urban local borides (ULBs). CCMC is the Implementing Agency (IA) for this subproject. A project implementation unit (PIU) will be established in CCMC headed by a full-time Project Manager (Executive Engineer or above) and comprising dedicated full-time staff of the CCMC for day-to-day implementation of the subproject. PIU is assisted by Construction Management and Supervision Consultant (CMSC) in implementation. Environmental and Social Safeguards (ESS) Managers in PMU/TNUIFSL will coordinate all the safeguard related activities of the subproject and will ensure the compliance with EMP and EARF. Environmental Specialist of the CMSC will assist PIU in implantation of subproject in compliance with EMP and EARF, and will carry out all necessary tasks.

5. **Screening and assessment of potential impacts.** ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. As

per the Government of India (GOI) Environmental Impact Assessment (EIA) Notification, 2006, this subproject do not require EIA study or environmental clearance. The potential environmental impacts of the subproject have been assessed using ADB Rapid Environmental Assessment Checklist for Sewerage. The potential negative impacts were identified in relation to pre-construction, construction and operation.

6. **Categorization.** Based on results of the assessment and ADB Safeguard Policy Statement (SPS), the subproject is classified as environmental Category B, i.e., subproject potential adverse environmental impacts are less adverse than those of category A, and are site-specific, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE) is required.

7. **Description of the Environment.** The subproject components are located in Kuniyamuthur (87-93 wards) and Kuruchi (93-100 wards) areas in the southern suburbs of Coimbatore City. Kuniyamuthur and Kuruchi are erstwhile municipalities added to Coimbatore CityMunicipal Corporation in 2011 . Located on Coimbatore – Palakkad Road, Kuniyamuthur is one of busiest markets in the city. Kuruchi is an industrial cluster, with two industrial estates. Coimbatore district forms part of upland plateau region of Tamil Nadu with many hill ranges, hillocks and undulating topography with a gentle slope towards east except for the hilly terrain in the west. Both Kuruchi and Kuniyamuthur areas have a predominantly plain terrain interspersed by Noyyal River and numerous water bodies. Generally, a sub-tropical climatic condition prevails in this area with average maximum and minimum temperature in the range of 36°C to 41°C and 14°C to 25°C respectively. The average annual rainfall is 940 mm (for last 10 years), and most of the rain is received during southwest and northeast monsoon seasons. Proposed sub project components are located within the urban area of Kuruchi and Kuniyamuthur, except STP site which is located 2 km away from the project area. Sewers will be under the public roads, pumping stations are located on small government vacant land parcels in the project area, and the STP site is identified within the large compound of solid waste management facility. This site is vacant, and away from habitations. It is proposed to dispose the treated effluent into Noyyal River, which is about 5 km from the site. As all the subproject components are located within or adjoining an urban area, there are no sensitive environmental features like forests. There are water bodies in the subproject area.

9. **Potential environmental impacts and mitigation measures.** The subproject is unlikely to cause significant adverse impacts that are irreversible, diverse or unprecedented because: (i) the components will involve straightforward construction and operation, so impacts will be mainly localized; (ii) there are no significant sensitive environmental features in the project sites although careful attention needs to be paid to minimizing disruption to population of urban area and (iii) predicted impacts are site-specific and likely to be associated with the construction process and are produced because the process is invasive, involving excavation and earth movements.

10. Sewerage system performs a crucial function of safely collecting, transporting, treating and disposing domestic wastewater, including, human excreta (designed as a separate system). Subproject is likely to have numerous positive impacts on the environment and public health. In this IEE, negative impacts were identified in relation to pre-construction, construction, and operation phases. Planning principles and design considerations have been reviewed and incorporated into the site planning and design process wherever possible; thus, environmental impacts as being due to the project design or location were not significant. Sewage pumping and lifting stations, which collect sewage to further pump to a higher elevation manhole, pump station or STP, are likely to generate odor. Although utmost care is taken to locate these away from the



houses, due to design considerations and land constraints, some sites are located close to the houses.

11. Sewage treatment facility would be designed to meet the preset disposal standards notified by CPCB for disposal of treated wastewater from STPs. The treated sewage effluent would be disposed into Noyyal River. This river, except in the monsoon, mostly carries wastewater from the villages and urban areas it flows through. It ultimately meets river Cauvery at Village Noyyal in Karur District, over 100 km east of Coimbatore. With the implementation of subproject, disposal of untreated wastewater from Kurchi and Kuniyamthur areas (subproject areas) will be prevented, and also treated wastewater will be disposed into river. This will in fact improve the water quality, and therefore no adverse impacts envisaged. Another impact is that of STP operation: from malfunction or decrease in treatment efficiency and sludge handling and disposal. This will result in release of untreated or partially treated wastewater that will pollute environment and cause public health issues. Mixing of industrial waste in sewage is also identified as one of the risk which could render treatment inadequate. Accumulation of silt in sewers in areas of low over time, overflows, blockages, power outages, harmful working conditions for the workers cleaning sewers etc. may create nuisance, unhealthy and hazardous conditions.

12. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result significant measures have already been included in the designs for the infrastructure. Various measures suggested for odor control including: appropriately locating sewage wells within site as far as away from the houses; developing tree cover; covered facilities; gas collection and treatment facilities, and design and operation measures to prevent odor build up; standard operating procedures for operation and maintenance; imparting necessary training; safety and personal protection equipment for workers, measures to maintain the STP treatment efficiency, and development of green buffer zone around the STP etc.,

13. Potential impacts during construction are considered significant but temporary, and are common impacts of construction in urban areas, and there are well developed methods to mitigate the same. Except sewer works, all other construction activities (lifting/pumping stations and STP) will be confined to the selected sites, and the interference with the general public and community around is minimal. In these works, the temporary negative impacts arise mainly from construction dust and noise, hauling of construction material, from the existing government licensed mining areas, waste and equipment on local roads (traffic, dust, safety etc.), mining of construction material, occupation health and safety aspects. Sewer works will be conducted along public roads in an urban area congested with people, activities and traffic. Therefore these works will have significant impacts arising mainly: from the disturbance of residents, businesses and traffic due to construction work; safety risk to workers, public and nearby buildings due to deep trench excavations in the road, especially in narrow roads; access impediment to houses and business, disposal of large quantities of construction waste, etc. These are all general impacts of construction in urban areas, and there are well developed methods of mitigation that are suggested in the EMP.

14. **Environmental Management Plan (EMP).** An EMP has been developed to provide mitigation measures to reduce all negative impacts to acceptable levels, along with the delegation of responsibility to appropriate agency. As stated above, various design related measures are already included in the project design. During construction, the EMP includes mitigation measures such as (i) proper planning of sewer works to minimize the public inconvenience (ii) barricading, dust suppression and control measures (iii) traffic management measures for works along the roads and for hauling activities; (iv) provision of walkways and planks over trenches to ensure

access will not be impeded; and (iv) finding beneficial use of excavated materials to extent possible to reduce the disposal quantity. EMP will guide the environmentally-sound construction of the subproject. EMP includes a monitoring program to measure the effectiveness of EMP implementation and include observations on- and off-site, document checks, and interviews with workers and beneficiaries.

15. The EMP is included in the bid documents to ensure compliance with the conditions set out in this document. The contractor will be required to submit to PIU, for review and approval, a site environmental management plan (SEMP) including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; and (iii) monitoring program as per EMP. No works are allowed to commence prior to approval of SEMP. A copy of the EMP/approved SEMP will be kept on site during the construction period at all times.

16. **Consultation, disclosure and grievance redress mechanism.** The stakeholders were involved in developing the IEE through discussions on-site and a public consultation workshop at city level, after which views expressed were incorporated into the IEE and in the planning and development of the project. The IEE will be made available at public locations and will be disclosed to a wider audience via the ADB, CCMC and TNUIFSL websites. The consultation process will be continued during project implementation. A grievance redress mechanism is described within the IEE to ensure any public grievances are addressed quickly.

17. **Monitoring and Reporting.** Contractor will submit a monthly EMP implementation report to PIU. PIU, with the assistance of CCMC, will monitor the compliance of Contractor, prepare a Quarterly Environmental Monitoring Report and submit to PMU. The PMU will oversee the implementation and compliance, and will submit semi-annual monitoring reports to ADB. ADB will post the environmental monitoring reports on its website. Monitoring reports will also be posted on CCMC and TNUIFSL websites

18. **Conclusions and Recommendations.** Therefore, per ADB SPS, the project is classified as environmental category B and does not require further environmental impact assessment. However, to conform to government guidelines STP requires consent to establish (CTE) and consent to operate (CTO) from Tamil Nadu Pollution Control Board (TNPCB). ), which shall be obtained for both the new and the proposed rehabilitation of existing STP prior to construction and operation, respectively. This IEE shall be updated by PIU during the implementation phase to reflect any changes, amendments and will be reviewed and approved by PMU. The updated IEE will be submitted to ADB for concurrence and disclosure.

## I. INTRODUCTION

### A. Background

1. The Tamil Nadu Urban Flagship Investment Program (TNUFIP) will advance India's national urban flagship programs to develop priority urban and environmental infrastructure in ten cities located within strategic industrial corridors of Tamil Nadu (the State), including those within the East Coast Economic Corridor (ECEC), to enhance environmental sustainability, climate resilience, and livability. It will also strengthen the capacity of state and local institutions and improve urban governance.

2. TNUFIP will be implemented over an 8-year period beginning in 2018, and will be funded by Asian Development Bank (ADB) via its multitranche financing facility (MFF). The executing agency is the Department of Municipal Administration and Water Supply (MAWS) of the State acting through the Tamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL) who will establish a program management unit (PMU). The urban local bodies (ULBs) will be the implementing agencies for projects and will establish program implementing units (PIU).

3. TNUFIP is aligned with the following impact: urban livability and climate resilience in cities of economic importance improved. TNUFIP will have the following outcomes: smart and climate resilient urban services delivered in ten cities in priority industrial corridors. The TNUFIP is structured under following three outputs:

- (i) **Output 1: Sewage collection and drainage improved and climate-friendly sewage treatment systems introduced.** This will include: (i) new (179 million liters per day [MLD]) and rehabilitated sewage (175 MLD) treatment capacity developed with solar power for operations installed on a pilot basis; (ii) reuse of treated sewage water for industrial purposes in selected areas; (iii) new and improved sewage collection pipelines (2,810 kilometers [km]) constructed with 100% household connections made (426,600 household connections); (iv) 173 new sewage pumping stations of 6,390 kilowatts (KW) capacity added; (v) 20 community water and sanitation committees formed with female participation; and (vi) climate resilient drainage and flood management systems established (250 km tertiary and 50 km primary and secondary).
- (ii) **Output 2: Access to reliable and smart drinking water services improved.** This will include: (i) smart water supply distribution systems (1,520 km pipelines) established within 110 new district metered areas to reduce NRW and provide regular water supply with 100% household connections (171,000 household connections); (ii) new transmission mains (120 km); (iii) 30 number of pump houses of 1,530 KW capacity; and (iv) new water storage reservoirs (40 reservoirs totaling 70 million liters). The TNUFIP will scale up smart water pilots in Chennai under TA-9048 to reduce nonrevenue water levels and optimize operational efficiency through the latest technologies in smart metering and digital diagnostic tools.
- (iii) **Output 3: Institutional capacity, public awareness, and urban governance strengthened.** This will include: (i) establishing a new state-level Urban Data and Governance Improvement Cell in the Commissionerate of Municipal Administration (CMA); (ii) establishing a new Project Design and Management Center in CMA; (iii) introducing and implementing a state-wide performance-based urban governance improvement program for all 135 cities in Tamil Nadu to improve financial management, revenues, administration, service delivery, gender and social inclusion, and wastewater

reuse and fecal sludge management; and (iv) implementing public awareness campaigns in areas of water conservation, sanitation, and hygiene in 10 project cities. Project design consultants (PDC) will be recruited to prepare new projects meeting ADB requirements.

4. **Scope of Project 1.** Tranche 1 is representative of MFF investments and will support subprojects in 6 cities (Chennai, Coimbatore, Rajapalayam, Tiruchirappalli, Tirunelveli, and Vellore). Outputs of tranche 1 include:

- (i) **Output 1: Sewage collection and drainage improved and climate-friendly sewage treatment systems introduced.** This includes: (i) 5 new STPs of 153 MLD treatment capacity including one STP with 2 megawatts (MW) solar-power installation for operations; (ii) 2 rehabilitated STPs of 61 MLD capacity; (iii) 8,000 cubic meter (m<sup>3</sup>) per day of treated wastewater reused; (iv) 1,860 km of new sewage collection pipelines with 100% household connections; (v) 124 new pump/ lift stations of 4,470 KW capacity; and (vi) 297,500 new household sewer connections. The breakdown by city is as follows: (i) sewage collection system with new 32 MLD STP and one rehabilitated 24 MLD STP in Tirunelveli with treated effluent supplied for industrial reuse; (ii) sewage collection system with new 2 MW solar-powered 30.53 MLD STP in Coimbatore; (iii) sewage collection system with new 30 MLD STP and one rehabilitated 37 MLD STP in Tiruchirappalli; (iv) sewage collection system with new 50 MLD STP in Vellore; (v) sewage collection system in four areas of Chennai; and (vi) sewage collection with new 10 MLD STP in Rajapalayam, and 12 community water and sanitation committees formed with female participation.
- (ii) **Output 2: Access to reliable and smart drinking water services improved.** This will support 4 areas of Chennai with the following: (i) 275.6 km of smart water supply distribution pipes in 20 newly established district metered areas to manage and reduce NRW connected to computerized control and data acquisition systems; (ii) 30,800 household metered connections; (iii) 11 km of new transmission pipes; (iv) 9 new storage reservoirs (4 underground and 5 overhead) of 11 million liters capacity; and (v) 5 pump stations of 230 KW capacity.
- (iii) **Output 3: Institutional capacity, public awareness, and urban governance strengthened.** This will include: (i) establishing a new state-level Urban Data and Governance Improvement Cell in the CMA; (ii) establishing a new Project Design and Management Center in the CMA; (iii) introducing and implementing a state-wide performance-based urban governance improvement program for all 135 cities under CMA to improve financial management (audited accounts), municipal revenues (taxes, user fees), administration (filling vacancies), and gender mainstreaming (gender equality social inclusion plan implementation); and (iv) implementing public awareness campaigns in areas of water conservation, sanitation, and hygiene. The PDC will be recruited for preparing projects in subsequent tranches.

5. Coimbatore, located in the central western part of Tamil Nadu, is second largest city in the state after capital Chennai. It is an industrial hub. Existing underground sewerage system cover the core area of Coimbatore City. The city limits were expended in the year 2011 and added surrounding municipalities and villages, increased the area from 105.60 sq. km to 257.04 sq. km. At present there is no sewerage in these added areas comprising (40 wards), and it is proposed to provide underground sewerage system in 13 wards comprising erstwhile Kuruchi and Kuniamuthur municipalities. Proposed subproject includes: (i) sewer network (434.52 kilometre

(km) length of sewers and 17,748 nos, manholes), (ii) 19 nos. of lift stations, (iii) 5 nos lift manholes, (iv) 11 nos. of pump stations (including 4 main pumping stations) (v) pumping mains (42.985 km), (vi) sewage treatment plant (STP) of 30 million litres per day (MLD) capacity, (vii) 2 megawatt (MW) photo voltaic solar power plant at STP site, and (viii) 69,668 house service connections.

## **B. Purpose of this Initial Environmental Examination Report**

6. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. The potential environmental impacts of the subproject have been assessed using ADB Rapid Environmental Assessment (REA) Checklist for Water Supply (Appendix 1). Then potential negative impacts were identified in relation to pre-construction, construction and operation of the improved infrastructure, and results of the assessment show that the subproject is unlikely to cause significant adverse impacts that are irreversible, diverse or unprecedented. Thus, this initial environmental examination (IEE) has been prepared in accordance with ADB SPS's requirements for environment category B projects.

7. This IEE is based on the detailed project report prepared by TWAD Board for Coimbatore City Corporation. The IEE was based mainly on field reconnaissance surveys and secondary sources of information. No field monitoring (environmental) survey was conducted, however, the environmental monitoring program developed as part of the environmental management plan (EMP) will require the contractors to establish the baseline environmental conditions prior to commencement of civil works. The results will be reported as part of the environmental monitoring report and will be the basis to ensure no degradation will happen during subproject implementation. Stakeholder consultation was an integral part of the IEE.

## **C. Report Structure**

8. This Report contains the following ten (10) sections including the executive summary at the beginning of the report:

- (i) Executive summary;
- (ii) Introduction;
- (iii) Description of the project;
- (iv) Policy, legal and administrative framework;
- (v) Description of the environment;
- (vi) Anticipated environmental impacts and mitigation measures;
- (vii) Public consultation and information disclosure;
- (viii) Grievance redress mechanism;
- (ix) Environmental management plan; and
- (x) Conclusion and recommendation.

## **II. DESCRIPTION OF THE PROJECT**

### **A. Project Area**

9. Project area comprises 13 municipal wards located in the southern outskirts of Coimbatore City, in Coimbatore District in the central western part of Tamil Nadu State (Figure 1). These areas were originally part of two municipalities – Kuruchi and Kuniamuthur, which were added to City Corporation limit in 2011. Total population of subproject area is 219,591 (2011 census) and has a geographical area of 34.17 square kilometer (km<sup>2</sup>).

## B. Existing Sewerage System

10. The existing underground sewerage system in covers almost entire area of Coimbatore City Corporation limit prior to its expansion in 2011. This area is divided into 3 sewerage zones with respect to sewage treatment works. Zone I forms the heart of the city and the sewage from this Zone (20.143 MLD) is pumped to the anaerobic lagoon STP at Vellalore. Zone II comprises original Corporation limits in North and West. Sewage collected from Zone II (16.62 MLD) is also pumped to the anaerobic lagoon at Vellalore. Zone III covers Tatabad, Sivanada colony, Gandhipuram, Sidthapuram, Pulicakulam, Trichy road and Ramanathapuram areas. Sewage from zone III (23.625 MLD) is pretreated at Nanjundapuram pumping station and pumped to anaerobic lagoon at Vellalore. To cover the uncovered area in the old city corporation limit, a project is being implemented under a centrally sponsored scheme. Old Corporation area is divided into eight (sewer network) zones , and the work is taken up in all zones to cover the uncovered areas with 2010 as base year and 2040 as ultimate design year. Sewer collection system works have been completed in Zones 1, 2,3,5,6 and 7, and 95% of works completed in Zones 4 and 8. All works will be completed by September 2018.

Of 3 STPs, 2 STPs (at Ukkadam and at Ondipudur) have been completed, and the third one at Nanjundapuram is held up due to litigation, and ULB now received clearance from court to proceed with the work, and will be completed soon.

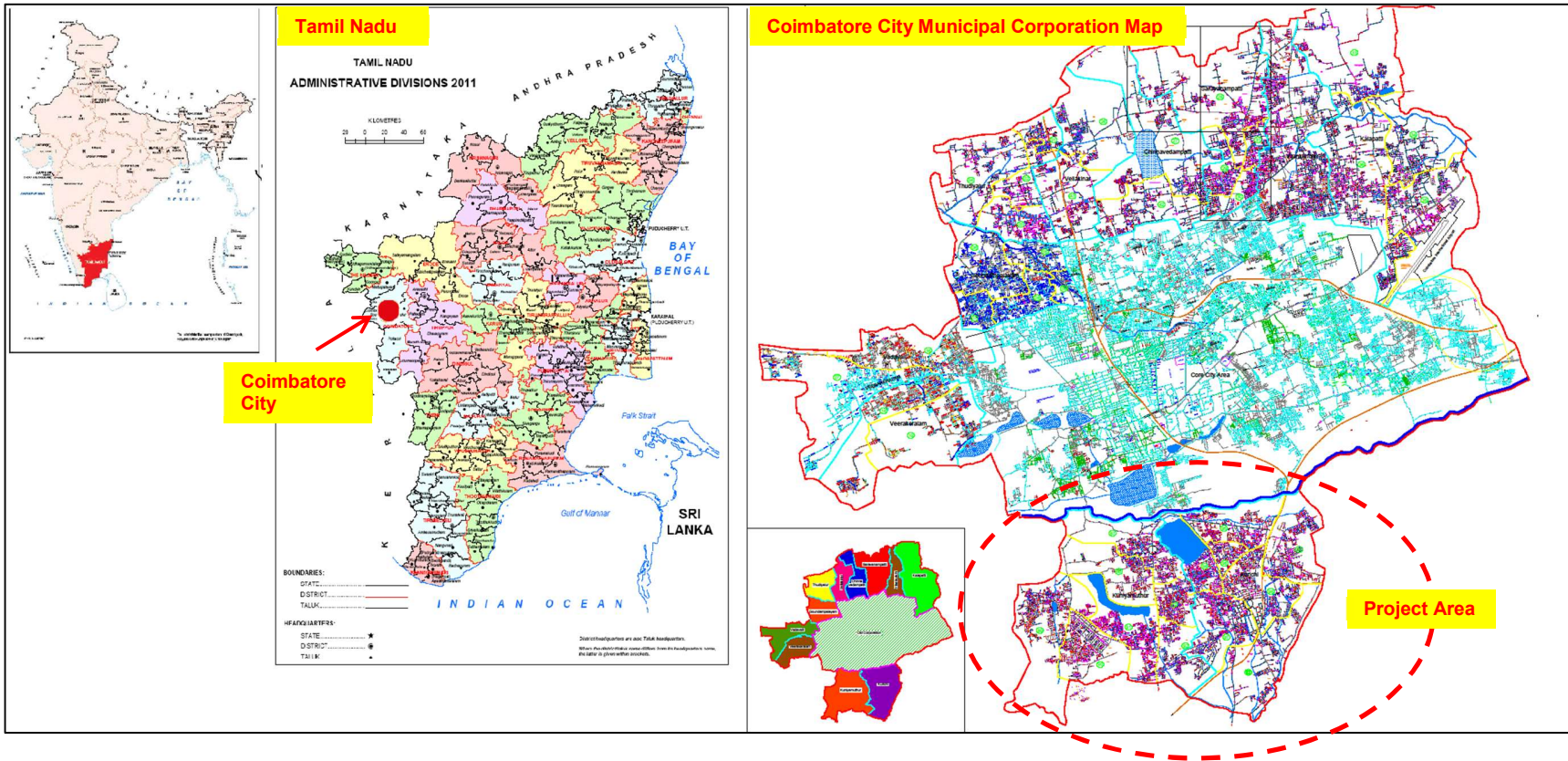
11. In 2011, government through a notification included 3 municipalities (Kurichi, Kuniyamuthur and Kavundampalayam) and 7 Town Panchayats (Chinnavedampatty, Kalapatti, Saravanampatti, Vellakinaru, Thudiyalur, Vadavalli, and Veerakeralam) and a village panchayat (Vilankurichi) in the Coimbatore Corporation limits, increasing the corporation area from 105.60 sq. km to 257.04 sq. km. Municipal wards reorganized and increase from 72 to 100, with newly added areas constituting 40 wards.

12. At present there is no underground sewerage system in these added areas. Road side drains are carrying both the sullage and the rain water. About 2/3rd of the houses have septic tanks. The houses in the slum areas do not have latrines and depend on community toilets and open spaces. Drains carrying wastewater join water bodies around the city. Overflowing of drains in rains, water pooling in low lying areas is not uncommon, creating unhealthy conditions.

13. In the present subproject it is proposed to provide underground sewerage system in 14 of 40 wards in added area, and STP. These wards (87-100) comprise Zone IV. Wards 87 to 93 comprise the erstwhile Kuniyamuthur Municipality. Wards 94 to 100 comprise the erstwhile Kurichi Municipality. Due to lack of sewerage system at present wastewater from houses flow in the open drains, which dispose into Kurichikulam (lake) and River Noyyal, polluting them.

14. Coimbatore City Municipal Corporation (CCMC) is the responsible agency for providing basic urban services including sewerage in the City, and is the implementation agency for this subproject. Detailed project report for the underground sewage scheme in Kuruchi and Kuniyamuthur has been prepared by Tamil Nadu Water and Drainage (TWAD) Board.

Figure 1: Location of Subproject



### C. Proposed Project

15. Following Table shows the nature and size of the various components of the subproject. Location of subproject components and conceptual layout plans are shown in Figure 2 to Figure 5. System is designed as a separate underground system catering only to domestic wastewater; storm runoff generated during rains will be carried by existing open drains and dispose into natural streams/ water bodies. Industrial wastewater will not be disposed into sewers. System is designed for 115 liters per capital per day, based on sewage generation rate of 80% of water supply. System is design with gravity flow as far as possible, however topography do not permit a complete gravity system from collection to inlet at the STP, and therefore wherever required sewage lifting and pumping stations introduced to optimize the system design.

**Table 1: Proposed Water Supply Subproject Components**

Infrastructure	Function	Description	Location																																																																				
Sewer network	Collect wastewater from houses and convey by a combination of gravity and pressure pumping to the STP	<p><i>New</i> 434.52 km; 150-300 mm dia: DWC (double walled corrugated) pipes (352.60 km) uPVC (unplasticized polyvinyl chloride) pipes (20.4 km) 200-900 mm dia: cast iron pipes (61.52 km)</p> <table border="1"> <thead> <tr> <th>Dia (mm)</th> <th>Material</th> <th>Length (m)</th> <th>%</th> </tr> </thead> <tbody> <tr><td>160</td><td>uPVC</td><td>20,406</td><td>5%</td></tr> <tr><td>200</td><td>DWC</td><td>343,880</td><td>79.1%</td></tr> <tr><td>250</td><td>DWC</td><td>5,299</td><td>1.2%</td></tr> <tr><td>300</td><td>DWC</td><td>3,422</td><td>0.8%</td></tr> <tr><td>200</td><td>CI</td><td>32,288</td><td>7.4%</td></tr> <tr><td>250</td><td>CI</td><td>3,111</td><td>0.7%</td></tr> <tr><td>300</td><td>CI</td><td>2,833</td><td>0.7%</td></tr> <tr><td>350</td><td>CI</td><td>5,582</td><td>1.3%</td></tr> <tr><td>400</td><td>CI</td><td>4,587</td><td>1.1%</td></tr> <tr><td>450</td><td>CI</td><td>4,201</td><td>1.0%</td></tr> <tr><td>500</td><td>CI</td><td>2,755</td><td>0.6%</td></tr> <tr><td>600</td><td>CI</td><td>905</td><td>0.2%</td></tr> <tr><td>700</td><td>CI</td><td>1,075</td><td>0.2%</td></tr> <tr><td>800</td><td>CI</td><td>3,141</td><td>0.7%</td></tr> <tr><td>900</td><td>CI</td><td>1,037</td><td>0.2%</td></tr> <tr><td></td><td></td><td>434,522</td><td>100%</td></tr> </tbody> </table> <p style="text-align: right;"><i>m = meter</i></p> <p><b>Manholes: 17,748 no,s</b> 10,733 nos. (brickwork) 7,015 nos. (reinforced cement concrete)</p>	Dia (mm)	Material	Length (m)	%	160	uPVC	20,406	5%	200	DWC	343,880	79.1%	250	DWC	5,299	1.2%	300	DWC	3,422	0.8%	200	CI	32,288	7.4%	250	CI	3,111	0.7%	300	CI	2,833	0.7%	350	CI	5,582	1.3%	400	CI	4,587	1.1%	450	CI	4,201	1.0%	500	CI	2,755	0.6%	600	CI	905	0.2%	700	CI	1,075	0.2%	800	CI	3,141	0.7%	900	CI	1,037	0.2%			434,522	100%	Sewers will be laid underground in the roads and internal streets in the project area comprising Kuruchi and Kuniamuthur in the southern outskirts of Coimbatore City
Dia (mm)	Material	Length (m)	%																																																																				
160	uPVC	20,406	5%																																																																				
200	DWC	343,880	79.1%																																																																				
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		434,522	100%																																																																				
Sewage lift stations (LS)	Collect sewage from low level sewer and pump to	<p>19 nos. <i>Components of LS</i></p> <ul style="list-style-type: none"> <li>Suction well of dia 1.5 m to</li> </ul>	Lift well will be constructed on the road shoulder (and in																																																																				



Infrastructure	Function	Description	Location
	higher sewer or to pumping stations	3.0 m and depth 1.83 – 5.01 m (closed) with a vent pipe <ul style="list-style-type: none"> <li>• Non-clog submersible pump sets</li> <li>• Control panel box</li> </ul>	the road itself when there is no earthen shoulder) where the sewer ends terminates into the lift well. Pumps will be installed in the well, and a control panel box will be installed near the well. Lift stations are proposed at following locations: <ol style="list-style-type: none"> <li>1. MGR Nagar</li> <li>2. E B Colony</li> <li>3. Kurichi Housing Unit</li> <li>4. Mohan nagar</li> <li>5. Bismi nagar</li> <li>6. Silver jubilee nagar</li> <li>7. Annapuram</li> <li>8. LIC colony</li> <li>9. Annai thersa layout</li> <li>10. Krishna College Road</li> <li>11. Sriraman nagar</li> <li>12. Kathiravan Nagar</li> <li>13. Thulasi gardens</li> <li>14. Indira nagar</li> <li>15. Rainbow colony</li> <li>16. Krishna Nagar Extension</li> <li>17. Sathya Nagar</li> <li>18. Punga Nagar</li> <li>19. Krishnasamy Nagar</li> </ol>
	Pump sewage from lower level manhole to higher level sewer or pumping station	5 no,s Lift manholes Pump will be fixed inside manhole	Manholes are located along the roads within the RoW. Pumps will be fixed inside manhole and covered.
Sewage pumping stations	Collect sewage and pump to main pumping stations	7 nos. Components of Sewage pumping stations <ul style="list-style-type: none"> <li>• Screen well Dia (3.5m – 8 m) and depth (2.15 – 6.53 m)</li> <li>• Grit well Dia (2m– 6 m) and depth (3.65 – 7.73 m)</li> <li>• Suction well Dia (4m – 7 m) and depth (4.98 – 8.7 m)</li> </ul>	Sewage pump stations are proposed at following locations: <ol style="list-style-type: none"> <li>1. Netaji nagar</li> <li>2. Rajarajeshwari nagar</li> <li>3. Rajagopala nagar</li> <li>4. Periyasamy street</li> <li>5. Gayathiri Nagar</li> <li>6. Pillayarapuram road</li> </ol>

Infrastructure	Function	Description	Location																														
		<ul style="list-style-type: none"> <li>Pump room (3m x 2 m<sup>2</sup>)</li> </ul> Non-clog submersible pump sets	7. Amman nagar																														
Main Sewage pumping stations (MPS)	Collect sewage from lift stations and pumping stations and pump to sewage treatment plant	4 no, <i>Components of MPS</i> <ul style="list-style-type: none"> <li>Screen well Dia (8 – 11.5 m) and depth (3.21 – 5.23 m)</li> <li>Grit well Dia (6 – 8.5 m) and depth (4.61 – 7 m)</li> <li>Suction well Dia (7 – 14 m) and depth (6.6 – 8.1 m)</li> <li>Pump room (3x2 m<sup>2</sup>)</li> <li>Non-clog submersible pump sets</li> </ul>	Main sewage pump stations are proposed at following locations: <ol style="list-style-type: none"> <li>Chinna sudikadu</li> <li>Muthu nagar</li> <li>Arputham nagar</li> <li>Sathyasai nagar</li> </ol>																														
Sewer pumping mains	Transfer sewage from lift stations, pump stations to MPS, and finally to STP	42.985 km CI pipes of dia 150-800 mm <table border="1"> <thead> <tr> <th>Dia (mm)</th> <th>Length (m)</th> <th>%</th> </tr> </thead> <tbody> <tr> <td>150</td> <td>10,825</td> <td>25.2%</td> </tr> <tr> <td>200</td> <td>1,800</td> <td>4.2%</td> </tr> <tr> <td>250</td> <td>3,350</td> <td>7.8%</td> </tr> <tr> <td>300</td> <td>9,010</td> <td>21.0%</td> </tr> <tr> <td>400</td> <td>2,100</td> <td>4.9%</td> </tr> <tr> <td>600</td> <td>5,000</td> <td>11.6%</td> </tr> <tr> <td>700</td> <td>3,300</td> <td>7.7%</td> </tr> <tr> <td>800</td> <td>7,600</td> <td>17.7%</td> </tr> <tr> <td></td> <td>42,985</td> <td>100.0%</td> </tr> </tbody> </table>	Dia (mm)	Length (m)	%	150	10,825	25.2%	200	1,800	4.2%	250	3,350	7.8%	300	9,010	21.0%	400	2,100	4.9%	600	5,000	11.6%	700	3,300	7.7%	800	7,600	17.7%		42,985	100.0%	Mains will be laid underground along the roads; large dia mains are located on wider roads in the project area
Dia (mm)	Length (m)	%																															
150	10,825	25.2%																															
200	1,800	4.2%																															
250	3,350	7.8%																															
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	42,985	100.0%																															
Sewage Treatment Plant (STP)	Treatment of collected wastewater to comply with disposal standards	<i>New</i> STP of capacity 30 MLD Proposed process: SBR (sequential batch reactor). Components: <ul style="list-style-type: none"> <li>Mechanical screens</li> <li>Grit removal,</li> <li>Flow measurement and flow splitter box</li> <li>Batch reactors with individual inlet flow control and a fully automated process</li> <li>Sludge management system</li> </ul>	Site is located at Vellalore in the eastern outskirts of Coimbatore City. Site is located within a large campus that is currently housing a solid waste management facility (compost plant and landfill) and also the existing anaerobic lagoon based STP. Total area of this campus is 650 acres, of which 75 acres allocated to the new STP.  Selected site is located ideally away from the residential areas. Few residential colonies are located near the boundary of this 650 acre site; STP will be constructed sufficiently																														

Infrastructure	Function	Description	Location
			inside the compound maintaining at least a distance of 200 m from the boundary.
Solar power plant	Captive power generation to supply to STP for operation; main purpose is to reduce the grid power usage, and reduce GHG emissions in STP operation	2 megawatt (MW) photo voltaic solar power plant	This will be erected within the STP site
Outfall sewer	Disposal of treated water from STP into River Noyyal	5 km length 800 mm dia DI (ductile iron) pipe	Pipe will laid underground in Vellalur-Singanallur Road
House service connections	Collect sewage from individual houses and convey into network	<ul style="list-style-type: none"> <li>69,668 nos.</li> </ul>	At each household, connected to wastewater outlet drain

#### D. Implementation Schedule

16. Contract will be awarded by May-June 2018. Construction is likely to start in June 2018, and will take about 36 months to complete. Detailed implementation schedule (including design/pre-construction, construction, commissioning, and operation phases) will be provided in the updated IEE per detailed design.

Figure 2: Location of Lifting and Pumping Stations

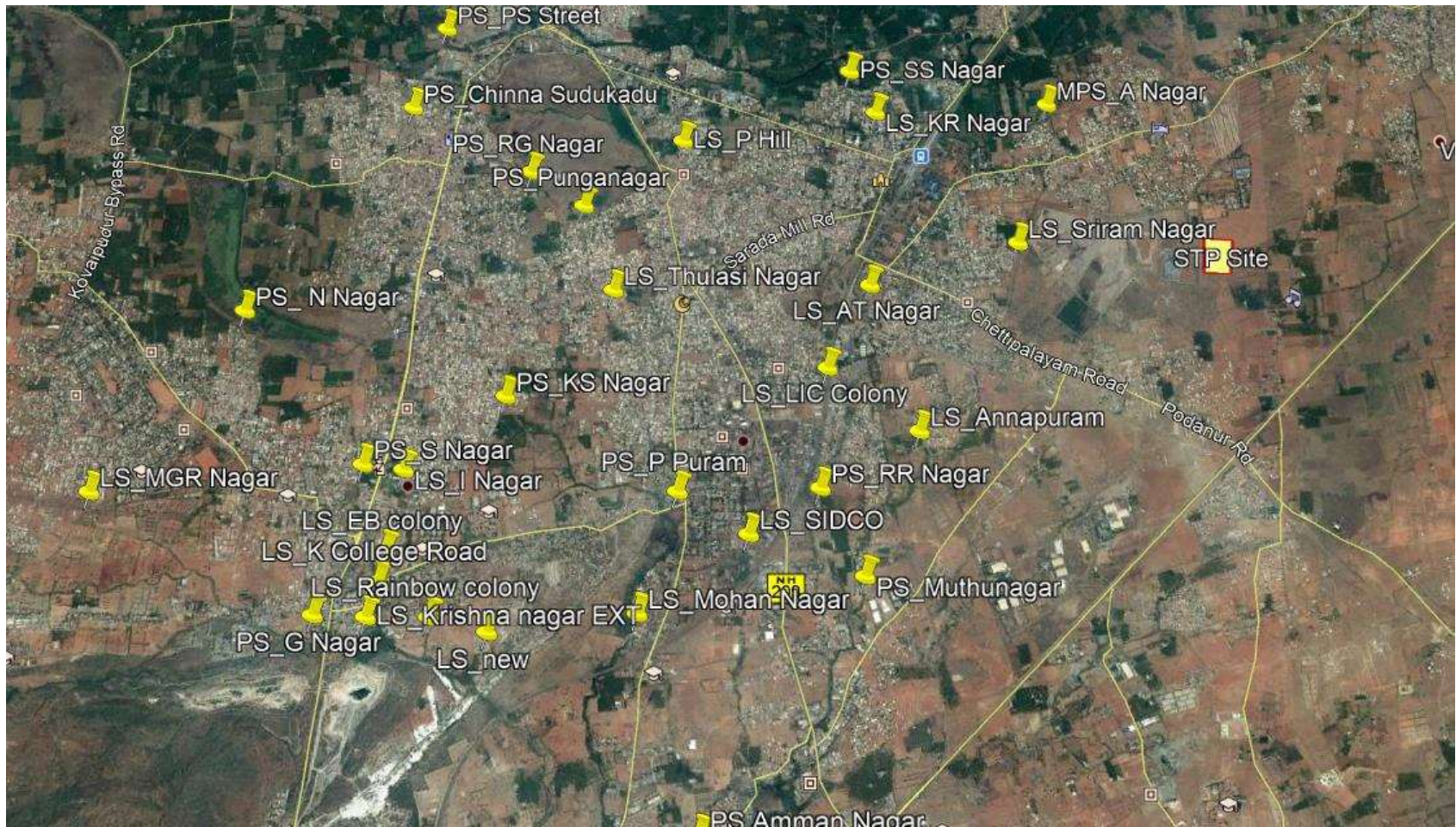
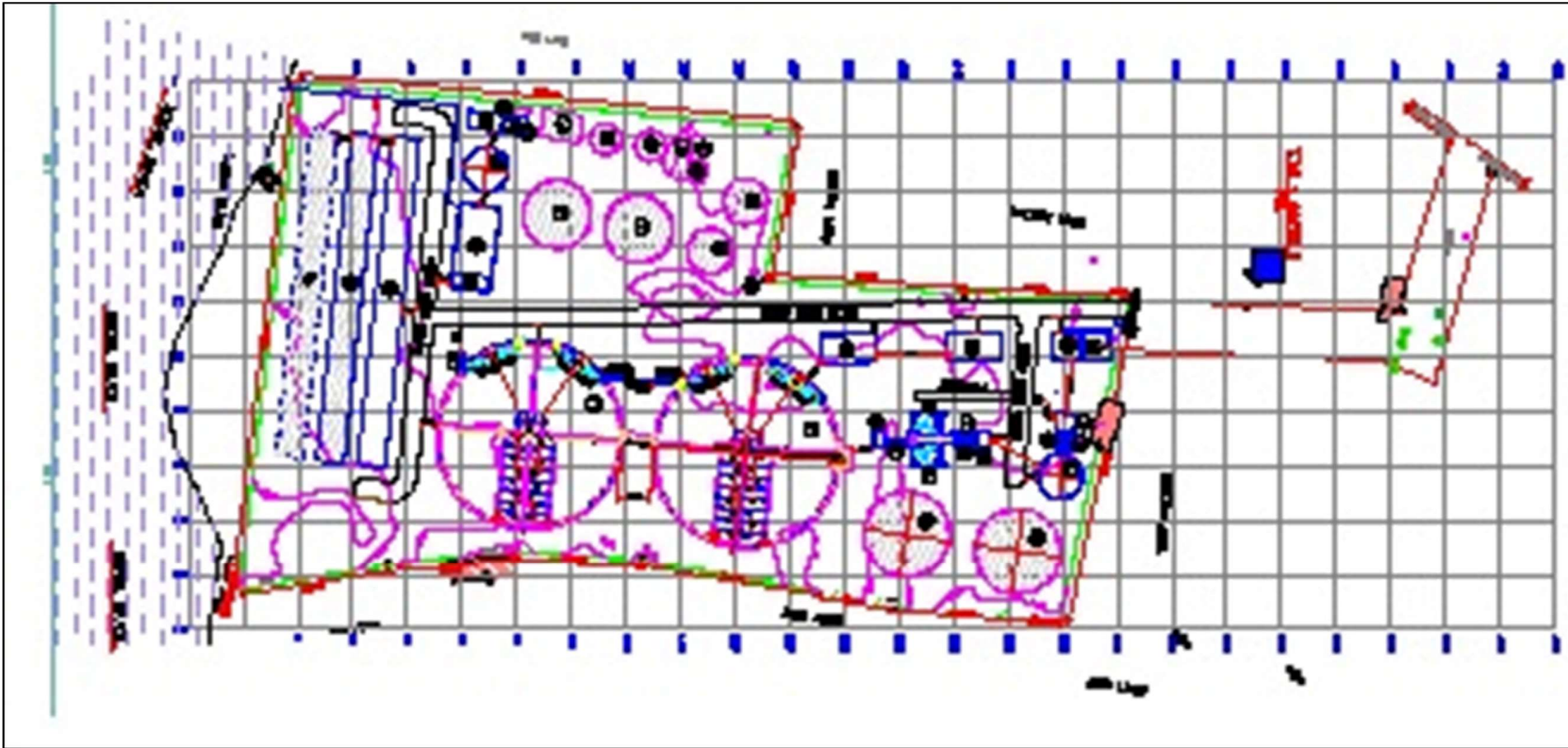


Figure 3: Sewage Treatment Plant Site



Figure 4: Sewage Treatment Plant Layout Map



\* This is indicative layout; actual layout will be prepared by contractor considering siting measures suggested in IEE.

Figure 5: Sewage Treatment Plant and Alignment of Outfall Sewer



### III. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

#### A. ADB Policy

17. ADB requires the consideration of environmental issues in all aspects of ADB's operations, and the requirements for environmental assessment are described in ADB SPS, 2009. This states that ADB requires environmental assessment of all ADB investments.

18. **Screening and categorization.** The nature of the environmental assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project; the sensitivity, scale, nature, and magnitude of its potential impacts; and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impacts, and are assigned to one of the following four categories:

- (i) Category A. A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.
- (ii) Category B. A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required.
- (iii) Category C. A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.
- (iv) Category FI. A proposed project is classified as category FI if it involves investment of ADB funds to or through a Financial Intermediary (FI)..

19. **Environmental Management Plan.** An EMP, which addresses the potential impacts and risks identified by the environmental assessment, shall be prepared. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the project's impact and risks.

20. **Public Disclosure.** ADB will post the safeguard documents on its website as well as disclose relevant information in accessible manner in local communities:

- (i) final or updated IEE upon receipt; and
- (ii) environmental monitoring reports submitted by the implementing agency during project implementation upon receipt.

#### B. National Environmental Laws

21. **Environmental assessment.** The Government of India EIA Notification of 2006 (replacing the EIA Notification of 1994), sets out the requirement for Environmental Assessment in India. This states that Environmental Clearance is required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts.

22. Category A projects require Environmental Clearance from the central Ministry of Environment, Forests and Climate Change (MoEFCC). The proponent is required to provide



preliminary details of the project in the prescribed manner with all requisite details, after which an Expert Appraisal Committee (EAC) of the MoEFCC prepares comprehensive Terms of Reference (TOR) for the EIA study. On completion of the study and review of the report by the EAC, MoEFCC considers the recommendation of the EAC and provides the Environmental Clearance if appropriate.

23. Category B projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State level EAC categorizes the project as either B1 (requiring EIA study) or B2 (no EIA study), and prepares TOR for B1 projects within 60 days. On completion of the study and review of the report by the EAC, the SEIAA issues the Environmental Clearance based on the EAC recommendation. The Notification also provides that any project or activity classified as category B will be treated as category A if it is located in whole or in part within 10 km from the boundary of protected areas, notified areas or inter-state or international boundaries.

24. None of the components of this underground sewerage system subproject falls under the ambit of the EIA Notification 2006, and, therefore EIA Study or Environmental Clearance is not required for the subproject.

25. **Applicable environmental regulations.** Besides EIA Notification 2006, there are various other acts, rules, policies and regulations currently in force in India that deal with environmental issues that could apply to infrastructure development. The specific regulatory compliance requirements of the subproject are shown in Table 2.

**Table 2: Applicable Environmental Regulations**

Law	Description	Requirement
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Act was enacted to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water. Control of water pollution is achieved through administering conditions imposed in consent issued under to this Act. All pollution potential activities will require consent to establish (CTE) from Tamil Nadu Pollution Control Board (TNPCB) before starting implementation and consent to operate (CTO) before commissioning.	Construction of proposed STP requires CTE and CTO from TNPCB before starting of construction and before commissioning of STP respectively.  Application has to be submitted online at <a href="http://tnocmms.nic.in/OCMMS/">http://tnocmms.nic.in/OCMMS/</a>
Environment (Protection) Act, 1986 and Central Pollution Control Board (CPCB) Environmental Standards.	Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the notified standards	To comply with applicable notified standards.
Noise Pollution (Regulation and Control) Rules, 2000 amended up to 2010.	Rule 3 of the Act specifies ambient air quality standards in respect of noise for different areas/zones.	To comply with the noise standards.
Air (Prevention and Control of Pollution) Act, 1981, amended 1987 and its Rules, 1982.	- Applicable for equipment and machinery's potential to emit air pollution (including but not limited to diesel generators and vehicles); - CTE and CTO from TNPCB; - Compliance to conditions and emissions standards stipulated in the CTE and CTO.	Generators will require CTE and CTO from TNPCB  Generators to comply with applicable emission standards.

Law	Description	Requirement
Solid Wastes Management Rules, 2016	Rules to manage municipal solid waste generated; provides rules for segregation, storage, collection, processing and disposal.	Solid waste generated at proposed facilities shall be managed and disposed in accordance with the SWM Rules
Construction and Demolition Waste Management Rules, 2016	Rules to manage construction and to waste resulting from construction, remodeling, repair and demolition of any civil structure. Rules define C and D waste as waste comprising of building materials, debris resulting from construction, re-modeling, repair and demolition of any civil structure.	Construction and demolition waste generated from the project construction shall be managed and disposed as per the rules(
Labor Laws	The contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The contractor shall base the employment relationship upon equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline. The contractor shall provide equal wages and benefits to men and women for work of equal value or type.	Appendix 2 provides applicable labor laws including amendments issued from time to time applicable to establishments engaged in construction of civil works, which will be complied with by the project.

**Table 3: Effluent Disposal Standards of Sewage Treatment Plans Applicable to All Modes of Disposal**

S. No.	Parameter	Standard	
		Location	Concentration not to exceed
1	pH.	Anywhere in the country	6.5 - 9.0
2	Bio-Chemical Oxygen Demand (BOD)	Metro Cities*, all State Capitals except in the State of Arunachal Pradesh, Assam, Manipur, Meghalaya Mizoram, Nagaland, Tripura Sikkim, Himachal Pradesh, Uttarakhand, Jammu and Kashmir, and Union territory of Andaman and Nicobar Islands, Dadar and Nagar Haveli Daman and Diu and Lakshadweep	20
		Areas/regions other than mentioned above	30
3	Total Suspended Solids (TSS)	Metro Cities*, all State Capitals except in the State of Arunachal Pradesh, Assam, Manipur, Meghalaya Mizoram, Nagaland, Tripura Sikkim, Himachal Pradesh, Uttarakhand, Jammu and Kashmir, and Union territory of Andaman and Nicobar Islands, Dadar and Nagar Haveli Daman and Diu and Lakshadweep	<50
		Areas/regions other than mentioned above	<100
4	Fecal Coliform (FC) (Most Probable Number per 100 milliliter, MPN/100ml)	Anywhere in the country	<1000

\*Metro Cities are Mumbai, Delhi, Kolkata, Chennai, Bengaluru, Hyderabad, Ahmedabad and Pune.

**Note :**

(i) All values in mg/l except for pH and Fecal Coliform.

(ii) These standards shall be applicable for discharge into water bodies as well as for land disposal/applications.

(iii) The standards for Fecal Coliform shall not apply in respect of use of treated effluent for industrial purposes.

(iv) These Standards shall apply to all STPs to be commissioned on or after the 1st June, 2019 and the old/existing STPs shall achieve these standards within a period of five years from date of publication of this notification in the Official Gazette.

(v) In case of discharge of treated effluent into sea, it shall be through proper marine outfall and the existing shore discharge shall be converted to marine outfalls, and in cases where the marine outfall provides a minimum initial dilution of 150 times at the point of discharge and a minimum dilution of 1500 times at a point 100 meters away from discharge point, then, the existing norms shall apply as specified in the general discharge standards.

(vi) Reuse/Recycling of treated effluent shall be encouraged and in cases where part of the treated effluent is reused and recycled involving possibility of human contact, standards as specified above shall apply.

(vii) Central Pollution Control Board/State Pollution Control Boards/Pollution Control Committees may issue more stringent norms taking account to local condition under section 5 of the Environment (Protection) Act, 1986”.


26. **Clearances/permissions to be obtained by Contractor.** Following Table shows the list of clearances/permissions required for project construction. This list indicative and the contractor should ascertain the requirements prior to start of the construction, and obtain all necessary clearances/permission prior to start of construction.

**Table 5: Clearances and Permissions Required for Construction**

S. No	Construction Activity	Statutory authority	Statute under which Clearance is Required	Implementation	Supervision
1	Construction of new sewage treatment plant (STP)	Tamil Nadu Pollution Control Board (TNPCB)	Consent to establish and consent to operate under Water Act, 1974	Contractor and Project Implementation Unit (PIU)	PIU
2	Tree Cutting	Department of Forest and District Collector	Clearances from the authorities as per the Tamil Nadu Timber Transit Rules, 1968 or latest.	PIU	Implementing agency and Project Management Unit (PMU)
3	Hot mix plants, Crushers and Batching plants	TNPCB	Consent to establish and consent to operate under Air Act, 1981	Contractor	PIU
4	Discharges from construction activities	TNPCB	Consent to establish and consent to operate under Water Act, 1974	Contractor	PIU
5	Storage, handling and transport of hazardous materials	TNPCB	Hazardous Wastes(Management and Handling)Rules. 1989Manufacturing, Storage and	Contractor	PIU

S. No	Construction Activity	Statutory authority	Statute under which Clearance is Required	Implementation	Supervision
			Import of Hazardous Chemicals Rules, 1989		
6	Sand mining, quarries and borrow areas	Department of Geology and mining, GoTN	Not applicable  Contractor to obtain material from the existing government licensed mines / quarries; Contractor will require prior approval of PIU for obtaining material from a particular source. PIU to review and approve only existing licensed mines	Contractor	PIU
7	For establishing new quarries and borrow areas	MOEFCC	Not applicable  No new quarries / borrow areas will be created for the subproject.	Contractor	PIU
8	Groundwater extraction	Public Works Department	(Groundwater) Tamil Nadu Groundwater Development and Management Act 2000	Contractor	PIU
9	Disposal of bituminous wastes	Tamilnadu State Pollution Control Board	Hazardous Wastes (Management and Handling) Rules. 1989	Contractor	PIU
10	Temporary traffic diversion measures	-	MoRTH 112 SP 55 of IRC codes	Contractor	PIU

27. **ADB SPS Requirements.** During the design, construction, and operation of the project the project management unit (PMU) and PIUs will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When Government of India regulations differ from these levels and measures, the PMU and PIUs will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the PMU and PIUs will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

**Table 4: WHO Ambient Air Quality Guidelines**

Table 1.1.1: WHO Ambient Air Quality Guidelines <sup>7, 8</sup>		
	Averaging Period	Guideline value in $\mu\text{g}/\text{m}^3$
Sulfur dioxide (SO <sub>2</sub> )	24-hour	125 (Interim target-1) 50 (Interim target-2) 20 (guideline)
	10 minute	500 (guideline)
Nitrogen dioxide (NO <sub>2</sub> )	1-year	40 (guideline)
	1-hour	200 (guideline)
Particulate Matter PM <sub>10</sub>	1-year	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline)
	24-hour	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter PM <sub>2.5</sub>	1-year	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline)
	24-hour	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

**Table 5: World Bank Group's EHS Noise Level Guidelines**

Table 1.7.1- Noise Level Guidelines <sup>54</sup>		
Receptor	One Hour L <sub>Aeq</sub> (dBA)	
	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational <sup>55</sup>	55	45
Industrial; commercial	70	70

#### IV. DESCRIPTION OF THE ENVIRONMENT

##### A. Methodology Used for Baseline Study

28. **Data collection and stakeholder consultations.** Data for this study has been primarily collected through comprehensive literature survey, discussion with stakeholder agencies, and field visits to the proposed subproject sites.

29. The literature survey broadly covered the following:

- (i) Project details, reports, maps, and other documents prepared by technical consultants, TWAD Board, CCMC, ADB project preparatory technical assistance (PPTA) team etc.;
- (ii) Discussions with Technical experts of the PPTA team, TNUIFSL, implementing agency, DPR preparation agency, and other relevant government agencies
- (iii) Secondary data from previous project reports and published articles; and
- (iv) Literature on land use, soil, geology, hydrology, climate, socioeconomic profiles, and other planning documents collected from Government agencies and websites.

30. **Ocular inspection.** Several visits to the project sites were made during IEE preparation period in 2017 to assess the existing environment (physical, biological, and socioeconomic) and gather information with regard to the proposed sites and scale of the proposed project. A separate socioeconomic study was conducted to determine the demographic information, existing service levels, stakeholder needs and priorities.

##### B. Physical Resources

###### 1. Location, Area and Connectivity

31. Situated in the central western part of Tamil Nadu, and about 500 km southwest of capital city Chennai, Coimbatore is the third largest city in Tamil Nadu after Chennai and Madurai. It is one of the fastest growing cities in India. This city serves as the District Headquarters for Coimbatore District.

32. The extent of Coimbatore city until recently was limited to 105.6 square km when it consisted of 72 administrative wards. In 2011 July, the Selection / Special Grade Municipalities around the corporation including the current project areas of Kuruchi and Kuniyamuthur, were

added to Coimbatore Corporation. The ward numbers of the corporation have since increased from 72 nos. to 100 nos. and the geographical area to 257 km<sup>2</sup>. Population of the Old municipal corporation area of Coimbatore city is 1,050,721 (2011 census).

33. Kurichi Municipality, with population of about 1.2 lakh was one of the most populous municipality in Coimbatore before the merger. Kurichi lies between Latitude: 10.96424 North Longitude: 76.97007 East and has an elevation of 413 m. The Municipality was constituted in the year of 1892 and was subsequently upgraded as third grade Municipality and later to special grade Municipality before it became part of Coimbatore Corporation area. It covers an area of 20.30 km<sup>2</sup>. Kuniyamuthur Municipality has a population of about 96 thousand and located in Coimbatore South sub district. Kuniyamuthur lies between Latitude 10.95277 North and Longitude: 76.95333 East with an elevation of 415m above sea level. Before it became part of Coimbatore Corporation, Kuniyamuthur was a Selection Grade Town Panchayat, later upgraded to Third Grade Municipality. It comprises of an area of around 23.54 sq.km.

34. Coimbatore has a well-developed transport infrastructure and is well connected by Road, Rail and Air with most cities and towns in India. NH 209 passes through Kurichi area. The Nearest railway station to the project area is Coimbatore Junction which is 8 km far from Kurichi and 10km from Kuniyamuthur.

## **2. Topography, Soils and Geology**

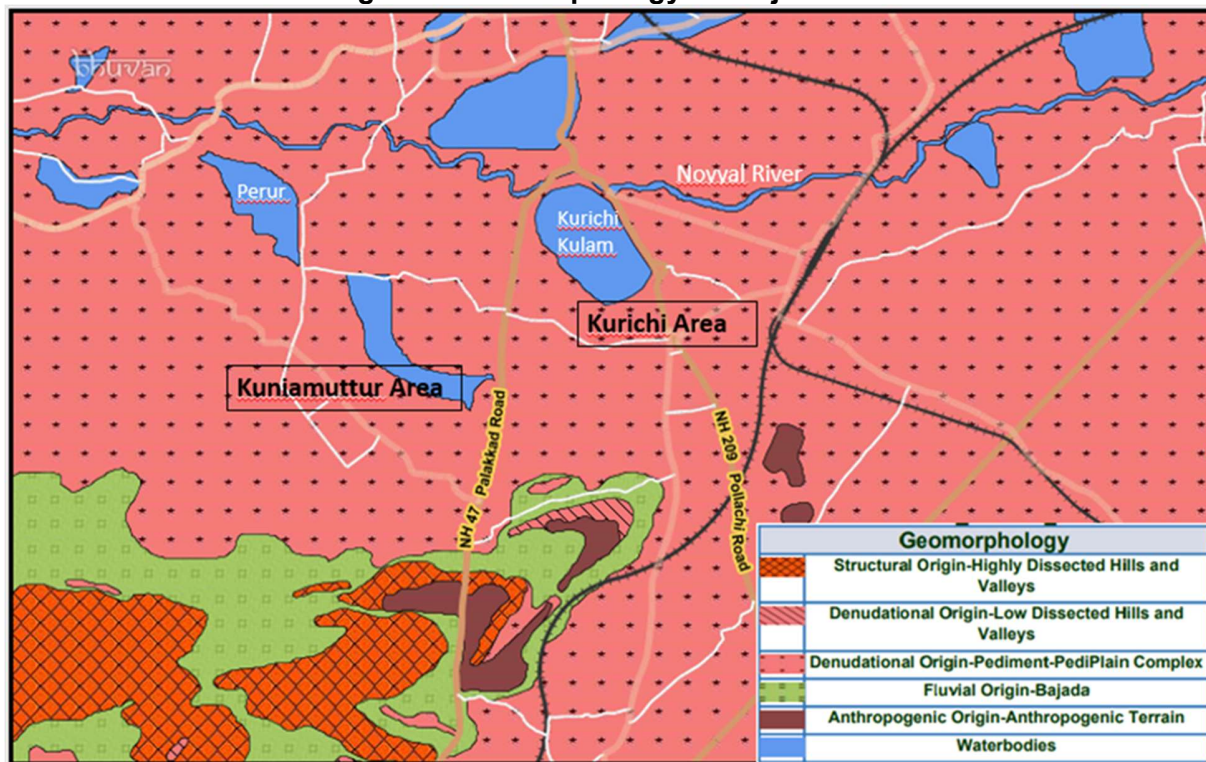
35. Coimbatore district forms part of the upland plateau region of Tamil Nadu with many hill ranges, hillocks and undulating topography with a gentle slope towards east except for the hilly terrain in the west. Both Kurichi and Kuniyamuthur areas have a predominantly plain terrain that is interspersed by Noyyal river bed and numerous water bodies. The region is bounded on the west in the shape of a horseshoe by steeply rising mountains of Western Ghats.

36. The soils of Coimbatore district can be broadly classified into 6 major soils types viz., Red calcareous Soil, Black Soil, Red non-calcareous, Alluvial and Colluvial Soil, Brown Soil, and Forest Soil. The project areas of Kurichi and Kuniyamuthur are covered by red soils, of which red calcareous soil is predominant. The Alluvial soils are found in small patches along the Noyyal river mainly in the upper reaches.

37. The geological formation of the district is classified as Gneissic complex or Gneissic granulite with and allied supra-crustal belt, which are believed to have occurred between 3400 to 3000 million years ago giving rise to an extensive group of grey gneisses designated as the "older gneiss complex". These gneisses act as the basement for a widespread belt of schist's. Sargur group comprises ultramafic rocks, amphibolites, Quartzite banded magnetites- quartzite occurring as small bands and lenses within the migmatites and gneisses.

38. Rocks are composed of minerals and amorphous solids. Since the geological set up controls the occurrence and movement of groundwater, the ability of the parent rock to store and transport groundwater is of great importance for its occurrence. The major rock types occurring in the district are fissile hornblende biotite gneiss, sand and silt, granite, amphibolites, metagabbro, pyroxenite, pyroxene granulite, charnockite, garnet sillimanite – graphite gneiss, calc-granulite and limestone and pink migmatite. There are no known or reported cases of land subsidence in or close to the subproject area.

**Figure 6: Geomorphology of Project Area**



### 3. Seismology

39. As per the seismic zoning map of India, Coimbatore falls under Zone III, which is the moderate earthquake risk zone in India. Structural design of infrastructure elements will be done with due consideration to relevant codes.

### 4. Climatic Conditions

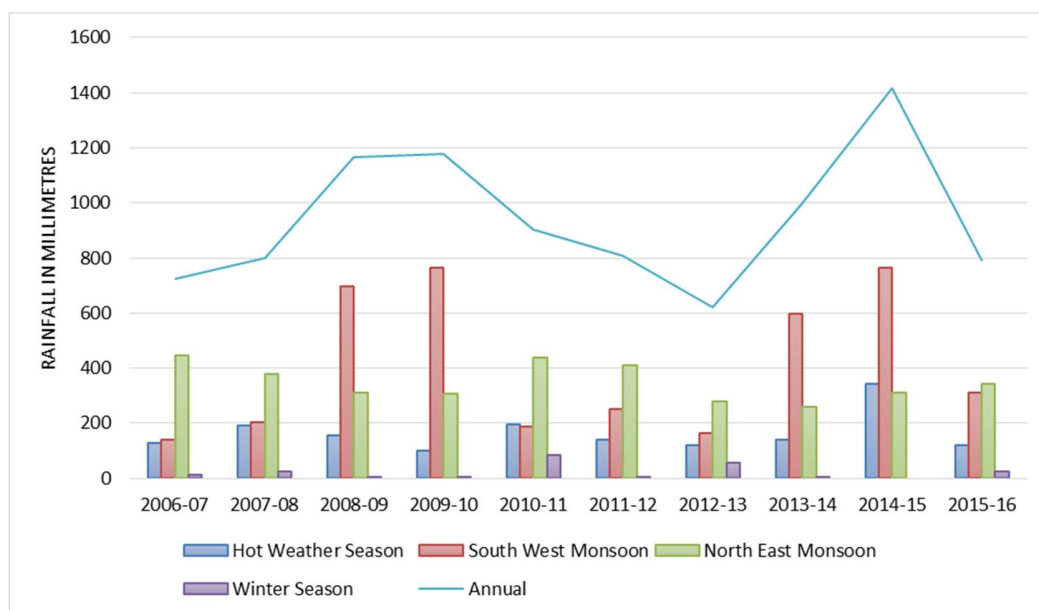
40. It is located at the foothills of Western Ghats, Coimbatore is blessed with a pleasant, salubrious climate due to its proximity to the thickly forested mountain ranges and the cool breeze blowing through the Palghat gap which makes the consistently hot temperatures pleasant. The city has a tropical wet and dry climate, with the wet season being from October to December due to the northeast monsoon. Coimbatore is located at an elevation of about 411 meters, and enjoys pleasant climate throughout the year. Due to the presence of the mountain pass, major parts of the district benefit from the south-west monsoon.

41. January and February experience a very pleasant climate. During March, the sky is clear, but the temperature start increasing which continues till the end of May. The highest temperature is recorded early in April/May. Due to the presence of the mountain pass, more elevated parts of the district benefit from the south-west monsoon in the months from June to August. September is the inter monsoon period and the sky is clear. During October and November, the North East monsoon sets in and provides most of the rains in this district. But after mid-December rain ceases. The temperature which was once set on the downward trend continues its course till the end of January. The climatic condition of Coimbatore district is most conducive for people and cotton ginning and weaving Industries.

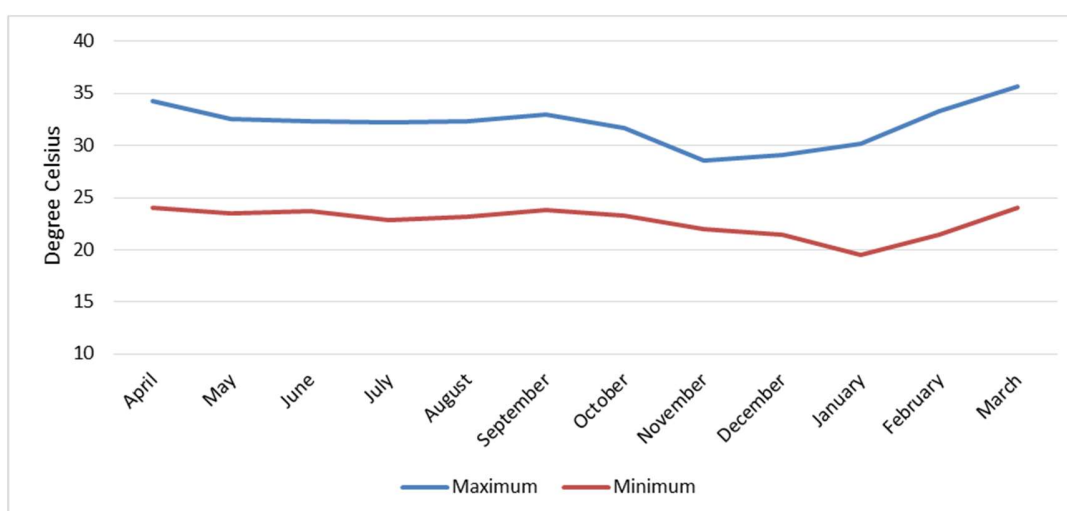


42. The maximum temperature ranges from 36°C to 41°C and the minimum temperature varies from 14°C to 31°C. The mean daily temperature during summer varies from 33°C to 40°C and the mean daily temperature during winter varies from 15°C to 31°C. Rain occurs during South-West and North-East monsoons. North-east monsoon contributes the maximum of 328.2 mm during October to December. The average annual rainfall of this district is 647.2 mm from four distinct seasons.

**Figure 7: Annual Seasonal Rainfall in Project Area**



**Figure 8: Monthly Max and Min Average Temperature in Project Area**



## 5. Surface Water

43. Noyyal River, a small river and tributary of River Cauvery, passes through Coimbatore city. The flow in the river is negligible, and only consists of wastewater it collects from the surrounding areas. The maximum width of the stream is about 50 m in the city, but this is visible only at some places like river bridges in the city. In most of the course, the width is about 10-20 m, and flow within that confines to a maximum of 5 m wide, and shallow. Prior to 2011, Noyyal formed part of southern boundary of the municipal corporation limit. In 2011, Kuruchi and Kuniamuthur municipalities (the subproject area), which are located south of the River are added to the municipal limit. It rises in Vellingiri hills in the Western Ghats in Tamil Nadu, close to Kerala border. This rain fed River flows from west to east, and travels a distance of 180 km through five districts of Coimbatore, Tirupur, Erode, Karur, and Trichy. Cities of Coimbatore and Tirupur are two main cities along its course, about 50 km apart. It finally joins River Cauvery at Noyyal, a village in Karur district. The river's basin is 180 km long and 25 km wide and covers a total area of 3,500 km<sup>2</sup>. Project area lies within the watershed expanse of the Noyyal River Basin and consists of a network of tanks and canals apart from lakes.

44. There are several lakes and tanks in Coimbatore. Nine notable lakes are: Ammankulam, Narasampathi, Krishnampathi, Selvampathy, Kumaraswamy aka Muthannakulam, Selvachinthamani, Periya Kulam aka Ukkadam Big Tank, Valankulam and Singanallur. There are 24 tanks in the city. However, none of these are located in the subproject area. Kuruchi Kulam, a big lake is located within Kuruchi, in the subproject area. Sengulum, another water body, is situated just outside the subproject area in southwestern side. Water quality data presented in the following Table shows contamination, probably due to entry of wastewater from the catchment areas, with biochemical oxygen demand (BOD) value of 6.10 milligram per liter (mg/l).

**Table 6: Water Quality Data of Lakes, 2015**

S. No.	Parameters	Units	Kuruchi Kulum	IS drinking water standards
1	DO	Mg/l	4.10	-
2	FC	MPN/100ml	155	Absent
3	PH	PH	8.02	6.5 – 8.5
4	EC	MS/cm	782	-
5	BOD	Mg/l	6.10	-
7	PO <sub>4</sub>	Mg/l	1.40	-
8	NO <sub>3</sub>	Mg/l	3.20	45
9	SO <sub>4</sub>	Mg/l	62	200 – 400
10	Cl <sup>-</sup>	Mg/l	122	250 – 1000
11	Alkalinity	Mg/l	378	200 - 600
12	TDS	Mg/l	540	500-2000
13	Turbidity	NTU	9.40	1 – 5

Values shown are absolute values of one-time sampling and laboratory resting

Source: Jeyaraj M. et al (2016).

## 6. Groundwater

45. The district is underlain by both porous and fissured formations. The important aquifer systems in the district are constituted by i) unconsolidated formations and ii) weathered and fractured crystalline rocks. The porous formations in the district are represented by alluvium and colluvium.

46. Ground water occurs under phreatic conditions in the weathered mantle and under semi-confined conditions in the fractured zones. The shallow aquifers in the major part of the district occur within the depth of 30 m while in the western most part of Coimbatore; they are more than 30 m. The depth of the wells ranged from 7 to 45 m bgl. The yield of large diameter wells in the district, tapping the weathered mantle of crystalline rocks ranges from 50 to 300 lpm and are able to sustain pumping for 2 to 4 hours per day. The Specific capacity of large diameter wells tested in crystalline rocks from 6.28 to 200.00 lpm/m. of drawdown.

47. The yield of bore wells drilled down to a depth of 50 to 100 m, by various state agencies mainly for domestic purposes ranged from 1 to 5 lps. The yield of successful bore wells drilled down to a depth of 304 mbgl during the ground water exploration programme of Central Ground Water Board ranged from <1 to 10 lps. The aquifer and well parameters of the wells show wide variation. The depth to water level in the district varied between 1.54 and 39.03 mbgl during pre-monsoon (May 2006) and varied between 0.62 and 36.42 mbgl during post monsoon (Jan 2007). The seasonal fluctuation shows a rise in water level, which ranges from 0.34 to 10.88 mbgl. The piezometric head varied between 1.47 to 50.66 mbgl (May 2006) during pre-monsoon and 0.34 to 51.02 mbgl during post monsoon (Jan 2007).

48. The estimation of groundwater resources for the Coimbatore district has shown that out of 19 blocks, 11 blocks are over exploited and 4 blocks are under "critical" category.

49. **Groundwater Quality.** Ground water in phreatic aquifers in Coimbatore district in general is colorless, odorless and slightly alkaline in nature. According to central ground water board (CGWB) report, the specific electrical conductance of ground water in phreatic zone ( $\mu\text{S}$  at  $25^\circ\text{C}$ ) during May 2006 was in the range of 597 to 4810 in the district. It is between 750 and 2250  $\mu\text{S}/\text{cm}$  at  $25^\circ\text{C}$  in the major part of the district. Conductivity below 750  $\mu\text{S}/\text{cm}$  has been observed in Kaltanpet whereas conductance exceeding 2250  $\mu\text{S}/\text{cm}$  has been observed in parts of Avinashi, P.N.Palayam, Tiruppur, Nachipalayam, Vadavalli, Singanallur, Slur, Podanur and Chinnaripalayam.

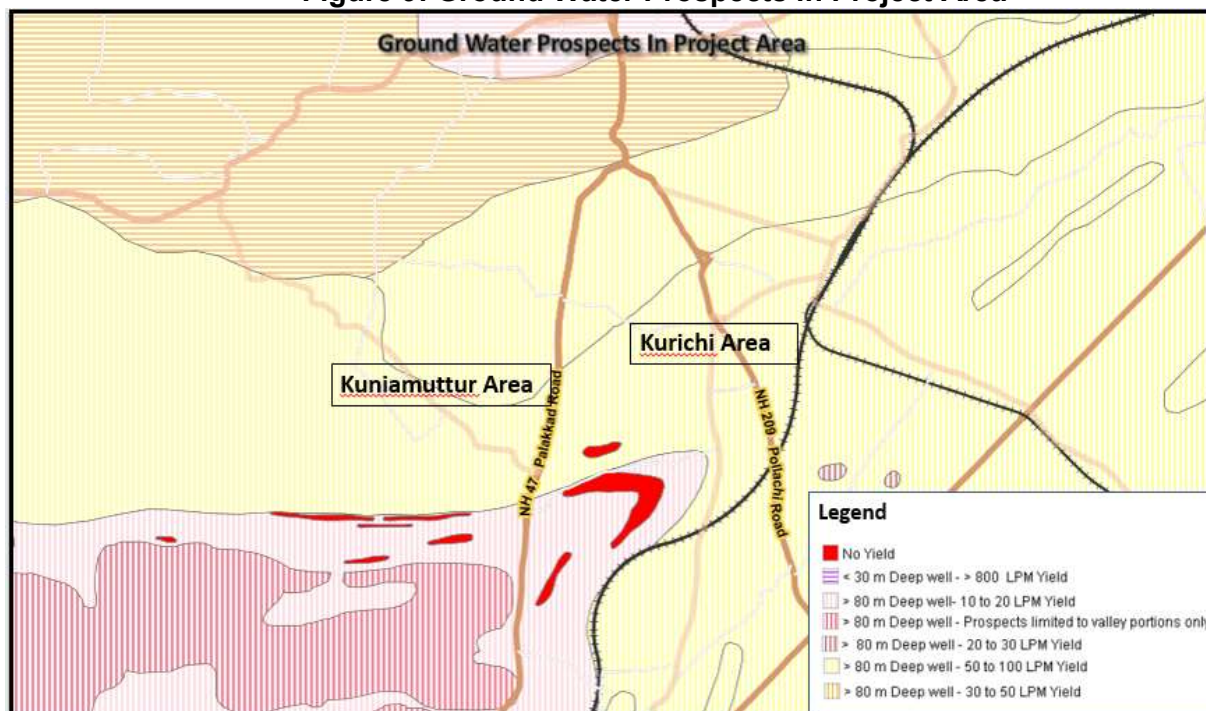
50. Following table shows the groundwater quality in Coimbatore along River Noyyal. Water hardness and calcium is higher than permissible limits.

**Table 7: Groundwater Quality**

Parameters	BIS standard	Pre-monsoon (mean)	Post-monsoon (mean)
pH	6.5 – 8.5	7.47	7.26
Total dissolved solids, mg/l	500 – 2000	1237.10	1329.72
Total hardness, mg/l	300 – 600	748.23	676.15
Calcium, mg/l	75 -200	518.26	512.69
Magnesium, mg/l	30 – 100	230.73	163.46
Sodium, mg/l	200	70.96	100.82
Potassium, mg/l	-	88.7	165.66
Chloride, mg/l	250 – 1000	218.63	200.3
Bicarbonate, mg/l	300 – 600	702.54	95.63
Sulphate, mg/l	200 – 400	17.06	19.31

Kalaivani S. and Ramesh K. (2014-15), "Groundwater Quality Assessment using WQI In South Coimbatore, Tamil Nadu, India", International Journal of Chem Tech Research, Vol. 7(1).

**Figure 9: Ground Water Prospects in Project Area**



Source: Bhuvan.

## 7. Ambient Air Quality

51. The ambient air quality in the project area is being monitored under National Air Quality Monitoring Programme (NAMP) at following locations in Coimbatore (i) District Collector's Office (Mixed zone), (ii) Ponniyarajapuram (Residential zone), and (iii) SIDCO Building (Industrial zone).

52. National ambient air quality monitoring (NAAQM) station at Small Industries Development Corporation (SIDCO) Industrial Estate is located within Kurichi area (southeastern corner) while rest of the two monitoring stations are about 5 kilometers away from the project area, but within Coimbatore City. The sources of pollution are windblown road dust, industries and automobile emissions. Kurichi area is traversed by NH209 and Kuniyammuttur area is bifurcated by Palakkad road. Both the roads are busy with high vehicular movement. This vehicular movement contribute to the air quality in the area. Maximum and average values of the respirable suspended particular matter (RSPM) is higher than the prescribed standard.

**Table 8: Annual Average Concentrations of Air Pollutants, 2014 -2015**

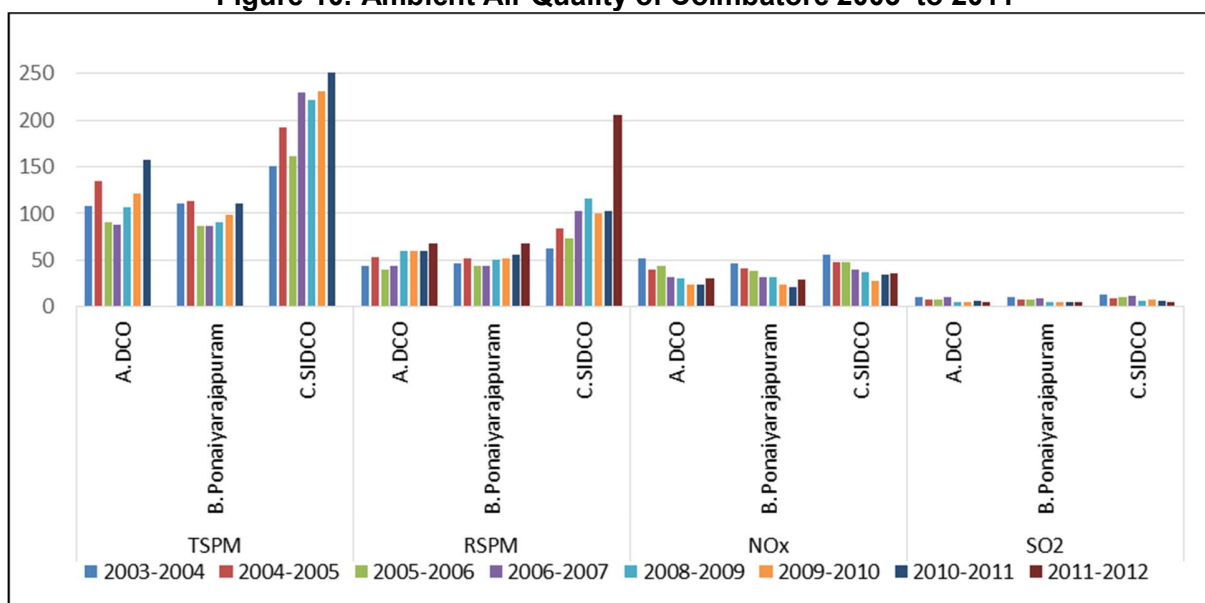
	Location	Category	Annual Average Concentrations of Air Pollutants in Micro Grams per Cubic Meter ( $\mu\text{g}/\text{m}^3$ )								
			SO <sub>x</sub>			NO <sub>x</sub>			RSPM		
			Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
1	DCO	Mixed	4	4	4	27	23	26	65	27	45

	Location	Category	Annual Average Concentrations of Air Pollutants in Micro Grams per Cubic Meter ( $\mu\text{g}/\text{m}^3$ )								
			SO <sub>x</sub>			NO <sub>x</sub>			RSPM		
			Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
2	Ponaiyarapuram	Residential	4	4	4	19	24	22	67	33	49
3	SIDCO	Industrial	4	4	4	29	23	27	88	38	57
NAAQ Standard											
Industrial, Residential, Rural and Other Areas			50			40			40		
Ecologically Sensitive Area			20			30			40		

Source: TNPCB Annual Report 2014-15

53. Following figure shows the ambient air quality in Coimbatore from 2003 to 2011. Particulate matter is higher than the prescribed standard. Oxides of nitrogen and sulphur are well within the limits.

Figure 10: Ambient Air Quality of Coimbatore 2003 to 2011



Source: Air Pollution Database in Tamil Nadu 2014 by Envis Centre.

## 8. Ambient Noise Levels

54. The ambient noise levels recorded in the vicinity of project area are higher than the day and night time noise standards (55 dBA and 45 dBA) for residential areas as well as for commercial areas (65 dBA and 55 dBA).

Table 9: Ambient Day-time Noise Levels in Coimbatore

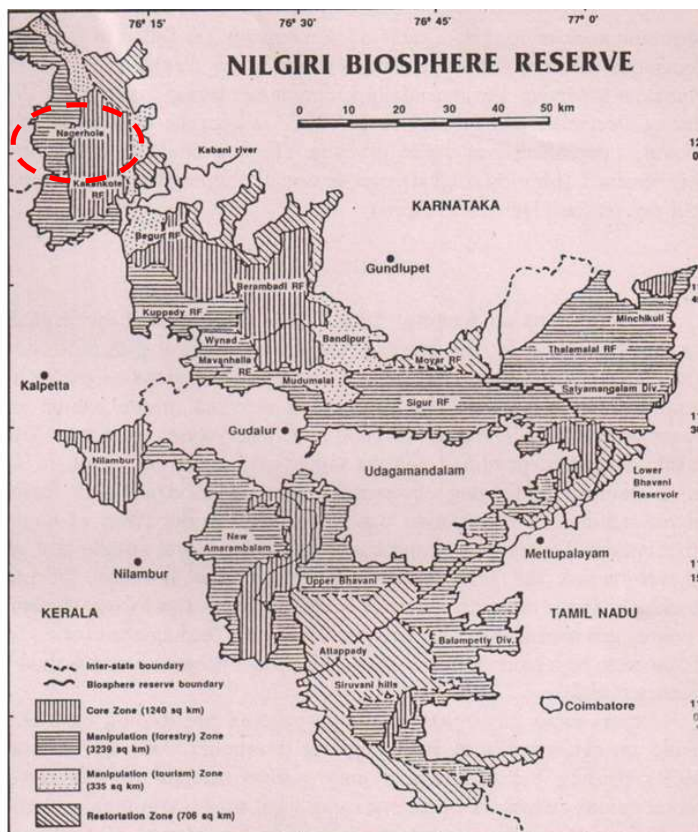
Area Name	Normal Day dB (A) Max	Festival Day dB(A) Max
Saibaba Kovil Signal	72	68

Ponnirajapuram	67	82
Standards	55	55

Source: CPCB 2014

### C. Ecological Resources

55. Geographically, Coimbatore is situated on the banks of river Noyyal and foothills of Western Ghats and Nilgiri Biosphere Reserve (NBR). NBR is spread over vast area of 5,520 sq. km in three states of Tamil Nadu, Kerala and Karnataka; about 46% area is situated in Tamil Nadu state. NBR falls under the biogeographic region of the Malabar rain forest. Mudumalai Wildlife Sanctuary, Wyanaad Wildlife Sanctuary, Bandipur National Park, Nagarhole National Park, Mukurthi National Park and Silent Valley are the protected areas present within this



reserve. The reserve extends from the tropical and subtropical moist broadleaf forests, tropical moist forests of the western slopes of the Ghats to the tropical and subtropical dry broadleaf forests tropical dry forests on the east slopes. Rainfall ranges from 500mm to 7,000 mm per year. The reserve encompasses three ecoregions, the South Western Ghats moist deciduous forests, South Western Ghats montane rain forests, and South Deccan Plateau dry deciduous forests. This encompasses Nilgiri mountains, spread in west of Coimbatore. The boundary of biosphere reserve is about 15-20 km from the project area. As the project is confined to urban area of Coimbatore municipal corporation, none of the components are located in or close to biosphere reserve. Noyyal river originates in a mountain range in the biosphere reserve.

56. Coimbatore and surrounding region receives scanty rainfall, and Noyyal River forms an important ecological aspect for water resources. There are series of tanks/lakes (32 in all) to hold overflow of Noyyal river during northwest and southwest monsoon along Noyyal river in its course of over 170 km. These are interconnected tanks, some of which are located in Coimbatore. The edible, freshwater teleost, *Mystus vittatus* (Bloch), the striped dwarf catfish, vernacularly called as 'Pown keluthi' is a fish variety cultured in major lakes in and around Coimbatore city. Twenty-one species of fish have been recorded from six of the city lakes.

57. A 2007 study by Sálím Ali Centre for Ornithology and Natural History(SACON) in 14 wetlands in the Coimbatore had recorded 12,000 birds, belonging to 54 species. Other studies, recorded around 133 species of birds representing 48 families and 16 orders around the city wetlands; most of the species were either wetland birds or wetland associated species. But the diversity and numbers in recent years has drastically reduced. According to Sivakumar T et al the following migratory birds were recorded at Kurichi Kulam (lake) in 2014: Little Crake, Water Cock, Black tailed Godwit, Marsh Sandpiper, Wood sandpiper, Grey Wagtail, Brown Shrike, Greenish Leaf Warbler, Orphean Warbler. None of the listed birds are protected or listed under the Schedule I of Wildlife Protection Act. The migratory season in the region generally spreads between July to January.

58. Mammals that are usually encountered in the project area includes the domestic cattle, cats and dogs. A study by Athira (2012) during the months of March and April 2012 around Ukkadam Lake documented *Pipistrellus* as the wide spread and dominant genus of bat in the study area.

59. Chandrabose (1981) and Chandrabose and Nair (1988) based on their study of over a decade have made a comprehensive account of the floral diversity; 159 species belonging to 51 families across the Coimbatore city including the Noyyal River, its ponds and canals. Flora like *Ceratophyllum demersum*, *Hydrilla verticillata*, *Ipomoea aquatica*, *Nymphaea nouchali*, *Eichhornia crassipes* and *Lemna paucicostata* *Colocasia esculenta*, *Cyperus alopecuroides*, *Argemone mexicana*, *Chloris barbata*, and *Cleome chelidonii* are commonly observed in the wetlands. Predominant trees in the area are Banyan or Aala maram (*Ficus benghalensis*), Neem (*Azadirachta indica*), the golden shower tree *Cassia fistula* and Tamarind or Puliymaram (*Tamarindus indica*).

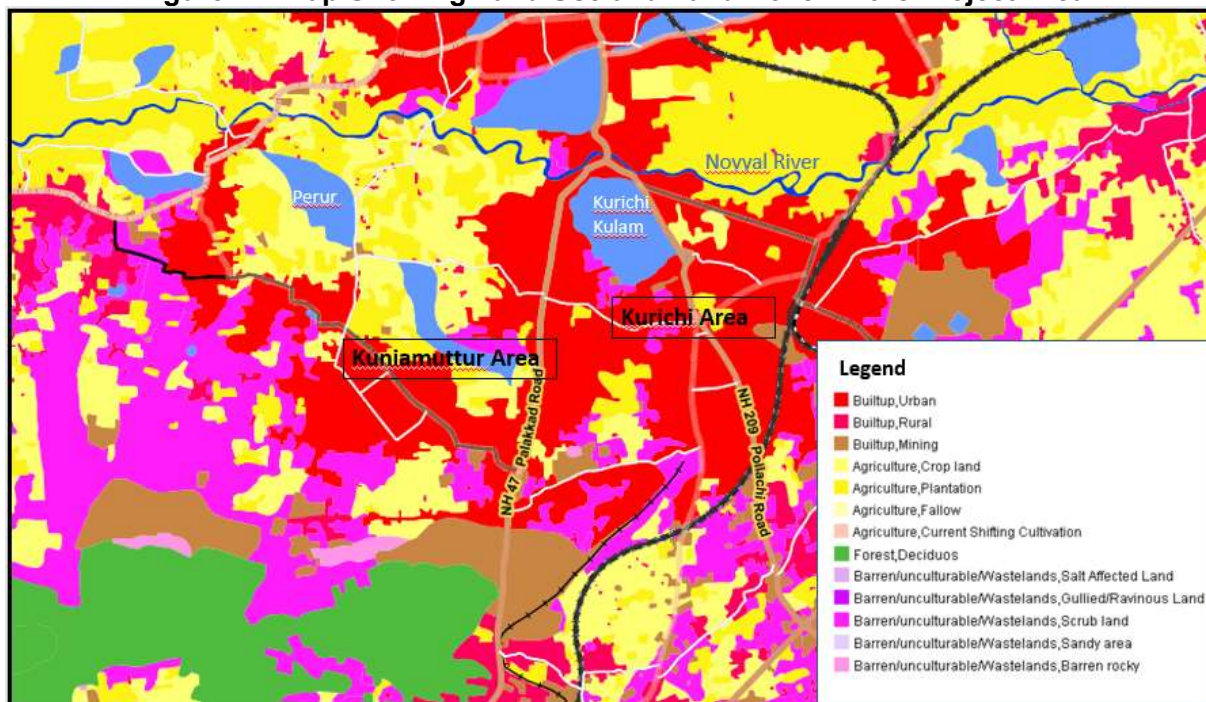
60. Subproject components are all located in urban land parcels surrounded by developed lands which were converted to agricultural and/or urban use many years ago, and therefore there are no sensitive environmental features in or near the subproject sites.

## **D. Economic Development**

### **1. Land use**

61. The urban agglomeration of Coimbatore expanded from 38 km<sup>2</sup> in 1973 to 79 km<sup>2</sup> in 1989 and further to 274 km<sup>2</sup> in 2011, registering over fivefold expansion, in less than four decades. In terms of spatial pattern, the city developed concentrically during the initial years and later into linear development along the major roads (Coimbatore Corporation City Development Plan 2006). A review of 2002 land use plan for the city indicated that nearly 75 per cent of land within the corporation limits had developed into urban land use, while the rest was classified as agricultural land, water bodies, vacant areas, and heritage sites. However, the network of manmade wetlands in Coimbatore that is its lifeline, contributes only 1.08% of the total area.

**Figure 11: Map Showing Land Use and Land Cover in the Project Area**



Source: Bhuvan

## 2. Industry and Agriculture

62. Coimbatore city is a major commercial and business hub in the state of Tamil Nadu. It is the highest revenue yielding district in the state even ahead of Chennai, it is one of the fastest-growing metro cities in India. Economy of Coimbatore is heavily influenced by industrial and service sectors: Information Technology, Engineering and Textiles. It is called the Manchester of South India due to its extensive textile industry, fed by the surrounding cotton fields. First cotton spinning and weaving mills were set up in Coimbatore district in way back in 1888. Rapid growth of textile has helped growth of associated industries like manufacture of machinery and tools. Next to textiles, manufacture of motors and pumps for domestic and agricultural uses are taking place in small and large scale in and around Coimbatore city. Wet grinder cluster and pump set cluster are the 2 industrial parks in the district. The city is the second largest software producer in Tamil Nadu, next to Chennai. Tamil Nadu Government owned SIDCO industrial unit, which is located at Kurichi in Coimbatore, and houses a large number of small scale engineering units. The city has two special economic zones (SEZ), the Coimbatore Hi-Tech Infrastructure (CHIL) SEZ and the Tidel park Coimbatore.

63. Due to urbanization, the project area of Kurichi and Kuniyamuthur has seen conversion of agriculture land for urban land use. Major Agricultural Crops cultivated in the region are Sorghum, Groundnut, Maize, Cowpea, Rice, Cotton. The most produced crop is Sorghum and the highest productivity is found in Maize.

## 3. Infrastructure

64. **Water Supply.** There are two major sources of supply of drinking water to Coimbatore City: Siruvani and Pillor schemes. These schemes are based on Siruvani and Pillor Dam, which are located about 30-40 km from Coimbatore City. The corporation is maintaining the distribution



of water supply. The entire supply of water from Siruvani is by nature of gravity whereas pumping is being done in the Pilloor scheme. A separate scheme to augment the Pilloor water supply scheme to the Coimbatore Corporation is in progress.

65. The increase in population under the Corporation limits due to the territorial reorganization in July has resulted in increased demand for water. As per the norms based on the city's population set by the Government of India, Coimbatore's Corporation is required to provide 135 liters per capita per day (lpcd) to the citizens within the city limits whereas the current capacity despite the schemes in place is 110 lpcd. This deficit gets aggravated especially during summer months before arrival of Monsoon rains.

66. **Sewerage.** The existing underground sewerage system covers almost entire area of Coimbatore City Corporation limit prior to its expansion in 2011. This area is divided into 3 sewerage zones. Zone 1 forms the heart of the city and the sewage from this Zone (20.143 MLD) is pumped to the anaerobic lagoon STP at Vellalore. Zone 2 comprises original Corporation limits in North and West. Sewage collected from Zone II (16.62 MLD) is also pumped to the anaerobic lagoon at Vellalore. Zone 3 covers Tatabad, Sivanada colony, Gandhipuram, Sidthapuram, Pulicakulam, Trichy road and Ramanathapuram areas. Sewage from zone III (23.625 MLD) is pretreated at Nanjundapuram pumping station and pumped to anaerobic lagoon at Vellalore. In 2011, government through a notification included 3 municipalities (Kurichi, Kuniamuthur and Kavundampalayam) and 7 Town Panchayats (Chinnavedampatty, Kalapatti, Saravanampatti, Vellakinaru, Thudiyalur, Vadavalli, and Veerakeralam) and a village panchayat (Vilankurichi) in the Coimbatore Corporation limits, increasing the corporation area from 105.60 sq. km to 257.04 sq. km. Municipal wards reorganized and increase from 72 to 100, with newly added areas constituting 40 wards. In the extended areas, there is no sewerage system, and therefore it is proposed to provide sewerage system in the extended areas under this subproject.

67. **Solid Waste Management.** The Coimbatore City Municipal Corporation (CCMC) is divided into different Zones and each Zone further divided into Sanitary Wards. Coimbatore city currently has four waste transfer stations, more than 3000 sanitary workers and about 650 acres of land being utilized for waste disposal. The waste management scenario in the city involves systematic management of waste from the households and other establishments. The waste generated in the city is transported in closed containers and is managed through semi closed transfer stations comprising of hydraulic waste compression mechanism. The city presently generates around 815 TPD of municipal solid waste (MSW) having an average generation rate of 600 gms/capita/day. The CCMC oversees the waste management in its 100 wards. CCMC collects around 775 TPD of MSW which accounts for almost 95% of collection efficiency.

68. **Transportation.** The Coimbatore District has got well developed road infrastructure connecting various important neighboring towns like Pollachi, Valparai and Metupalayam. Coimbatore city is internally well connected through the large network of roads maintained by the Corporation. The NH 47 and NH 209 runs through the project area. The Coimbatore Junction (Railway Station) is connected to all the major Indian cities – Chennai, Bangalore, Indore, Bhopal, Gwalior, Jabalpur, New Delhi and Mumbai. It also connects the neighboring State of Kerala. The city has an airport (Coimbatore Airport) at Peelamedu (11 km from the city) and an air-force base at Sulur (15 km). Coimbatore airport caters to domestic flights to all the major Indian cities and international flights to Sharjah and Singapore.

## E. Socio-Cultural Resources

### 1. Demography

69. Project area consisting of east while Kuruchi and Kuniyamuthur municipalities are added to Coimbatore City municipal area in the year 2011, and therefore the 2011 census population and demographic details are available separately for old Coimbatore city municipal corporation and the two municipalities. As presented in the following Table, project area is experiencing tremendous population growth, while population core city of Coimbatore is slower than the overall state population. This shows the rapid expansion of city into outer areas from the congested core city. Literacy rate is about 90%.

**Table 10: Demographic Characteristics (2011 Census)**

Demographic Parameters	Tamil Nadu	Coimbatore (Old MC area)	Kuruchi Municipality	Kuniyamuthur Municipality
Population (2011)	72,147,030	1,050,721	123,667	95,924
Geographical area (sq.km)	130,060	105.60	20.30	13.87
Total households	18,462,231	282,839	32,830	25,270
Decadal Growth rate (2001-11)	15.61%	12.9%	58.8%	62.9%
Sex ratio	996	997	1001	1001
Population Density, (per sq. km)	555	9,950	6,092	6,916
Household size	3.9	3.7	3.8	3.8
literacy rate	80.09%	91.30%	89.93%	89.37%
literacy rate (male)	86.77%	94.46%	93.82%	93.27%
literacy rate (female)	73.73%	88.15%	86.05%	85.50%
SC Population	20.01%	10.3%	10.51%	10.08%
ST Population	1.1%	0.1%	0.28%	0.06%
Work participation ratio	45.58%	45%	44%	45%
Work participation ratio – male	59.31%	68%	67%	67%
Work participation ratio - female	31.8%	22%	22%	22%
Main workers	85%	94.6%	91.4%	94.4%
Marginal workers	15%	5.4%	8.6%	5.6%
Cultivators	12.9%	0.4%	0.6%	0.4%
Agricultural Laborers	29.2%	0.7%	0.6%	1.8%
HH industry workers	4.1%	2.9%	2.4%	2.2%
Other workers	53.7%	96.0%	96.5%	95.4%

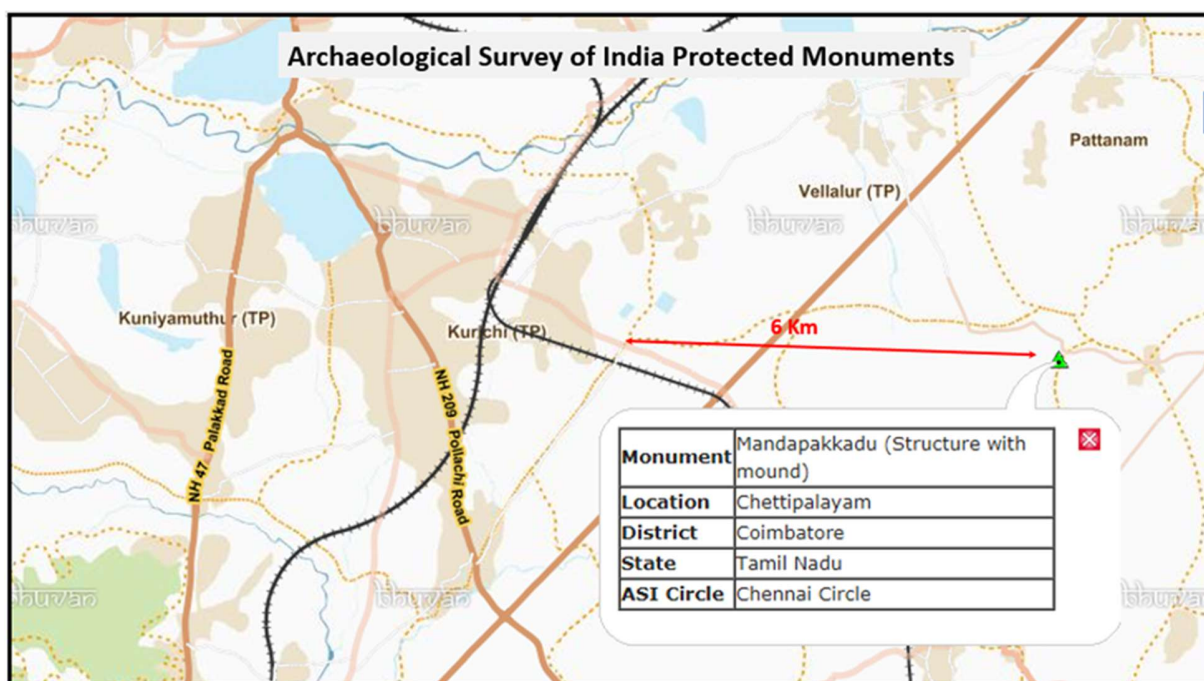
### 2. History, Culture and Tourism

70. Though the origin of Coimbatore is shrouded in legend it has been established that Chola and Vijayanagar Kings and Tippu Sultan were associated with its history. The early name of Coimbatore city was 'Kovanpatti', meaning the hamlet of Kovan, the chieftain of Irula Tribes. The Perur temple inscriptions (12th century) described the town as the Kovanpudur, a hamlet in Perur Nadu. Gradually the name Kovanpudur got changed and Koyampudur came to be used. During the British period, due to the difficulty in pronunciation, the officials have recorded the name as Coimbatore.

71. Coimbatore in its present form was organized by the British in the early 19<sup>th</sup> century. Though the region developed as a sound agrarian's economy, Coimbatore came to be known for its industrial enterprises and in the process, it is called the 'Manchester of South India' and the 'Detroit of India'. Industrialization of the region began in 1888 and continued into the 20<sup>th</sup> century. The city experienced a textile boom in 1920s and 1930s due to the decline of the Cotton industry in Mumbai. The region played a significant role in the Indian independence movement. In 1981, Coimbatore was constituted as a corporation.

72. Sukrawarpet and Range Gowder Street in the city is known for its old buildings, and other notable places include Tamil Nadu Agricultural University, Forest College, GASS Forest Museum, Victoria Hall, Sarvajana Higher Secondary School (where Rabindranath Tagore himself had come and sung the National Anthem in 1926). However, none of these are located in the subproject areas. There are no Archaeological Survey of India or state protected monuments in the project region. The nearest protected monument (Mandapakkadu) is located around 6km aerial distance from the project area.

**Figure 12: Nearest Archaeological Survey of India Protected Monument**







Source: Bhuvan.




## F. Subproject Site Environmental Features



73. Features of the selected subproject sites are presented in the following table.



**Table 11: Site Environmental Features**

Infrastructure	Location and Environmental Features	Site Photograph
<p>Sewage treatment plant and solar power plant</p>	<p>Site is located within the solid waste management facility of the corporation at Vellalore, in southern outskirts of Coimbatore city. Total land area of this waste management facility is 650 acres, of which 75 acres allotted for construction of STP.</p> <p>Site is presently vacant, and covered with shrubs and bushes of local species. Site is not a low lying area, and drains towards east. Noyyal River flows in the eastern side at about 5 km from the site.</p> <p>Site is located on the outskirts of the city, new developments, mostly residential, can be observed all around the site (about 250 m distance), except in the east. A government police housing colony (RAF) is located adjacent to the site. However, given large site, existing SWM facilities, and old oxidation pond based STP are located well inside the site and adequately away from the surrounding residential areas. For the proposed STP, an area of 75 acres allocated while required is about 20-25 acres. The new STP will also be located away from the boundary wall. Given the SBR based modern STP, odor nuisance will be minimal, however, at least a 250 m buffer will be maintained. Eastern side of the site is mostly under agricultural use.</p> <p>Treated water from the STP will be disposed into Noyyal River.</p>	




Infrastructure	Location and Environmental Features	Site Photograph
		
Sewage pumping stations	<p><b>1. Main sewage pumping station at Chinna Sudukadu</b> This is the main pumping station; sewage from pump and lift stations will be collected here and conveyed to the STP.</p> <p>Site is selected within a large vacant along an internal main road; site is currently vacant, and part of it is used for solid waste collection. Site is located within a fairly well developed neighborhood with residential and commercial buildings (~50 m).</p> <p>However, the site is large and SPS will be located within the site maintaining maximum buffer with houses . Other measures – design and operation, green buffer etc., will be required to prevent any odor issues.</p>	 





Infrastructure	Location and Environmental Features	Site Photograph
		
	<p><b>2. Main pumping station at Muthunagar</b></p> <p>Site selected in a large vacant land along a village main road, in the city outskirts. Site is currently vacant, and there are no notable tree cover or vegetation. Site is mostly surrounded by vacant and agricultural lands, and houses (&gt;200 m) are located towards the city, and are located away from the site. A construction labor camp (shanty with GI sheet one-roomed accommodations) is located on the backside of the site. This is temporary. Site is not low-lying or flood prone.</p> <p>The site is large and sewage pumping stations will be located within the site maintaining maximum buffer all around.</p>	
	<p><b>3. Main sewage pumping station at Arputham nagar</b></p> <p>Site is on the outskirts, in a newly developing area. Site currently vacant, and covered with shrubs and bushes.</p> <p>Site is at the end of sparsely developed residential colony; adjoined on the other side by vacant / agricultural lands. Few houses are located close to the site (&lt;50 m). However, the site is large and sewage pumping stations will be located within the site maintaining maximum buffer with houses, separated by a green buffer. A small drain/stream passes adjoining the site. Site is not low-lying or flood prone.</p>	




Infrastructure	Location and Environmental Features	Site Photograph
	<p><b>4. Main sewage pumping station at Sathyasai Nagar</b>  Site is located in a newly developing residential area, in the outskirts of the city. This is reserved site earmarked for common facilities/infrastructure, and is currently used as playground. Site is vacant there are no notable trees or vegetation. Houses are located close on the one side (~ 10 m), and Noyyal river and vacant/agricultural lands on the other.</p> <p>There are no alternative or more feasible sites in the area. It is proposed to accommodate sewage pumping station within the site, by locating as far as away from the houses, and close to Noyyal River so that maximum buffer is maintained to nearby houses. Other measures – design and operation, green buffer etc., will be required to prevent any odor issues..</p>	
	<p><b>5. Sewage pumping stations at Nethaji Nagar (Kulathu Palayam)</b>  Site is located on the outskirts of the city with sparse development. Site is vacant and covered with shrubs and bushes. Site is not low-lying or flood prone. It is located adjoining a large vacant land (water body originally) on one side, a municipal crematorium, and a residential colony behind it separated by a compound wall (&lt;10 m). A graveyard is located adjacent to the site. There are also houses beside the graveyard.</p> <p>The house behind the site is very close (&lt;10 m), and therefore an alternative site identification exercise has been conducted . However, there is no technically feasible government owned land; although a large parcel of government land available, this is, as per the land records, under water body, and can't be used.</p> <p>In this circumstances, it is proposed to locate the pumping station away</p>	






Infrastructure	Location and Environmental Features	Site Photograph
	<p>from the house, moving it towards grave yard and the road. Sensitive site planning to build the high odor potential units such as wet well, away from the houses will be implemented. Other measures – design and operation, green buffer etc., will be required to prevent any odor issues.</p>	
		
	<p><b>6. Sewage pumping stations at Rajarajeshwari Nagar (Odai)</b>  Site is located in the outskirts with very sparse development around. Site is vacant and covered with shrubs and bushes. A small stream, dry except monsoon, flows adjoining the site (&lt; 10 m).  A private house and a small temple located next to the site. Alternative site identification exercise has been conducted, but no technically feasible government owned available in the area. In this circumstances, it is proposed to accommodate sewage pumping station within the site, by locating as far as away from the house and temple, so that maximum buffer is maintained with high odor potential units such as wet well. Other measures – design and operation, green buffer etc., will be required to prevent any odor issues.</p>	













Infrastructure	Location and Environmental Features	Site Photograph
		
	<p><b>7. sewage pumping station at Rajagopala Nagar</b>          Located in a newly developing residential area on the outskirts of the city; development is sparse. Site is selected in a large open plot reserved for common amenities; 3 sides of the site is buffered by roads with abutting houses (about 10 m), and large vacant space on the other side. Site is sparsely covered with shrubs, bushes, and a couple of trees</p> <p>It is proposed to locate the sewage pumping station within the site, maintaining maximum buffer to roads all round with high odor potential units such as wet well. It will also be separated by a green buffer. Other measures – design and operation, will be required to prevent any odor issues.</p>	
	<p><b>8. Sewage pumping station at Periyasamy street</b>          Site is located on outskirts of city limits, surrounded mostly agricultural and vacant lands. Very sparse development / rural setting can be observed on side of the site. Site is vacant and covered with thick vegetation, shrubs and bushes. Site is comparatively low lying, adjoining a small stream drain. Two old unused municipal water pump rooms (wooden structures) are on site. A municipal crematorium is located adjacent to the site. Houses are located about 50-100 m from the site.</p>	




Infrastructure	Location and Environmental Features	Site Photograph
		
	<p><b>9. sewage pumping station at Gayathiri Nagar</b>  Site is located on the city outskirts, in a newly developing area. Site is vacant, there is no tree cover or vegetation. Site is located along an internal main road, and few houses are located on the other side of the road (about 20 m). Site is surrounded by hilly areas.</p> <p>However, the site is large and sewage pumping station will be located within the site maintaining maximum buffer from the road and houses on the other side of the road.</p>	
		
	<p><b>10. sewage pumping station at Pillayapuram road</b>  Site selected in a large vacant land along Pillayapuram road. Site is currently vacant, covered with shrubs and bushes. Site is located within a fairly well developed neighborhood with residential and commercial buildings (&lt; 50 m).</p> <p>However, the site is large and sewage pumping station will be located within the site maintaining maximum buffer with houses.</p>	








Infrastructure	Location and Environmental Features	Site Photograph
	<p><b>11. sewage pumping station at Amman Nagar</b></p> <p>Site selected in a large vacant land along a main road, in the city outskirts. Site is currently vacant, and there are no notable tree cover, except small shrubs and bushes. Site is mostly surrounded by agricultural lands, and houses are located towards the city, and are located away from the site. A small drain in passing along the site. Site is not low-lying or flood prone. A stream/nallah is flowing near the site,</p> <p>The site is large and sewage pumping station will be located within the site maintaining maximum buffer all around.</p>	
Sewage lift stations	<p><b>1. SLS at Bismi Nagar, near Pillayarpuram hill</b></p> <p><b>Lift station consists of a small closed underground sump to collect the sewage, fitted with submergible pumps, and an electricity panel board above the ground. A vent pipe will be fixed to the sump to release accumulated gases.</b></p> <p>For this LS, it is proposed to convert/reconstruct, an existing septic tank at community toilet into a lift station. The sewage will be collected in the sump and pumped to nearest sewer manhole.</p> <p>This LS site (existing septic tank) is located within a low income residential area surrounded by houses (&lt;10 m).</p>	
		

Infrastructure	Location and Environmental Features	Site Photograph
	<p><b>2. SLS at Silver Jubilee Nagar</b></p> <p>Site is located near Pillayarapuram hill; away from residential areas, and surrounded by agricultural/vacant undeveloped lands. A school is located at about 50 m from the site. Houses are located at about 100 m from the site. No notable tree cover or vegetation.</p>	
	<p><b>3. SLS at Mohan Nagar</b></p> <p>Site is adjacent to a stream/nallah. Predominantly low lying area near the stream, but land is reclaimed and level is raised. Located in an undeveloped area, surrounded by vacant/agricultural lands. Houses are located at about 100 m from the site. An industry/godown is located near the site</p>	
	<p><b>4. SLS at Kurichi Housing Unit</b></p> <p>Site is located in an industrial area, and is thickly covered with shrubs and bushes. Proposed site is adjacent to an industry (&lt; 10 m).</p>	
	<p><b>5. SLS at EB Colony</b></p> <p>Located on the city outskirts, no much development around. Site is vacant, partly covered with shrubs and bushes. Houses are located at about 100 m.</p>	
	<p><b>6. SLS at MGR Nagar</b></p> <p>Site is vacant, partly covered with shrubs and bushes. Old municipal pump room is on the site and an institutional building (college) is located behind the site (about 20 m). Site is mostly surrounded by open areas; sparse development in the surroundings.</p>	

Infrastructure	Location and Environmental Features	Site Photograph
	<p><b>7. SLS at Annapuram</b></p> <p>Site is located in the outskirts of a residential colony and surrounded mostly by vacant/ undeveloped lands on one side, and newly developed residential areas on the other side. Houses are located at about 100 m. Site is covered with few shrubs and bushes; a water tank is located in the site</p>	
	<p><b>8. SLS at LIC colony</b></p> <p>Site is located next to an old building (belonging to city corporation), near a railway line (~50 m). Site is undulating terrain, covered with shrubs, in an undulating area; residential houses are located slightly away (&lt;50 m) from the site</p>	
	<p><b>9. SLS at Annai Theresa Nagar</b></p> <p>Site selected at the end of a residential colony (&lt;20 m). Site is vacant and no tree cover, and is large can be provided with adequate buffer to surrounded houses</p>	
	<p><b>10. SLS at Krishna College Road</b></p> <p>Site is located on the bank of a stream/nallah, and a residential building is located adjacent to the site (&lt; 10 m); lift station will be constructed away from the building, and close to the nallah and road.</p>	
	<p><b>11. SLS at Krishna Nagar Extension</b></p> <p>Site is identified within the road right of way. It is selected on a dead-end corner of a road, in a low-income residential area; houses are located on both sides of the road (&lt; 10 m).</p>	

Infrastructure	Location and Environmental Features	Site Photograph
		
	<p><b>12. SLS at Rainbow Colony</b>  Site is identified within the road right of way.  It is selected on a dead-end corner of a road, in a residential area; houses are located on both sides of the road (&lt; 10 m).</p>	
	<p><b>14. SLS at Indira Nagar</b>  Site is identified within the road right of way. It is selected on a dead-end corner of a road, in a residential area; houses are located on both sides of the road (&lt; 10 m); a private property (vacant land) is located at the end of the road; it was informed there is no entrance to the property from this road; it is accessible from another road from behind</p>	
	<p><b>15. SLS at Thulasi gardens</b>  Site is identified within the road right of way. It is selected on a dead-end corner of a road, in a residential area; houses are located on both sides of the road (&lt; 10 m).</p>	
	<p><b>16. SLS at Kathiravan Nagar</b>  Located in a residential colony, and site is just next to a house (&lt; 10 m), a playground. Site is earmarked for developing common facilities  Site is covered with shrubs and bushes</p>	

Infrastructure	Location and Environmental Features	Site Photograph
	<p><b>17. SLS at Krishnasamy Nagar</b>            Site is located within a residential area, and this is a site reserved for developing common infrastructure facilities. Part of the site is used for overhead tank (under construction), and remaining site is proposed for pumping station.</p> <p>Site is located in a corner with roads on 2 sides, and one side by under construction OHT. There is a house on the other side sharing the boundary. There are also houses on the other side of the roads. Site is large compared to the requirement, therefore SLS will be constructed with buffer (~10 m) to the houses.</p>	
	<p><b>18. SLS at Punga Nagar near kurichi kulam</b>            Initially a site was selected next to houses, and an alternative was site selected in the vicinity. Site selected is a reserved area in the residential colony for common usage and infrastructure. Site is large and surrounded by roads on 3 sides. Development is sparse, houses in and around the site (&lt;50 m), separated with site by roads. It is proposed to locate the lift station towards the roads, so that maximum buffer is maintained from the houses.</p>	
	<p><b>19. Sathya Nagar</b>            Site is selected in a large open land, which is currently vacant and covered with shrubs and bushes. This is situated in the outskirts of the city, with thick development on one side (houses are at &lt;50 m), and remaining sides with sparse or no development. Within this large land, lift station site located deep inside, maintaining maximum buffer with residential areas, separated by a green buffer. Approach road to the site is very narrow and through a dense residential area. Site is not low-lying or flood prone.</p>	

Infrastructure	Location and Environmental Features	Site Photograph
<p>Sewer network</p>	<p>Sewer lines will be laid in the centre of road by cutting black top, within the road right of way. In wider roads, like SH, NH, divided 2-way roads etc., sewers will be laid along the edge of the road, but mostly within the black top portion. In the outskirts where adequate land in the road shoulder is available along the blacktop and is clear of any structures or activities, pipes will be laid in this earthen shoulder. Large diameter pipes will be laid on main roads (400 – 900 mm), while the tertiary sewers of small size (150 mm to 300 mm dia) that collect wastewater from each house will be laid in all streets in the subproject area. Trench size to bury the sewer will be of 0.8 m to 1.5 m wide and 1.2 m to 8 m deep</p>	
		
		
		
<p>Outfall sewer</p>	<p>Outfall sewer of 800 m dia 5 km length will be laid from STP to disposal point of Noyyal River along the Vellalore main road. Sewer will be laid within the road shoulder / carriage way.</p>	



Infrastructure	Location and Environmental Features	Site Photograph
		

## V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

74. Potential environmental impacts of the proposed infrastructure components are presented in this section. Mitigation measures to minimize/mitigate negative impacts, if any, are recommended along with the agency responsible for implementation. Monitoring actions to be conducted during the implementation phase is also recommended to reduce the impact.

75. Screening of potential environmental impacts are categorized into four categories considering subproject phases: location impacts and design impacts (pre-construction phase), construction phase impacts and operations and maintenance phase impacts.

- (i) **Location impacts** include impacts associated with site selection and include loss of on-site biophysical array and encroachment either directly or indirectly on adjacent environments. It also includes impacts on people who will lose their livelihood or any other structures by the development of that site.
- (ii) **Design impacts** include impacts arising from Investment Program design, including technology used, scale of operation/throughput, waste production, discharge specifications, pollution sources and ancillary services.
- (iii) **Construction impacts** include impacts caused by site clearing, earthworks, machinery, vehicles and workers. Construction site impacts include erosion, dust, noise, traffic congestion and waste production.
- (iv) **O&M impacts** include impacts arising from the operation and maintenance activities of the infrastructure facility. These include routine management of operational waste streams, and occupational health and safety issues.

76. Screening of environmental impacts has been based on the impact magnitude (negligible/moderate/severe – in the order of increasing degree) and impact duration (temporary/permanent).

77. This section of the IEE reviews possible project-related impacts, in order to identify issues requiring further attention and screen out issues of no relevance. ADB SPS (2009) require that impacts and risks will be analyzed during pre-construction, construction, and operational stages in the context of the project's area of influence.

78. The ADB Rapid Environmental Assessment Checklist in [http://www.adb.org/documents/guidelines/environmental\\_assessment/eaguidelines002.aspx](http://www.adb.org/documents/guidelines/environmental_assessment/eaguidelines002.aspx) has been used to screen the project for environmental impacts and to determine the scope of the IEE.

79. In the case of this project (i) most of the individual elements involve simple construction and operation, so impacts will be mainly localized and not greatly significant; (ii) negative impacts associated with sewage facilities such as odor are already considered in the design and siting,

(iii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation and earth movements; and (iv) being mostly located in an urban area, will not cause direct impact on biodiversity values. The project will be in properties held by the local government and access to the project location is through public rights-of-way and existing roads hence, land acquisition and encroachment on private property will not occur.

#### **A. Pre-Construction Impacts – Design and Location**

80. **Design of the Proposed Components.** Technical design of the (i) sewage treatment plants; (ii) sewage pumping and lifting stations; and (iii) sewer network including manholes and house connections, follows the relevant national planning and design guidelines, focusing on providing a robust system which is easy to operate, sustainable, efficient and economically viable.

81. **Design of Sewage Treatment Plant.** A 30 MLD STP is proposed to be constructed at the identified site to treat the sewage generated from the subproject areas of Kuruchi and Kuniamuthur. Since the treatment and disposal system is proposed under DBOT contract, the STP will be designed by the DBOT contractor. The STP process will be designed to meet the stipulated disposal standards for STP.

82. One of the critical aspects in STP operation is, change in raw sewage characteristics at inlet of STP may affect the process and output quality. The system is designed for municipal wastewater, which does not include industrial effluent. Characteristics of industrial effluent widely vary depending on the type of industry, and therefore disposal of effluent into sewers may greatly vary the inlet quality at STP, and will upset process and affect the efficiency. Although legally the disposal of effluent meeting certain standards is allowed into municipal sewers the monitoring of the same is not-practical. Although there are no significant presence of industries with problematic water discharges in the subproject area of Kuruchi and Kunimuthur, following measures are suggested to safeguard sewerage system efficiency:

- (i) No industrial wastewater shall be allowed to dispose into municipal sewers
- (ii) No domestic wastewater from industrial units shall be allowed into municipal sewers
- (iii) Ensure that there is no illegal discharge through manholes or inspection chambers
- (iv) Conduct public awareness programs; in coordination with TNPCB
- (v) Conduct regular wastewater quality monitoring (at inlet and at outlet of STP) to ensure that the treated effluent quality complies with the standards

83. The site for STP selected within large land parcel reserved for city's waste management. This 650 acre land parcel currently houses a compost plant, landfill, and old facultative ponds for sewage treatment. An area of 75 acres is allocated for the proposed STP, while the land requirement is about 20-25 acres. This land is located in the southern periphery of Coimbatore city, surrounded by newly developing areas (250-500 m), rural habitations and agricultural lands. Except in the north where there are housing colonies, proposed site is surrounded by vacant and agricultural lands, and the solid waste management facility. The SBR being an aerobic process and conducted in a compacted and a closed system with automated operation, odor nuisance will be very minimal. Limited bad odors may be generated from wet well, primary treatment units and sludge treatment. Besides operating the plant as per the standard operating procedures, which will further minimize the odor potential, the following measures are also included in the site planning and design:

- (i) Site layout design of STP within allocated 75 acre land, maintaining adequate buffer to the closest housing area (Government police / RAF housing colony) in the northern boundary.
- (ii) Providing a green buffer zone of 15-20 m wide all around the STP with trees in multi-rows and land scaping. This will act as a visual screen around the facility and will improve the aesthetic appearance.
- (iii) Dewatering units shall be located in enclosed building vented to odour control unit, and health and safety precaution shall be put in place H<sub>2</sub>S build up.
- (iv) Locate sludge drying beds maintaining maximum distance from the residential area

84. **Sewage sludge** generally consists of organic matter, pathogens, metals and micro pollutants. The concentration of parameters such as metals can be influenced by input to the sewers system from industry. Since no industrial wastewater is allowed into sewers, it is unlikely that sludge contains heavy metals. The sludge from reactors will be collected in sludge sump and conveyed to centrifuge for dewatering. Dewatering units will be in enclosed building vented to odour control unit, and health and safety precaution shall be put in place H<sub>2</sub>S build up. The sludge in the form of a wet cake will be further air-dried in the sludge drying beds. The treatment and drying processes kill enteric bacteria and pathogens, and because of its high content of nitrates, phosphates and other plant nutrients the sludge is an excellent organic fertilizer for application to the land. Adequate drying is however necessary to ensure maximum kill of enteric bacteria. To achieve adequate drying minimum drying period (15 days) shall be ensured. The drying period, which will be varying depending on the season will be determined during operation and be followed. A sludge management plan will be developed by the STP facility designer. Sludge shall be periodically tested for presence of heavy metals. Proper sludge handling methods should be employed. Personal Protection Equipment should be provided to the workers.

85. Properly dried sludge can be used as soil conditioner. Periodic testing of dried sludge will be conducted to ensure that it does not contain heavy metals that make it unsuitable for food crops. Tests will be conducted to confirm the concentrations below the following standards. As there are no specific standards notified for sludge reuse, the compost quality standards notified under the Solid Waste Management Rules, 2016 have been adopted here. Rules stipulate that "In order to ensure safe application of compost, the following specifications for compost quality shall be met":

**Table 12: Standards for Sludge Reuse as Manure**

<b>Standards for Composting</b> . As there are no specific standards notified for sludge reuse, the compost quality standards notified under the Solid Waste Management Rules, 2016 (Schedule II A, Standards for Composting) have been adopted here. According to the standards "In order to ensure safe application of compost, the following specifications for compost quality shall be met, namely:-			
<b>Parameters</b>	<b>Units</b>	<b>Organic Compost (FCO 2009)</b>	<b>Phosphate Rich Organic Manure (FCO 2013)</b>
Arsenic	mg/kg	10	10
Cadmium	mg/kg	5	5
Chromium		50	50
Copper		300	300
Lead		100	100
Mercury		0.15	0.15
Nickel		50	50
Zinc		1000	1000
C/N ratio		<20	<20:1
PH		6.5 – 7.5	(1:5 solution) maximum 6.7
Moisture, percent by weight, maximum		15.0 – 25.0	25.0
Bulk density (g/cm <sup>3</sup> )		<1	Less than 1.6
Total Organic Carbon, per cent by weight, minimum		12	7.9
Total Nitrogen (as N), per cent by weight, minimum	percent by weight	0.8	0.4
Total Phosphate (as P <sub>2</sub> O <sub>5</sub> ) percent by weight, minimum	percent by weight	0.4	10.4
Total Potassium (as K <sub>2</sub> O), percent by weight, minimum	percent by weight	0.4	-
Colour			
Odour		Absence of foul Odor	
Particle size		minimum 90% material should pass through 4.0 mm is sieve	minimum 90% material should pass through 4.0 mm is sieve
Conductivity, not more Than	dsm-1	4	<b>8.2</b>

\* compost (final product) exceeding the above stated concentration limits shall not be used for food crops. however, it may be utilized for purposes other than growing food crops.

86. **Sewer system – collection and conveyance.** The sewerage system is designed as a separate system of sewage collection (i.e. caters only to wastewater). Existing surface road side drains in the project area cater to collection and conveyance of runoff during rains. The underground gravity sewers will carry sewage from households to the nearest lifting or pumping station, from where the sewage is pumped to the STP. To maximize the benefits as intended, City Corporation will ensure that all existing septic tanks are phased out by bypassing the inlet and connecting the toilet discharge from each house directly to sewerage system.

87. Accumulation of silt in sewers in areas of low over time, overflows, blockages, power outages, harmful working conditions for the workers cleaning sewers etc. are some of the issues that are taken into consideration during the sewer system design. Measures such as the following are included in sewer system design to ensure that the system provides the benefits as intended:

- (i) Limit the sewer depth where possible
- (ii) Sewers shall be laid away from water supply lines and drains (at least 1 m), if not

- possible, sewer lines shall be laid below the water lines;
- (iii) In all cases, the sewer line should be laid deeper than the water pipeline (the difference between top of the sewer and bottom of water pipeline should be at least 300 mm)
- (iv) In unavoidable cases, where sewers are to be laid close to storm water drains, appropriate pipe material(that has no or least infiltration risk) shall be selected (stoneware pipes shall be avoided)
- (v) For shallower sewers and especially in narrow roads, use small inspection chambers in lieu of manholes;
- (vi) Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize silt/garbage entry
- (vii) Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulfide generation

88. **Sewage Pumping stations and lift stations.** It is proposed to construct 16 sewage lift stations, and 13 sewage pumping stations, which will receive sewage from the catchment area via the sewer network and pump to higher level manholes or pumping stations or to STP as per the design. Lift stations are necessitated where in the design the depth of sewer exceeds the downstream interlinking manhole invert levels. Attempts to eliminate lift stations by examining the feasibility of providing rider mains are assessed to be uneconomical. Therefore, in such situations, the feasible and practical solution was to opt for a low capacity lift station with submersible pumps to lift and convey the collected sewage from peripheral areas to the downstream system through a bell-mouth chamber.

89. Lift stations will cater to small area, and will be located at lowest point where the sewage from catchment area will be collected, and then pumped to a higher level manhole for further gravity flow or to a pumping station, from where it is ultimately pumped to the STP. Lift station consists of a sewage sump or suction well of dia 1.5 m to 3 m and 1.83 m to 5.01 m deep, below the ground, to receive sewage, submersible pumps in the sump to pump out, and an electrical panel board for operation of pumps above the ground. A generator set will also be provided at each lift station of required size.

90. **Sewage pump stations** will also perform same function as sewage lift stations but cater to much larger area or sewage flow, and will also have several components, and occupy comparatively larger area. Components of sewage pumping station include:

- (i) Screen well;
- (ii) Grit well Suction well;
- (iii) DG set platform;
- (iv) Pump room.

91. At these pumping or lifting stations, the operation involves accumulation of incoming sewage in the suction well, and then pumping out as the sewage level reaches the designed pumping depth. The water level in the well rises up before the pumping cycle starts, and as the pumping is performed the water level goes down, registering its lowest depth at the end of pumping of cycle. This cycle of rising and lowering will continue throughout the day and night, however, the duration between successive pumping cycles will significantly vary depending on the sewage generation. During morning and evening peak hours, sewage will accumulate quickly, and pumping frequency will be high. The sewage retention time in the suction well therefore varies throughout the day, with very high retention periods during the nights and mid-days.

92. **Odor from pump and lift stations.** In the suction wells, the sewage emits gases, which accumulated in the air above water surface. The gas may include odorous compounds like hydrogen sulphides (H<sub>2</sub>S), amines, fatty acids, aldehydes, ketones and other volatile organic compounds (VOCs). As the water level rises before the pumping cycle, it physically displaces the air, along with the odorous gas compounds. H<sub>2</sub>S is the most dominant odor causing compound, and therefore can cause nuisance to nearby households. When sewage becomes stagnant, H<sub>2</sub>S is generated in the anaerobic conditions. The quantum of H<sub>2</sub>S generation depend on quantity of accumulated sewage and sewage retention time that create anaerobic conditions. Both increase in quantity of sewage accumulation and retention time will increase the H<sub>2</sub>S generation. Design considerations are included to minimize the both as much as possible. Pumping stations cater to large area and will have high capacity of suction wells and pump sets, while lift stations are small with lower capacity of suction wells and pumps sets. The retention time is kept to its lowest possible so that there is no stagnation of sewage for long time which could create anaerobic conditions.

93. Given that lifting stations and pumping stations are to be located at technically feasible locations (e.g., lowest point to where sewage can be conveyed from households by gravity) within or close to the residential areas which are being served by respective pumping/lifting station. Given the very limited land availability in urban areas like the project area, that too of government owned lands, locating the pumping stations ideally about 50-100 m away from the houses is not practical. In Coimbatore, sites for pumping stations were identified based on the technical suitability and availability of government owned land parcels to avoid land acquisition. Given the comparatively higher potential of odor generation, priority has been given to accommodate pumping stations at more suitable locations away from houses and mostly in sparsely populated areas. Sites which are located close have been selected only in cases where there are no other alternative lands available.

94. Following design related measures are included in the sewage pumping and lifting station design. As presented in the baseline profile, few lifting stations are located along the roads within the road right of way. In such cases there is no buffer space between the houses and the lifting station, and also no layout planning related measures as given below including creating buffer area around the facility may not be feasible. Odor potential of lifting stations is very minimal given small scale operation, however, given close location to houses, design related measures as given below are included.

#### **Layout planning related measures**

- (i) Siting of wells within the identified site at an internal location as far as possible from adjoining residential buildings;
- (ii) Develop green buffer zone around the facilities with a combination of tall and densely growing trees in multi rows as per the land availability to control odor and also act as visual shield, and improve aesthetical appearance;
- (iii) Provision of high compound wall.

#### **Design related measures to prevent and control odor from pumping/lifting station operations**

- (i) Proposed wells to be closed using RCC slabs. Design of RCC slab to consider both superimposed loads (human and equipment loads) and severe corrosion risk from sewer gas from within wells.
- (ii) RCC Slab to be designed and fixed in a modular manner such that access to

- pumps / appurtenances and other equipment can be provided for maintenance/replacement/renewal purposes;
- (iii) Since human intervention is involved and safety shall be primary and critical consideration, additional protection by way of a metallised grating / grill work shall be provided over the sections (or full cross section if required) where workers will stand / work for inspection and repair/O&M purposes;
  - (iv) Provision of passive gas ventilation arrangement by providing a take-off vent from top of well by positioning vent in such a way that cover slab fitment/movement/drawl if required for maintenance purposes is not compromised.
  - (v) Height of vent to be provided appropriately and a minimum 2 m above the lintel level (top level) of window(s)/passageways/doors in the nearby adjoining buildings.
  - (vi) Provision of odor control / mitigation system as per site conditions / requirements. Suitable granular activated carbon filter with bird-screen fitted at the vent outlet to control odor. Size of GAC (including material size) should be selected based on the vent diameter and expelled air flow rate expected;
  - (vii) Submersible sewage pumps of suitable rating, minimum submergence requirements, open impeller with cutting-tearing arrangement and high strength-corrosion resistant heavy duty construction shall be proposed;
  - (viii) In locations / cases where sewage flow in the present to intermediate design stage is envisaged to be low, position of the submersible pumps and design of the collection well floor by providing necessary side benching / sloped flooring to allow for higher submergence during low flow shall be made to ensure regular pump operation and avoid sewage stagnation beyond the permissible limit;
  - (ix) Diesel Generators shall be provided for all pump stations and in cases of lift stations with space for control room. In cases of lift manholes (road-side or road-center type structures with only provision of kerb-side kiosk), an electrical cut-out provision shall be made for connecting an Emergency Mobile / Skid Mounted Diesel Generator for pumping out during long period of electricity supply interruption;
  - (x) Develop standard operating procedures/operational manual for operation and maintenance of lifting and pump stations; this shall include measures for emerge situations;
  - (xi) Provide training to the staff in SOPs and emergency procedures;
  - (xii) Periodic monitoring of H<sub>2</sub>S levels at sewage pumping and lifting stations using handheld H<sub>2</sub>S meters.<sup>1</sup>

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<sup>1</sup> There are no any standards notified by Government of India or Government of Tamil Nadu. However, Central Pollution Control Board (CPCB) has stipulated Guidelines on Odor Pollution and its Control. These guidelines deal only with the basics of odor pollution, its sources and measurement, technologies for its control etc. but do not specify any threshold limits for odor-causing pollutants. Therefore, as part of mitigation, provision for odor control measures has been made in the sewage pumping stations for all UGSS subprojects. However, in case of STPs, the odor-causing processing units will be located far off to the extent possible within the premises so as to mitigate the odor nuisance. Further, the technology for treating sewage plays a vital role since release of gases like H<sub>2</sub>S cannot be avoided in the process involving anaerobic decomposition whereas release of H<sub>2</sub>S will almost be nil in case of aerobic treatment. PIU and design engineers have not specified any odor standards adopted elsewhere in the preliminary design as not to limit the technology that can be considered by the bidders in the treatment of domestic sewage. Sufficient mitigation measures have been taken for all sewage pumping stations and will be taken for all STPs when finalizing/revising the IEEs based on the detailed engineering design.

95. **Provision of odor treatment system.** Besides the above measures, following odor control and mitigation measures are considered at all sewage pumping and lifting stations, for facilities located very close to the houses/properties.

- (i) Provide closed wells fitted with necessary ventilation wherever required;
- (ii) Provide greenbelt (tree cover) around the lift stations, wherever possible;
- (iii) a suitable arrangement such to capture the gaseous emissions from the wells and treat via scrubber/activated carbon filter before letting out into the ambient air; such system should be designed appropriately to meet the likely emissions/flow rate of respective pumping / lifting stations. This system shall be provided for all pumping/lifting stations located close (<50 m) to houses

96. **Noise from pumping operations.** Operation of pumps and motors and diesel generators is a major source of noise. As the pumping and lifting stations are located in the residential areas, with few located very close to the houses, noise generated from lifting/pump stations can have continuous negative impacts on the surrounding population. Although STP is located outside the city, noise control measures are necessary. High inside noise levels can affect the health of operators and staff at the facilities, and therefore, noise levels needs to be maintained within and outside the plant at acceptable levels. .

- (i) Procure good quality latest technology high pressure pumps that guarantee controlled noise at a level of around 80dB(A) at a distance of 1 m<sup>2</sup>
- (ii) Use appropriate building materials and construction techniques for pump houses which can absorb sound rather than reflect noise
- (iii) Use acoustic enclosures – manufacturer specified, for all pumps, motors
- (iv) Procure only CPCB approved generators to meet air emission and noise level requirements
- (v) Provide sound mufflers for ventilators in the plant rooms; and sound proof doors
- (vi) Provide ear plugs designated for noise reduction to workers

97. **Energy Efficiency.** Project area is mostly plain and gently sloping ground, it is therefore not technically feasible or economical to design a completely gravity system to collect sewage from individual houses and transfer the same the STP on the outskirts of the city. It necessitated provision of lifting and pumping stations, which are optimized to the extent possible to minimize the overall pumping. In the current design, sewage will be collected from the houses via sewer network and conveyed by gravity to the lifting or pumping station. In several places, lifting stations are designed just to lift the sewage to higher level and deliver it to a nearby sewer manhole on the higher elevation, from there it can flow by again by gravity, rather than pumping directly to a pumping station. This optimized the energy consumption.

98. To optimize the power consumption, the hydraulic design shall follow optimal approach, and the following also considered in design and selection of pumping systems. According to Manual for the Development of Municipal Energy Efficiency Projects in India (jointly developed by Bureau of Energy Efficiency (BEE) and International Finance Corporation in 2008), energy savings, at minimum, of 25% to 40% is possible with appropriate measures. The following measures shall be considered and incorporated into the subproject designs:

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<sup>2</sup> Indian Standards require to maintain the noise level of 70 dBA or less during night time. However, in case of STPs/WTPs/Water Supply Head works, where heavy duty pump sets are to be installed and the noise levels may even exceed 80 decibels at 1 m distance, noise level will be measured at the time of commissioning the units and necessary mitigation measures such as noise barriers will be installed if required.



- (i) Using low-noise and energy efficient pumping systems
- (ii) Efficient Pumping system operation
- (iii) Installation of Variable Frequency Drives (VFDs)

99. **Solar power plant.** To reduce the power consumption from grid (which is mainly of thermal power), and to promote green power, it is proposed to erect a 2 megawatt photovoltaic (PV) solar power plant at the STP site. As stated previously, sufficient land is available to set up the solar power plant within selected STP site. The power generated will be used for operation of STP. As the land is already available, which is mostly barren and unused, no negative impacts envisaged due to erection and operation of solar PV plant.

100. **Tree cutting at selected project sites.** As presented in the baseline profile of subproject sites, there are no notable tree cover in the project sites. STP site has few small trees of local species, similarly some pumping station sites. Sewers are proposed within the roads, and therefore no tree cutting envisaged. Following measures need to be implemented to minimize and/or compensate for the loss of tree cover.

- (i) Minimize removal of trees by adopting to site condition and with appropriate layout design of STP and pumping stations
- (ii) Obtain prior permission for tree cutting
- (iii) Plant and maintain 10 trees for each tree that is removed

101. **Utilities.** Telephone lines, electric poles and wires, water lines, drains, if exists within the proposed project locations may require to be shifted. All the selected project sites are vacant and unused government lands, there are no notable existing utilities. Sewer lines are proposed within the road way, where there are no utilities. In the outer areas where there is adequate earthen shoulder along the road carriage way, sewer lines can be accommodated in the shoulder. In such cases, the work may require shifting of utilities on the shoulder. To mitigate the adverse impacts due to relocation of the utilities, the contractor, in collaboration with the City Corporation will

- (i) identify the locations and operators of these utilities to prevent unnecessary disruption of services during construction phase; and
- (ii) instruct construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services

102. **Site selection of construction work camps, stockpile areas, storage areas, and disposal areas.** Priority is to locate these near the project location. but at least 100m away from residential areas, groundwater wells and surface water bodies. However, if it is deemed necessary to locate elsewhere, sites to be considered will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems. Residential areas will not be considered for setting up construction camps to protect the human environment (i.e., to curb accident risks, health risks due to air and water pollution and dust, and noise, and to prevent social conflicts, shortages of amenities, and crime). Extreme care will be taken to avoid disposals near forest areas, water bodies, or in areas.

103. **Site selection of sources of materials.** Significant quantities of coarse aggregate and fine aggregate will be required for construction works. Contractor should procure these materials only from the quarries permitted/licensed by Department of Geology and Mining. Contractor should procure material from existing quarries. No new quarry areas should be created/ established for the subproject.

104. **Social and Cultural Resources – Chance Finds.** Any work involving ground disturbance can uncover and damage archaeological and historical remains. For this project, excavation will

occur in project sites for foundations, laying pipelines, and for construction of underground structures at pumping/lifting stations and at STP. There are no archeologically or historically recognized sites or places close to project sites or within the project area. Therefore it is not likely that the project sites contains any archaeological or historical remains, and risk of uncovering them is very low. Nevertheless, City Corporation will follow chance find protocol to ensure that any chance finds are recognised and measures are taken to ensure they are protected and conserved:

- (i) Construction contractors to follow these measures in conducting any excavation work
- (ii) Create awareness among the workers, supervisors and engineers about the chance finds during excavation work
- (iii) Stop work immediately to allow further investigation if any finds are suspected;
- (iv) Inform State Archaeological Department if a find is suspected, and taking any action they require to ensure its removal or protection in situ.

## **B. Construction Impacts**

105. Main civil works in the subproject include construction of sewage treatment plant, sewage pumping and lifting stations at the identified sites. These works will be confined to sites, and construction will include general activities like site clearance, excavation for foundations, and creation of concrete structures will be one of the major construction activities for this project, as many of the subproject components will be fixed to concrete plinths and most will be housed in buildings with at least some concrete structural elements. Most such structures will be constructed from reinforced concrete, where steel reinforcing rods and bars are placed and attached by hand to create an interior skeleton for the foundations, walls, columns, plinths, etc, and heavy-duty metal and timber/plywood formwork is bolted around the outside to build a mould into which pre-mixed concrete is poured. Once the concrete has set, the formwork is removed, and the concrete surface is finished by masons by hand if necessary. Some buildings, such as the pump station, facilities, etc., may be constructed from brick work, in which case this work will be done using standard house-building techniques.

106. Technical components of the STP comprise a variety of pre-fabricated elements, which are installed on site as ready-made individual units. These will be directly brought from the manufacturers place to the sites lifted into position by crane, affixed to plinths or other installation points, and connected up to pipework and the electricity supply.

107. Since these works are confined to the boundary of identified sites, there is no direct or significant interference of construction work with the surrounding land use. However, construction dust, noise, use of local roads for transportation of construction material, waste, labour camps etc., will have negative impacts, which needs to be avoided or mitigated properly.

108. Subproject also include linear works (laying of 480 km sewers along the roads). This covers almost entire project area of Kuruchi and Kuniyamuthur, and sewers will be laid along almost all the roads. Small sewers (tertiary sewers) that collect sewage from households will be laid in all streets and roads, the larger sewers that collect sewage from tertiary sewers and convey to pumping stations and STP will be laid mostly on wider main roads. Sewers will be laid by open cut method.

109. Open cut trenching method of sewer laying involves trench excavation in the road, placing sewers in the trench, jointing and testing, and refilling with the excavated soil. Proposed pipes for tertiary sewers are double wall corrugated (DWC) pipes and conveying mains (pumping mains)

are of cast iron. The diameter of sewer ranges from 150 mm to 900 mm, of which nearly 93% of the sewers are of size between 150 mm and 250 mm. According to the design the sewers will be laid at a depth of 1 to 10 m. The width of the trench excavation along the roads will vary from 0.8 m to 1.4 m, and the depth varies from a minimum of 1 m to 10 m. Nearly 90% length of sewers will be laid in trench of depth 3 m or less, and there are very few sewers that will be laid in a trench of more than 6 m deep (0.4% sewers only). The design is optimized to minimize the sewer depth to the extent possible with an optimal combination of sewer depth and pumping requirements. Details of sewer construction are provided in the following Table.

**Table 13: Sewer Construction**

Dia of Sewer	Sewer Material	Total Length of Sewers to be Laid (m)	Percentage of Length (%) (diameter- wise)	Width of Trench (m)	Depth of Trench and Percentage of Sewer Length (%)	
					Depth (m)	Percentage (%)
150	DWC	17,844	3.7%	0.8	0-2m	83.3%
200	DWC	388,598	80.9%	0.8	2-2.5m	10.2%
					2.5-3m	6.4%
250	DWC	5,008	1.0%	0.8	0-2m	65.7%
					2-2.5m	22.6%
					2.5-3m	11.8%
300	DWC	4,175	0.9%	0.9	0-2m	85.0%
					2-2.5m	8.2%
					2.5-3m	6.8%
200	CI	35,160	7.3%	0.8	3-3.5 m	41.8%
					3.5-4 m	26.3%
					4-6m	30.3%
					6-8m	1.6%
250	CI	3,168	0.7%	0.8	2.5-3m	3.4%
					3-3.5 m	15.8%
					3.5-4 m	17.3%
					4-6m	48.3%
					6-8m	13.4%
					8-10m	1.8%
300	CI	2,293	0.5%	0.9	3-3.5 m	4.0%
					3.5-4 m	11.1%
					4-6m	66.6%
					6-8m	18.3%
350	CI	6021	1.3%	0.9	0-2m	37.5%
					2-2.5m	18.8%
					2.5-3m	11.2%
					3-3.5 m	4.0%
					3.5-4 m	5.9%
					4-6m	22.1%
					6-8m	0.5%
400	CI	3572	0.7%	0.9	0-2m	35.0%
					2-2.5m	6.9%
					2.5-3m	3.6%
					3-3.5 m	16.4%
					3.5-4 m	5.3%
					4-6m	29.1%
					6-8m	3.7%
450	CI	3106	0.6%	0.9	0-2m	31.1%
					2-2.5m	6.5%
					2.5-3m	16.2%
					3-3.5 m	17.1%
					3.5-4 m	8.9%
					4-6m	20.3%
500	CI	2994	0.6%	1.0	0-2m	48.9%
					2-2.5m	7.9%
					2.5-3m	2.5%
					3-3.5 m	4.3%
					3.5-4 m	4.3%
					4-6m	32.1%
600	CI	681	0.1%	1.1	0-2m	25.3%
					2-2.5m	8.5%
					2.5-3m	0.0%
					3-3.5 m	0.0%
					3.5-4 m	0.0%
					4-6m	41.9%
					6-8m	24.4%
700	CI	1396	0.3%	1.2	0-2m	8.2%
					2-2.5m	14.5%
					2.5-3m	16.9%
					3-3.5 m	35.8%
					3.5-4 m	18.4%
					4-6m	6.2%

Dia of Sewer	Sewer Material	Total Length of Sewers to be Laid (m)	Percentage of Length (%) (diameter-wise)	Width of Trench (m)	Depth of Trench and Percentage of Sewer Length (%)	
					Depth (m)	Percentage (%)
800	CI	2634	0.5%	1.25	0-2m	2.2%
					2-2.5m	9.8%
					2.5-3m	7.6%
					3-3.5 m	8.2%
					3.5-4 m	30.7%
					4-6m	39.5%
					6-8m	2.0%
900	CI	3461	0.7%	1.4	0-2m	1.8%
					2-2.5m	23.1%
					2.5-3m	9.1%
					3-3.5 m	18.9%
					3.5-4 m	32.5%
					4-6m	14.7%
		<b>480,111</b>	<b>100%</b>	<b>0.8 to 1.4</b>	0-2m	73.3%
					2-2.5m	9.6%
					2.5-3m	6.1%
					3-3.5 m	3.8%
					3.5-4 m	2.7%
					4-6m	4.1%
					6-8m	0.4%
					8-10m	0.01%

110. Earth work excavation will be undertaken by machine (backhoe excavator) and include danger lighting and using sight rails and barricades. The work will also be supplemented manually where there is no proper working area (e.g., very narrow streets) for the backhoe excavators. As trenches are deep (up to 6-10 m), there is risk of collapse of trenches and/or damage to surrounding buildings, safety risk to pedestrians and traffic. Necessary precautions such as bracing / shoring in the trench will be provided for trenches of more than 1.2 m deep. The normal working hours will be 8 hours daily, the total duration of each stage depends on the soil condition and other local features. Excavated soil will be used for refilling the trench after placing the sewer and therefore residual soil after pipe laying and refilling is not significant. Total earthwork excavation will be over 750,000 m<sup>3</sup>, of which nearly 95% will be reused, and the remaining 37,500 m<sup>3</sup> of excess soil needs to be disposed safely.

111. Although sewer laying work involves quite simple techniques of civil work, the invasive nature of excavation in the urban area where there are a variety of human activities, will result in impacts to the environment and sensitive receptors such as residents, businesses, and the community in general. These anticipated impacts are temporary and for short duration, however, needs to be mitigated.

112. Located about 6-7 km from the city center of Coimbatore City, subproject area comprise outer areas of the corporation added to corporation limit in 2011 and forms the southern boundary of the City Corporation.. The subproject area is predominantly a mix of urban and suburban areas. Agricultural activities can still be observed in the subproject area. It is mainly a mix of old habitations with narrow streets, and well planned newly developed / developing residential layouts in the lands previously under agricultural use. Old and new developments are intercepted with agricultural and vacant lands.

113. Sewers will extend to all residential and developed areas, while large diameter sewers will be laid mostly along the main roads. These main roads include a national highway (NH149, Dindugal-Bangalore Highway), 2 state highways (Salem-Cochin Road (SH-1), Ramanathapuram - Chettyalayam Road (SH2), 2 MDRs (Major district roads) and ODRs (other district roads). The

next level roads are internal main roads providing connectivity within the city. These include: Sharada mill road, Podanur main road, Gandhiji road, KHU phase main roads, MGR Nagar main road, Edayarpalayam main road, Gnanapuram Road, Amman Kovil Road, Ayyaswamy Naiker street etc., Main road carry considerable flow of traffic and are centres of commercial activities. Following areas in the subproject has comparatively narrow roads and high density population: Rajaji nagar, Edayarpalayam, Sundarapuram, Anna nagar, Uthami nagar, Sathyanagar, Pillayarapuram, Mohan nagar, Krishna Nagar, etc.

114. Anticipated impacts during the construction phase are discussed below along with appropriate mitigation measures to avoid, minimize or mitigate those impacts to acceptable levels.

115. **Sources of Materials.** Significant amount of sand and coarse aggregate will be required for this project, which will be sourced from quarries. Quarries inevitably cause extensive physical changes; as construction materials are excavated from the ground, leaving large cavities, or levelling hillsides, etc. The physical damage caused by quarries is controlled by allowing them to operate within specific limited areas only, so the damage is restricted in extent and not allowed to spread indiscriminately. New quarries are subject to a rigorous process of environmental assessment to ensure appropriate siting and adequate environmental controls on the operation. It will therefore be important to ensure that construction materials for this project are obtained from existing government approved licensed quarries only, to ensure these controls are in place. In Coimbatore, construction sand is normally obtained from Karur (about 130 km), and gravel and aggregate is available locally in Coimbatore district, which is known for stone quarries. Contractor should not create / use any new borrow pits / quarries. The contractor should also make a concerted effort to re-use as much excavated material from this project as possible. The construction contractor will be required to:

- (i) Obtain construction materials only from government approved quarries with prior approval of PIU
- (ii) PIU to review, and ensure that proposed quarry sources have all necessary clearances/ permissions in place prior to approval
- (iii) Contractor to submit to PIU on a monthly basis documentation on material obtained from each sources (quarry/ borrow pit)
- (iv) Avoid creation of new borrow areas, quarries etc., for the project; if unavoidable, contractor to obtain all clearances and permissions as required under law, including Environmental Clearance prior to approval by PIU

116. **Air Quality.** Construction work, especially from earthwork activities, coupled with dry and windy working conditions, material and debris transport, and works along the public roads carrying significant traffic, have high potential to generate dust. Significant quantities of earthwork will be conducted in the subproject, spread all over the project area. Over 750,000 m<sup>3</sup> of earthwork is anticipated from the subproject, and 95% of which will be reused for filling the trenches. Also emissions from construction vehicles, equipment, and machinery used for excavation and construction will induce impacts on the air quality. Anticipated impacts include dust and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons. Dust generation from construction work in individual and confined work sites like STP, pumping stations etc., will be mainly during the initial construction phase of earth work, as the site is confined, dust can be effectively controlled with common measures. STP is located outside the city, away from habitation area. Dust generation will be significant during sewer laying along the roads. Increase in dust/ particulate matter in ambient air is detrimental, and may have adverse impacts on people and environment. To mitigate the impacts, construction contractors will be required to:

### For all construction works

- (i) Provide a dust screen (6 m high) around the construction sites of pumping and lifting stations and STP; provide 2 m high barricades for the sewer works
- (ii) Damp down the soil and any stockpiled material on site by water sprinkling; (3-4 times a day - before the start of work, 1-2 times in between, and at the end of the day); when working in the roads there should permanently be one person responsible for directing when water sprinkling needs to take place to stop the dust moving;
- (iii) Reduce the need to sprinkle water by stabilizing surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition;
- (iv) Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process;
- (v) Cover the soil stocked at the sites with tarpaulins and surround by dust screens.
- (vi) Control access to work area, prevent unnecessary movement of vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation;
- (vii) Use tarpaulins to cover the loose material (soil, sand, aggregate etc.) when transported by open trucks;
- (viii) Control dust generation while unloading the loose material (particularly aggregate, sand, soil) at the site by sprinkling water and unloading inside the barricaded area; minimize the drop height when moving the excavated soil
- (ix) Clean wheels and undercarriage of haul trucks prior to leaving construction site
- (x) Ensure that all the construction equipment, machinery are fitted with pollution control devices, which are operating correctly, and have a valid pollution under control (PUC) certificate.
- (xi) no vehicles or plant to be left idling at site generators to be at placed maximum distance from properties

### For sewer works

- (i) Barricade the construction area using hard barricades (of 2 m height) on both sides
- (ii) Initiate site clearance and excavation work only after barricading of the site is done
- (iii) Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes etc.), to the barricaded area;
- (iv) Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area;
- (v) Undertake the work section wise: a 500 section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones;
- (vi) Conduct work sequentially - excavation, sewer laying, backfilling; testing section-wise (for a minimum length as possible) so that backfilling, stabilization of soil can be done;
- (vii) Remove the excavated soil of first section to the disposal site; as the work progresses sequentially, by the time second section is excavated, the first section will be ready for back filling, use the freshly excavated soil for back filling, this will avoid stocking of material, and minimize the dust;
- (viii) Backfilled trench at any completed section after removal of barricading will be the main source of dust pollution. The traffic, pedestrian movement and wind will

generate dust from backfilled section. Road restoration shall be undertaken immediately.

117. **Immediate road restoration after refilling the trench.** Excavation and refilling activities disturb the top soil, and under the influence of wind, traffic, pedestrians, and other activities etc., produces dust. There is large potential to generate significant quantities of dust after refilling the trench, and prior to road relaying. It is a common practice not to restore the road immediately after refilling the trench so as to allow sufficient time for the refilled material to stabilize naturally. Given the dry and windy conditions, and heavy traffic and other activities along the roads, the refilled trenches with loose top soil along the roads will generate maximum dust, and create very unhealthy conditions. Moreover, as the barricades/dust screens will be removed after the trench is refilled, there will be absolutely nothing to control the dust generation. Dust control activities like wetting of top soil will not be effective given the site conditions. It is therefore necessary to restore/relay the road surface immediately or take suitable steps to arrest the dust. Soil consolidation technique shall be used so that road can be restored immediately.

- (i) Immediately consolidate the backfilled soil and restore the road surface; if immediate road restoration is not possible, provide a layer of plain cement concrete (PCC) of suitable mix on the backfilled trench so that dust generation, erosion is arrested and it will also provide a smooth riding surface for the traffic until the road is properly restored. Backfilled trench without any road restoration is a major source of dust.

118. **Surface Water Quality.** Run-off from stockpiled materials and chemicals from fuels and lubricants during construction works can contaminate water quality of the receiving water bodies and streams/rivers. Project area receives rainfall in southwest and northeast monsoon seasons, between June/July to November/December. Kuruchi Kulam, a big lake, is located within the project area, and Noyyal River flows in the northern boundary. Sengulum, another water body, is situated just outside the subproject area in southwestern side. Noyyal River flows only during monsoon, rest of the time it carries mostly wastewater from the surrounding areas. Besides, there are two other small water bodies in and around the project area. Project area mostly drains into Noyyal river. It is important that runoff from the construction areas, which may contain silt and chemical traces do not enter these water bodies. Impact will be temporary, and but needs to be mitigated. Construction contractor will be required to:

- (i) All earthworks be conducted during the dry season to prevent the problem of soil/silt run-off during rains
- (ii) 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 (at least 100 m)
- (iii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, only designated disposal areas shall be used;
- (iv) Install temporary silt traps, oil traps, or sedimentation basins along the drainage leading to the water bodies;
- (v) Place storage areas (with impermeable surface) 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;
- (vi) Store fuel, construction chemicals etc., on an impervious floor, also avoid spillage by careful handling; provide spill collection sets for effective spill management
- (vii) Dispose any wastes generated by construction activities in designated sites; and
- (viii) Conduct surface quality inspection according to the Environmental Management Plan (EMP).



119. **Surface and Groundwater Quality.** Another physical impact that is often associated with excavation is the effect on drainage and the local water table if groundwater and surface water collect in the voids. In the project area, groundwater table is much deeper than the anticipated excavation depth and therefore this impact is not envisaged. However during the rains, water will be collected in open pits and trenches. The water collected in excavated pits will contain silt and disposal of this in drainage channels lead to silting. To avoid this the contractor needs to be implement the following measures:

- (i) As far as possible control the entry of runoff from upper areas into the excavated pits, and work area by creation of temporary drains or bunds around the periphery of work area;
- (ii) Pump out the water collected in the pits/excavations to a temporary sedimentation pond; dispose off only clarified water into drainage channels/streams after sedimentation in the temporary ponds;
- (iii) Consider safety aspects related to pit collapse due to accumulation of water.

120. **Generation of Construction Wastes.** Solid wastes generated from the construction activities are excess excavated earth (spoils), discarded construction materials, cement bags, wood, steel, oils, fuels and other similar items. Domestic solid wastes may also be generated from the workers' camp. Improper waste management could cause odor and vermin problems, pollution and flow obstruction of nearby watercourses and could negatively impact the landscape. Total earthwork excavation will be over 750,000 m<sup>3</sup>, of which nearly 95% will be reused, and the remaining 37,500 m<sup>3</sup> of excess soil needs to be disposed safely. The following mitigation measures to minimize impacts from waste generation shall be implemented by the contractor:

- (i) Prepare and implement a Construction Waste (Spoils) Management Plan (format is given in Appendix 3);
- (ii) As far as possible utilize the debris and excess soil in construction purpose, for example for raising the ground level or construction of access roads etc.;
- (iii) Avoid stockpiling any excess spoils at the site for long time. Excess excavated soils should be disposed off to approved designated areas immediately;
- (iv) If disposal is required, the site shall be selected preferably from barren, infertile lands; sites should located away from residential areas, forests, water bodies and any other sensitive land uses;
- (v) Domestic solid wastes should be properly segregated in biodegradable and non-biodegradable for collection and disposal to designated solid waste disposal site; create a compost pit (with impermeable bottom and sides) at workers camp sites for disposal of biodegradable waste; non-biodegradable / recyclable material shall be collected separately and sold in the local recycling material market;
- (vi) Residual and hazardous wastes such as oils, fuels, and lubricants shall be disposed off via licensed (by TNPCB) third parties;
- (vii) Prohibit burning of construction and/or domestic waste;
- (viii) Ensure that wastes are not haphazardly thrown in and around the project site; provide proper collection bins, and create awareness to use the dust bins; recycle waste material where possible
- (ix) Conduct site clearance and restoration to original condition after the completion of construction work; PIU to ensure that site is properly restored prior to issuing of construction completion certificate.

121. **Noise and Vibration Levels.** While pumping and lifting station sites are located predominantly urban and suburban areas, STP is located outside the city. Sewer lines are spread over entire project area. Except STP, all these sites are located close to habitation areas, where there are houses, schools and hospitals, religious places and businesses. The sensitive receptors are the general population in these areas. Increase in noise level may be caused by excavation, particularly breaking of cement concrete or bitumen roads for laying of sewers, operation of construction equipment, and the transportation of equipment, materials, and people. Vibration generated from construction activity, for instance from the use of pneumatic drills, will have impact on nearby buildings. This impact is negative short-term, and reversible by mitigation measures. The construction contractor will be required to:

- (i) Plan activities in consultation with PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance, especially near schools and other sensitive receptors
- (ii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and use portable street barriers to minimise sound impact to surrounding sensitive receptor; and
- (iii) Maintain maximum sound levels not exceeding 70 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s.
- (iv) Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity; if any building at risk, structural survey be completed prior to work, to provide baseline in case any issues from vibration, and if building is structurally unsound that measures taken to avoid any further damage. Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach;
- (v) Consult local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals.

122. **Accessibility and Traffic Disruptions.** Excavation along the roads for laying of sewers, hauling of construction materials and operation of equipment on-site will cause traffic problems. There are four types of roads/highways in the project area that provide regional connectivity: national highway (NH), state highway (SH), major district roads (MDR) and other district roads (ODR). Sewers are proposed along:

- (i) NH149 (Dindugal-Bangalore Highway);
- (ii) SH1 (Salem-Cochin Road);
- (iii) SH2 (Ramanathapuram - Chettyalayam Road);
- (iv) Kovai Pudur Road (MDR5);
- (v) Pothanur Junction Road (MDR8);
- (vi) Kuruchi-Nachipalayam Road (ODR1);
- (vii) Pothanur-Singanallur Road (ODR4, Vellalore Road);
- (viii) Kaikolampalayam road (ODR7);
- (ix) Pothanur Chettyalayam-Echanari Salai (ODR10);
- (x) Kovai Pudur Salai (ODR18);
- (xi) Pothanur Chettyalayam-Seenivasanagar Salai (ODR26);
- (xii) Salem Cochin Road-Sundarapuram (ODR-27); and
- (xiii) Kuruchi-Pothanur Road (ODR34).

123. National highway and state highways carry considerable traffic, followed by MDRs and ODRs. Sewers will also be laid along the internal main roads that provide connectivity within the

city. These include: Sharada mill road, Podanur main road, Gandhiji road, KHU phase main roads, MGR Nagar main road, Edayarpalayam main road, Gnanapuram Road, Amman Kovil Road, Ayyaswamy Naiker street etc., These roads also carry considerable flow of traffic and are centres of commercial activities.

124. Internal roads in the project area are narrow, except in the newly developing residential layout which comparatively have wide roads. The areas with narrow roads include: Rajaji nagar, Edayarpalayam, Sundarapuram, Anna nagar, Uthami nagar, Sathanagar, Pillayarapuram, Mohan nagar, Krishna Nagar etc., Newly developed residential colonies like Krishnasamy nagar, Punga nagar, Rajgopala nagar, satya nagar etc., have wide internal roads, and less traffic.

125. As the sewer lines are proposed to be laid within the road carriage way, it will disrupt the traffic in one-traffic lane. In the narrower roads, sewers will be laid in the center of the road, and therefore during the work traffic movement will be mostly disrupted.

126. Works related to all the remaining components (lifting/pumping stations and STP) will be confined to the selected sites, therefore there is no direct interference of these works with the traffic and accessibility.

127. Hauling of construction material, equipment, construction waste, etc., to and from the work site may increase the road traffic on local roads. This will further inconvenience the local community and road users. Potential impact is negative but short term and reversible by mitigation measures. The construction contractor will be required to:

#### **Sewer works**

- (i) Prepare a sewer work implementation plan in each zone separately and undertake the work accordingly; ensure that for each road where the work is being undertaken there is an alternative road for the traffic diversion; take up the work in sequential way so that public inconvenience is minimal;
- (ii) Plan the sewer work in coordination with the traffic police; provide temporary diversions, where necessary with clear signage and effectively communicate with general public
- (iii) Avoiding conducting work in all roads in a colony at one go; it will render all roads unusable due to excavations at the same time, creating large scale inconvenience
- (iv) Undertake the work section wise: a 500 section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones
- (v) Confine work areas in the road carriageway to the minimum possible extent; all the activities, including material and waste/surplus soil stocking should be confined to this area. Proper barricading should be provided; avoid material/surplus soil stocking in congested areas – immediately removed from site/ or brought to the as and when required;
- (vi) Limit the width of trench excavation as much as possible by adopting best construction practices; adopt vertical cutting approach with proper shoring and bracing; this is especially to be practiced in narrow roads and deeper sewers; if they deep trenches are excavated with slopes, the roads may render completely unusable during the construction period
- (vii) Leave spaces for access between mounds of soil to maintain access to the houses/properties; access to any house or property shall not be blocked completely; alternative arrangements, at least to maintain pedestrian access at all times to be provided;

- (viii) Provide pedestrian access in all the locations; provide wooden/metal planks with safety rails over the open trenches at each house to maintain the access;
- (ix) Inform the affected local population in advance about the work schedule, a week before, and a day before start of work
- (x) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum;
- (xi) Keep the site free from all unnecessary obstructions;
- (xii) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints. Provide information to the public through media – newspapers and local cable television (TV) services;
- (xiii) At work site, public information/caution boards shall be provided including contact for public complaints.

**Hauling (material, waste/debris and equipment) activities:**

- (i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites;
- (ii) Schedule transport and hauling activities during non-peak hours (peak hours 7 to 10 AM and 4 to 7 PM);
- (iii) Locate entry and exit points in areas where there is low potential for traffic congestion;
- (iv) Drive vehicles in a considerate manner;
- (v) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.

128. **Socio-Economic – Income.** Sites for all projects components are carefully selected in government owned vacant lands and therefore there is no requirement for land acquisition or any resettlement. Blocking of access to the business / livelihood activities, especially during pipeline laying along the roads, may impact the income of households. However, given the alignment of pipeline within the road carriage way, and also the measures suggested for ensuring accessibility during sewer works, notable but temporary impact is envisaged. Some shops and other premises along the roads may lose business income if the access will be impeded by excavation of trenches, the presence of heavy vehicles and machinery, etc. Access disruption to hospitals, socio cultural places etc., will inconvenience public. Implementation of the following best construction measures will avoid the disturbance reduce the inconvenience and disturbance to the public. Resettlement and social issues are being studied in a parallel resettlement planning study of this subproject.

- (i) Inform all businesses and residents about the nature and duration of any work well in advance so that they can make necessary preparations;
- (ii) Do not block any access; leave spaces for access between barricades/mounds of excavated soil and other stored materials and machinery, and providing footbridges so that people can crossover open trenches;
- (iii) Barricade the construction area and regulate movement of people and vehicles in the vicinity, and maintain the surroundings safely with proper direction boards, lighting and security personnel – people should feel safe to move around
- (iv) Control dust generation;
- (v) Immediately consolidate the backfilled soil and restore the road surface; this will also avoid any business loss due to dust and access inconvenience of construction work;

- (vi) Employee best construction practices, speed up construction work with better equipment, increase workforce, etc., in the areas with predominantly commercial, and with sensitive features like hospitals, and schools;
- (vii) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and
- (viii) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.

129. **Socio-Economic – Employment.** Manpower will be required during the 24-months construction stage. This can result in generation of temporary employment and increase in local revenue. Thus potential impact is positive and long-term. The construction contractor will be required to employ local labour force as far as possible.

130. **Occupational Health and Safety.** Workers need to be mindful of the occupational hazards which can arise from working in confined areas such as trenches, working at heights, near the heavy equipment operating areas etc.,. Potential impacts are negative and long-term but reversible by mitigation measures. The construction contractor will be required to:

- (i) Follow all national, state and local labour laws (indicative list is in Appendix 2);
- (ii) Develop and implement site-specific occupational health and safety (OH and S) Plan, informed by OHS risk assessment seeking to avoid, minimise and mitigate risk, which shall include measures such as: (a) safe and documented construction procedures to be followed for all site activities; (b) ensuring all workers are provided with and use personal protective equipment; (c) OH and S Training<sup>3</sup> for all site personnel, (d) excluding public from the work sites; and (e) documentation of work-related accidents; Follow International Standards such as the World Bank Group's Environment, Health and Safety Guidelines<sup>4</sup>.
- (iii) Ensure that qualified first-aid is provided at all times. Equipped first-aid stations shall be easily accessible throughout the sites;
- (iv) Secure all installations from unauthorized intrusion and accident risks
- (v) Provide health and safety orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;
- (vi) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;
- (vii) Ensure the visibility of workers through their use of high visibility vests and other PPE when working in or walking through heavy equipment operating areas;
- (viii) Ensure moving equipment is outfitted with audible back-up alarms;
- (ix) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards

<sup>3</sup> Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective and the worker is competent at their job. The level of supervision and monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker.

<sup>4</sup> <http://www.ifc.org/wps/wcm/connect/a99ab8804365b27aa60fb6d3e9bda932/EHS-Guidelines+101-Webinar.pdf?MOD=AJPERES>

and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and

- (x) Disallow worker exposure to noise level greater than 85 dBA for duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.
- (xi) Provide supplies of potable drinking water;
- (xii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances

131. **Community Health and Safety.** Sewers works and deep excavations along the roads and narrow streets, and hauling of equipment and vehicles have potential to create safety risks to the community. Deep excavations without any proper protection may endanger the close by buildings. Hazards posed to the public, specifically in high-pedestrian areas may include traffic accidents and vehicle collision with pedestrians. Potential impact is negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

- (i) Confine work areas; prevent public access to all areas where construction works are on-going through the use of barricading and security personnel
- (ii) Attach warning signs, blinkers to the barricading to caution the public about the hazards associated with the works, and presence of deep excavation
- (iii) Minimize the duration of time when the sewer trench is left open through careful planning; plan the work properly from excavation to refilling and road relaying
- (iv) Control dust pollution – implement dust control measures as suggested under air quality section
- (v) Ensure appropriate and safe passage for pedestrians along the work sites
- (vi) Provide road signs and flag persons to warn of on-going trenching activities..
- (vii) Restrict construction vehicle movements to defined access roads and demarcated working areas (unless in the event of an emergency)
- (viii) Enforce strict speed limit (20-30 kmph) for plying on unpaved roads, construction tracks
- (ix) Provide temporary traffic control (e.g. flagmen) and signs where necessary to improve safety and smooth traffic flow
- (x) Where traffic is diverted around crossings, traffic control or careful selection of the exit from the working areas will be provided with the aim of ensuring that vehicles join the road in a safe manner.
- (xi) At sensitive locations particularly where there are schools and markets close to the road, awareness of safety issues will be raised through neighbourhood awareness meetings
- (xii) All drivers and equipment operators will undergo safety training
- (xiii) Maintain regularly the construction equipment and vehicles; use manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.

109. **Construction Camps.** Contractor may require to set up construction camps – for temporary storage of construction material (sewer, cement, steel, fixtures, fuel, lubricants etc.), and stocking of surplus soil, and may also include separate living areas for migrant workers. The contractor will however be encouraged to engage local workers as much as possible. Operation of work camps can cause temporary air, noise and water pollution, and may become a source of conflicts, and unhealthy environment if not operated properly. Potential impacts are negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

- (i) Consult PIU before locating project offices, sheds, and construction plants;

- (ii) Select a camp site away from residential areas (at least 100m buffer shall be maintained) or locate the camp site within the existing facilities of City Corporation
- (iii) Avoid tree cutting for setting up camp facilities
- (iv) Provide a proper fencing/compound wall for camp sites
- (v) Camp site shall not be located near (100 m) water bodies, flood plains flood prone/low lying areas, or any ecologically, socially, archeologically sensitive areas
- (vi) Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit
- (vii) Ensure conditions of liveability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be used as accommodation for workers
- (viii) Camp shall be provided with proper drainage, there shall not be any water accumulation
- (ix) Provide drinking water, water for other uses, and sanitation facilities for employees; drinking water should be regularly tested to confirm that drinking water standards are met
- (x) Prohibit employees from cutting of trees for firewood; contractor should provide cooking fuel (cooking gas); fire wood not allowed
- (xi) Train employees in the storage and handling of materials which can potentially cause soil contamination
- (xii) Wastewater from the camps shall be disposed properly either into sewer system; if sewer system is not available, provide on-site sanitation with septic tank and soak pit arrangements (100 m away from surface water body or groundwater well)
- (xiii) Recover used oil and lubricants and reuse or remove from the site;
- (xiv) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; provide a compost pit for bio degradable waste, and non-biodegradable / recyclable waste shall be collected and sold in local market
- (xv) Remove all wreckage, rubbish, or temporary structures which are no longer required; and
- (xvi) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to PIU; PIU to review and approve camp clearance and closure of work site

### **C. Operation and Maintenance Impacts**

132. Operation and Maintenance of the sewerage system will be carried out by Coimbatore City Corporation. Operation will involve collection and conveyance of wastewater from houses to nearest lifting/pumping stations; operation of lifting/pumping stations to pump accumulated sewage main pumping stations; operation of main pumping stations to pump accumulated sewage to STP; treatment of sewage at STP to meet the disposal standards; and final disposal of treated wastewater into Noyyal river STP is proposed under DBOT modality, and the contractor will prepare detailed designs for STP including the outfall sewer and disposal arrangements. At present, treatment and disposal system is designed in outline only (preliminary design); and during the detailed design phase, the assessment will be updated accordingly.

133. During its operation phase, STP will treat 30million liters of wastewater every day. As discussed in the preconstruction stage impacts, various measures, following measures are

suggested for detailed design to avoid, mitigate any impacts on the environment due to operation of STP.

- (i) Process design to meet the stringent inland water disposal standards
- (ii) Conduct a detailed baseline water quality assessment of receiving water body – Noyyal River; monitor water quality periodically during operation phase as per the Environmental Monitoring Plan
- (iii) Develop a sludge management plan : Sludge management to collect, treat and dispose the accumulated sludge safely; sludge will be treated in a mechanical centrifuge which will thicken the sludge by separating the liquid, thicken sludge will be further dried, and dried sludge will be used as a soil conditioner in fields; Sludge will be tested periodically for heavy metal concentration.
- (iv) Designing the entire system to maintain optimal flow and terminal pressure, and optimising the overall energy usage in sewer system, including STP
- (v) Using low-noise and energy efficient pumping systems
- (vi) Installing the noise-producing pumps and motors etc., in enclosed buildings with noise reducing walls, and also maintaining adequate buffer to the nearby inhabited areas
- (vii) Provision of appropriate personal protection equipment to the workers and staff

134. **Treatment and Disposal.** Sewage treatment facility would be designed to meet the preset disposal standards notified by CPCB for disposal of treated wastewater from STPs. The treated sewage effluent would be disposed into Noyyal River This river, except in the monsoon, mostly carries wastewater from the villages and urban areas it flows through. It ultimately meets river Cauvery at Village Noyyal in Karur District, over 100 km east of Coimbatore. With the implementation of subproject, disposal of untreated wastewater from Kurchi and Kuniathur areas (subproject areas) will be prevented, and also treated wastewater will be disposed into river. This will in fact improve the water quality, and therefore no adverse impacts envisaged. At present no water quality data of Noyyal available, and a detailed baseline will be established during the detailed design phase since the implementation modality of this subproject is design-build. This is part of scope of work of DB contractor. Any change / lowering of treatment efficiency during operation may lead to poor quality of wastewater and may further pollute River Noyyal. It is therefore critical that STP treats the sewage as designed. Operation and maintenance of STP and change in incoming sewage quality will have impact on the treatment efficiency.

135. During the detailed design phase::

- (i) Conduct a detailed baseline water quality assessment of receiving water body – Noyyal River
- (ii) Monitor water quality periodically during operation phase as per the Environmental Monitoring Plan

136. **STP operation.** It must be ensured that the facility is operated with standard operating procedures and only by trained staff. Ensuring uninterrupted power supply with back-up facility is a must. Standard operating procedures and operation manual shall be prepared by the contractor. Besides routine operation, this will cover all necessary items such as preventive maintenance, periodic maintenance and emergency maintenance, replacement of pumps, motors, and other electro-mechanical parts as per the design life to optimize energy use and system efficiency etc., Manual shall also include safety awareness and mock drills for worker safety.

137. **Quality of Raw Sewage.** As discussed previously, one of the critical aspects in STP operation is, change in raw sewage characteristics at inlet of STP may affect the process and



output quality. The system is designed for municipal wastewater, which does not include industrial effluent. Characteristics of industrial effluent widely vary depending on the type of industry, and therefore disposal of effluent into sewers may greatly vary the inlet quality at STP, and will upset process and affect the efficiency. There are no significant presence of industries with problematic water discharges in the subproject area of Kuruchi and Kunimuthur, however, it is important that no wastewater from industries is allowed into the sewer network with strict monitoring and enforcement.

138. **Sewage sludge.** Sewage sludge contains harmful substances such as bacteria and pathogens, and nutrients like nitrogen, phosphates. Improper handling and disposal of the sludge will have adverse impacts on health and environment. STP will have proper facilities for handling, treatment and disposal of sludge safely with implementation of sludge management plan. Therefore no adverse impacts envisaged. The treatment and drying processes kill enteric bacteria and pathogens, and because of its high content of nitrates, phosphates and other plant nutrients the sludge is an excellent organic fertilizer for application to the land. The reuse of sludge should be preceded by rigorous bacteriological tests to confirm that the treatment methods render all dried sludge and effluent free from enteric bacteria and pathogens, so that it is safe to humans, animals and crops. Sludge shall also need to be periodically tested for presence of heavy metals, to check if it meets the compost standards specified the Solid Waste Management and Handling Rules, 2016.

139. Following measures are to be implemented during the operation phase:

- (i) Ensure proper knowledge transfer, hands-on training to municipal staff engaged in STP operation has been provided by contractor prior to handover of facility;
- (ii) Ensure continuous uninterrupted power supply;
- (iii) Operate and maintain the facility following standard operating procedures of operational manual;
- (iv) Undertake preventive and periodic maintenance activities as required;
- (v) Maintain the mechanical / electrical parts as per the maintenance plan to avoid any hazards;
- (vi) Conduct periodic training to workers;
- (vii) Ensure that all safety apparatus at STP including personal protection equipment are in good condition all times; and are at easily accessible and identifiable place; periodically check the equipment, and conduct mock drills to deal with emergency situations;
- (viii) Implement sludge management plan at the STP;
- (ix) No wastewater from industrial premises (including domestic wastewater) shall be allowed to dispose into municipal sewers;
- (x) Monitor regularly and ensure that there is no illegal discharge through manholes or inspection chambers; conduct public awareness programs; in coordination with TNPCB;
- (viii) Conduct regular wastewater quality monitoring (at inlet and at outlet of STP) to ensure that the treated effluent quality complies with design standards;
- (ix) Conduct periodic testing of dried sludge/compost to check presence of heavy metals and confirming to the applicable standards to use as compost.

140. **Odor and Noise from Sewage lifting and pumping stations.** Various measures are included in the design of these facilities giving utmost importance to odor and noise. Therefore it is anticipated there will not be any significant generation of odor or noise that will impact the

surrounding households. Following measures are to be implemented during the operation:

- (i) Strictly follow standard operating procedures / operational manual for operation and maintenance of lifting and pump stations;
- (ii) Ensure that operating staff is properly trained, and have clear understanding of odor issues vis-à-vis its related with operational practices;
- (iii) Ensure that pumping cycles are properly followed; and there is no buildup of sewage beyond design volume in the wells;
- (iv) Conduct periodic H<sub>2</sub>S monitoring at pumping and lifting stations using handheld H<sub>2</sub>S meters.

141. **Sewer network.** During the system design life (15/30 years for mechanical/civil components) it shall not require major repairs or refurbishments and should operate with little maintenance beyond routine actions required to keep the equipment in working order. The stability and integrity of the system will be monitored periodically to detect any problems and allow remedial action if required. Any repairs will be small-scale involving manual, temporary, and short-term works involving regular checking and recording of performance for signs of deterioration, servicing and replacement of parts.

142. There are also certain environmental risks from the operation of the sewer system, most notably from leaking sewer pipes as untreated fecal material can damage human health and contaminate both soil and groundwater. It will be imperative therefore that the operating agency establishes a procedure to routinely check the operation and integrity of the sewers, and to implement rapid and effective repairs where necessary. There is an occupation health risk to workers engaged in sewer maintenance activities. Following measures should be followed:

- (i) Establish regular maintenance program, including:
  - a. Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas;
  - b. Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration; and
  - c. Monitoring of sewer flow to identify potential inflows and outflows;
  - d. Conduct repairs on priority based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages).
- (ii) Maintain records; review previous sewer maintenance records to help identify “hot spots” or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed;
- (iii) When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.
- (iv) Prohibit/prevent disposal of wastewater/effluent from industrial units in the sewers;

- ensure regular checking to ensure no illegal entry of industrial wastewater into sewers;
- (v) Develop an Emergency Response System for the sewerage system leaks, burst and overflows, etc.;
  - (vi) Provide necessary health and safety training to the staff in sewer cleaning and maintenance;
  - (vii) Provide all necessary personnel protection equipment;
  - (viii) Do not conduct manual cleaning of sewers; for personnel engaged sewer maintenance work, there is a risk due to oxygen deficiency and harmful gaseous emissions (hydrogen sulphide, methane, etc.); provide for adequate equipment (including oxygen masks) for emergency use.

## **VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE**

### **A. Overview**

143. The active participation of stakeholders including local community, NGOs/CBOs, etc., in all stages of project preparation and implementation is essential for successful implementation of the project. It will ensure that the subprojects are designed, constructed, and operated with utmost consideration to local needs, ensures community acceptance, and will bring maximum benefits to the people. Public consultation and information disclosure is a must as per the ADB policy.

144. Most of the main stakeholders have already been identified and consulted during preparation of this IEE, and any others that are identified during project implementation will be brought into the process in the future. Primary stakeholders of the subproject are: residents, shopkeepers and businesspeople who live and work near sites where facilities will be built (sewer network, pumping/lifting stations and STP), government and utility agencies responsible for provision of various services in project area. Secondary stakeholder are: NGOs and CBOs working in the area, community representatives, beneficiary community in general, government agencies, TNUFSL, Government of Tamil Nadu and the ADB.

### **B. Public Consultation**

145. The public consultation and disclosure program is a continuous process throughout the project implementation, including project planning, design and construction.

#### **1. Consultation during Project Preparation**

146. The subproject proposal is formulated by Coimbatore corporation in consultation with the public representatives bodies in the project area to suit their requirements.

147. Focus-group discussions with other stakeholders were conducted during project preparation, and information on likely issues and the proposed mitigation and monitoring measures provided, to learn their views and concerns. A socio economic household survey has been conducted in the project area, covering sample households, to understand the household characteristics, health status, and the infrastructure service levels, and also the demand for infrastructure services. General public and the people residing along the project activity areas were also consulted. A project area level consultation workshop was conducted in Coimbatore with the public representatives and prominent citizens, NGOs etc. on 17.11.17.

148. It was observed that people are willing to extend their cooperation as the proposed project will provide sewerage system, enhance basic infrastructure service levels and overall living standard of the public. The public expressed their concern regarding the nuisance and disturbance (dust, road closure and traffic management activities) during the construction stage which can have impact on their day to day activities. Public demanded for advance notice before construction and proper warning signs along the construction area to avoid accidents and inconvenience. Public opined that an appropriate operation and maintenance system should be in place for sewerage system for its best functioning and to have the maximum health and aesthetic benefits. Issue of bad odors from lifting and pumping stations located close to the houses is also raised. Project team explained proposed EMP to manage the negative impacts, including odor prevention and control measures included in the design and operation.

## **2. Consultation during construction**

149. Prior to start of construction, PIU will conduct information dissemination sessions at various places and solicit the help of the local community, leaders/prominent for the project work as required. Focus group meetings will be conducted to discuss and plan construction work (mainly pipeline work) with local communities to reduce disturbance and other impacts and also regarding the project grievance redress mechanism. Project information and construction schedule will be provided to the public via mass media (newspapers, television, ULB websites etc.,). A constant communication will be established with the affected communities to redress the environmental issues likely to surface during construction phase. Contractor will provide prior public information (in Tamil and English) about the construction work in the area once 7 days prior to the start of work and again a day before the start of work via pamphlets (a sample public information template is provided in Appendix 4). At the work sites, public information boards will also be provided to disseminate project related information.

## **C. Information Disclosure**

150. Executive summary of the IEE will be translated in Tamil and made available at the offices of PMU, PIU, and Coimbatore Corporation and also displayed on their notice boards. Hard copies of the IEE will be accessible to citizens as a means to disclose the document and at the same time creating wider public awareness. Electronic version of the IEE in English and Executive Summary in Tamil will be placed in the official website of the TNUIFSL and Coimbatore Corporation after approval of the IEE by ADB. Stakeholders will also be made aware of grievance register and redress mechanism.

151. Public information campaigns to explain the project details to a wider population will be conducted. Public disclosure meetings will be conducted at key project stages to inform the public of progress and future plans. Prior to start of construction, the PIU will issue Notification on the start date of implementation in local newspapers. A board showing the details of the project will be displayed at the construction sites for the information of general public.

152. Local communities will be continuously consulted regarding location of construction camps, access and hauling routes and other likely disturbances during construction. The road closure together with the proposed detours will be communicated via advertising, pamphlets, radio broadcasts, road signage, etc.

## VII. GRIEVANCE REDRESS MECHANISM

153. A common GRM will be in place to redress social, environmental or any other project related grievances. The GRM described below has been developed in consultation with stakeholders. Public awareness campaign will be conducted to ensure that awareness on the project and its grievance redress procedures is generated. The campaign will ensure that the poor, vulnerable and others are made aware of grievance redress procedures and entitlements per project entitlement matrix, and Project Management Unit (PMU) and Coimbatore Project Implementation Unit (PIU) to be established by TWADB will ensure that their grievances are addressed.

154. Affected persons will have the flexibility of conveying grievances/suggestions by dropping grievance redress/suggestion forms in complaints/suggestion boxes or through telephone hotlines at accessible locations, by e-mail, by post, or by writing in a complaints register in CCCM or PIU offices. PIU Safeguards officer will have the responsibility for timely grievance redress on safeguards and gender issues and for registration of grievances, related disclosure, and communication with the aggrieved party.

155. GRM provides an accessible, inclusive, gender-sensitive and culturally appropriate platform for receiving and facilitating resolution of affected persons' grievances related to the project. A two-tier grievance redress mechanism is conceived, one, at project level and another, beyond project level. For the project level GRM, a Grievance Redress Committee(GRC) will be established in PIUs; Safeguards officer, supported by the social, gender and environmental safeguards specialist of Construction Management and Supervision Consultant (CMSC) will be responsible for creating awareness among affected communities and help them through the process of grievance redress, recording and registering grievances of non-literate affected persons.

156. GRM aims to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project. All grievances – major or minor, will be registered. Documentation of the name of the complainant, date of receipt of the complaint, address/contact details of the person, location of the problem area, and how the problem was resolved will be undertaken. PIU will also be responsible for follow-through for each grievance, periodic information dissemination to complainants on the status of their grievance and recording their feedback (satisfaction/dissatisfaction and suggestions).

157. In case of grievances that are immediate and urgent in the perception of the complainant, the contractor, and supervision personnel of the CMSC and PIU will resolve the issue on site, and any issue that is not resolved at this level will be dealt at PIU head level for immediate resolution. Should the PIU fail to resolve any grievance within the stipulated time period, the unresolved grievances will be taken up at CCMC level. In the event that certain grievances cannot be resolved even at CCMC level, particularly in matters related to land purchase/acquisition, payment of compensation, environmental pollution etc., they will be referred to the district level Grievance Redress Committee (GRC) headed by the District Collector. Any issue which requires higher than district level inter-departmental coordination or grievance redress, will be referred to the state level Steering Committee.

158. GRC will meet every month (if there are pending, registered grievances), determine the merit of each grievance, and resolve grievances within specified time upon receiving the complaint-filing which the grievance will be addressed by the state-level Steering Committee. The Steering Committee will resolve escalated/unresolved grievances received.

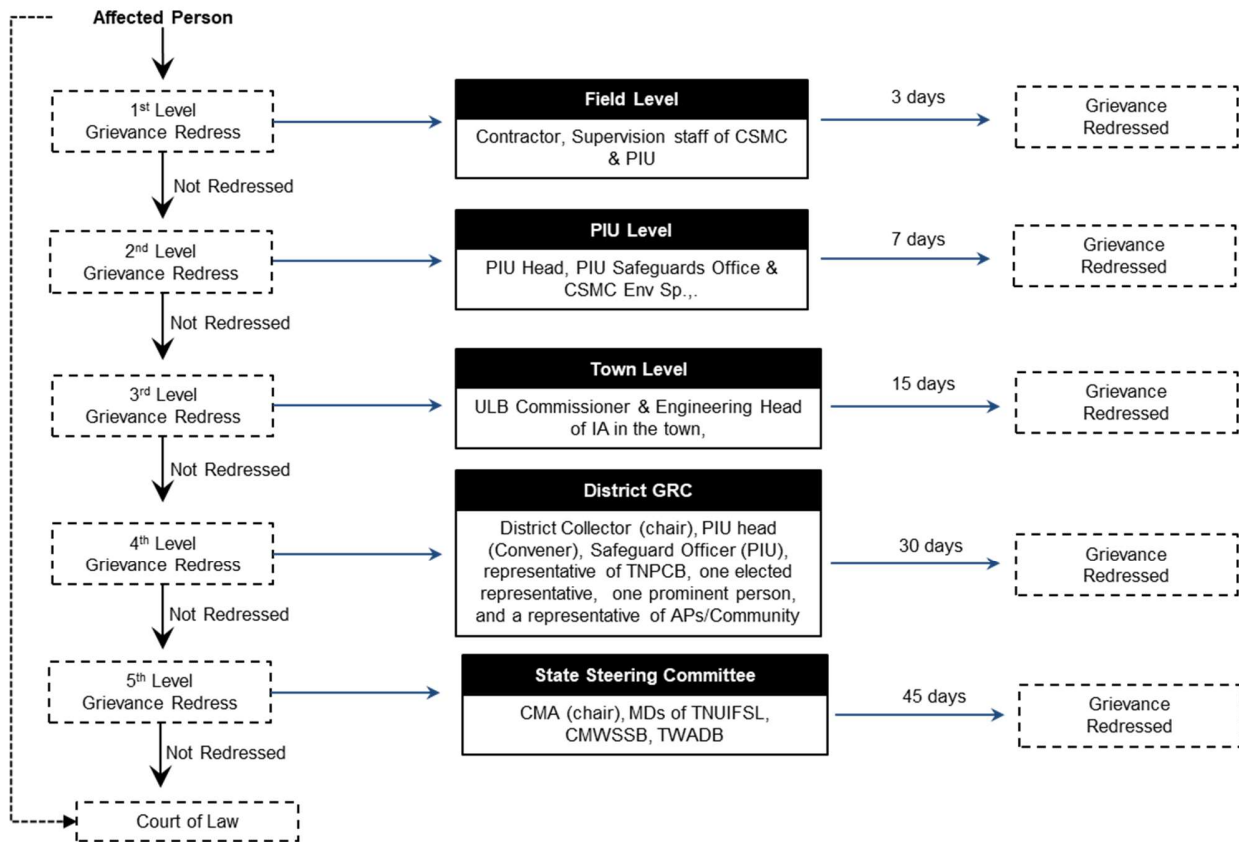
159. **Composition of Grievance Redress Committee.** GRC will be headed by the District Collector, and members include: PIU head, Safeguards Officer of PIU, representative of TNPCB, one elected representative / prominent citizen from the area, and a representative of affected community. GRC must have a women member.

160. **State level steering committee** will include Commissioner of Municipal Administration as chair, member include managing directors of TNUIFSL, CMWSSB, TWAD Board and others as necessary.

161. **Areas of Jurisdiction.** The areas of jurisdiction of the GRC, headed by the District Collector will be (i) all locations or sites within the district where subproject facilities are proposed, or (ii) their areas of influence within the District. The SC will have jurisdictional authority across the state (i.e., areas of influence of subproject facilities beyond district boundaries, if any).

162. The multi-tier GRM for the project is outlined below (Figure 11), each tier having time-bound schedules and with responsible persons identified to address grievances and seek appropriate persons' advice at each stage, as required. The GRC will continue to function throughout the project duration. The implementing agencies/ULBs shall issue notifications to establish the respective PIU level grievance redress cells, with details of composition, process of grievance redress to be followed, and time limit for grievance redress at each level.

**Figure 13: Proposed TNUFIP Grievance Redress Mechanism**



163. **Recordkeeping.** Records of all grievances received, including contact details of complainant, date the complaint was received, nature of grievance, agreed corrective actions and the date these were effected and final outcome will be kept by PIU (with the support of CSMC) and submitted to PMU.

164. **Information dissemination methods of the GRM.** The PIU, assisted by CSMC will be responsible for information dissemination to affected persons and general public in the project area on grievance redress mechanism. Public awareness campaign will be conducted to ensure that awareness on the project and its grievance redress procedures is generated. The campaign will ensure that the poor, vulnerable and others are made aware of grievance redress procedures and entitlements per agreed entitlement matrix including. whom to contact and when, where/ how to register grievance, various stages of grievance redress process, time likely to be taken for redress of minor and major grievances, etc. Grievances received and responses provided will be documented and reported back to the affected persons. The number of grievances recorded and resolved and the outcomes will be displayed/disclosed in the PIU, offices, ULB notice boards and on the web, as well as reported in the semi-annual environmental and social monitoring reports to be submitted to ADB. A Sample Grievance Registration Form has been attached in Appendix 5.

165. **Periodic review and documentation of lessons learned.** The PMU will periodically review the functioning of the GRM and record information on the effectiveness of the mechanism, especially on the PIU's ability to prevent and address grievances.

166. **Costs.** All costs involved in resolving the complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by the respective PIU. Cost estimates for grievance redress are included in resettlement cost estimates.

167. **Country legal procedure.** An aggrieved person shall have access to the country's legal system at any stage, and accessing the country's legal system can run parallel to accessing the GRM and is not dependent on the negative outcome of the GRM.

168. **ADB's Accountability Mechanism.** In the event that the established GRM is not in a position to resolve the issue, the affected person also can use the ADB Accountability Mechanism through directly contacting (in writing) the Complaint Receiving Officer (CRO) at ADB headquarters or the ADB India Resident Mission. The complaint can be submitted in any of the official languages of ADB's developing member countries. Before submitting a complaint to the Accountability Mechanism, it is recommended that affected people make a good faith effort to resolve their problems by working with the concerned ADB operations department (in this case, the resident mission). Only after doing that, and if they are still dissatisfied, they could approach the Accountability Mechanism. The ADB Accountability Mechanism information will be included in the project-relevant information to be distributed to the affected communities, as part of the project GRM.

## VIII. ENVIRONMENTAL MANAGEMENT PLAN

### A. Environmental Management Plan

169. An environmental management plan (EMP) has been developed to provide mitigation measures to reduce all negative impacts to acceptable levels.

170. The EMP will guide the environmentally-sound construction of the subproject and ensure efficient lines of communication between TNUIFSL, PMU, CCMC, PIU, consultants and contractors. The EMP will (i) ensure that the activities are undertaken in a responsible non-detrimental manner; (ii) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (iii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iv) detail specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (v) ensure that safety recommendations are complied with. The EMP includes a monitoring program to measure the environmental condition and effectiveness of implementation of the mitigation measures. It will include observations on- and off-site, document checks, and interviews with workers and beneficiaries.

171. The contractor will be required to submit to PIU, for review and approval, a site environmental management plan (SEMP) including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; and (iii) monitoring program as per SEMP. No works are allowed to commence prior to approval of SEMP.



172. A copy of the EMP/approved SEMP will be kept on site during the construction period at all times. The EMP included in the bid and contract documents to ensure compliance to the conditions set out in this document.

173. For civil works, the contractor will be required to (i) carry out all of the mitigation and monitoring measures set forth in the approved SEMP; and (ii) implement any corrective or preventative actions set out in safeguards monitoring reports that the employer will prepare from time to time to monitor implementation of this IEE and SEMP. The contractor shall allocate budget for compliance with these SEMP measures, requirements and actions.

174. The following tables show the potential environmental impacts, proposed mitigation measures and responsible agencies for implementation and monitoring.

**Table 14: Design Stage Environmental Impacts and Mitigation Measures**

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
Design of STP	Deficient treatment due to substandard operation / system malfunction	<ul style="list-style-type: none"> <li>(i) Design process to meet the CPCB disposal standards of inland water disposal</li> <li>(i) Ensuring continuous uninterrupted power supply, including a back-up facility (such as generator)</li> <li>(ii) Providing operating manual with all standard operating procedures (SOPs) for operation and maintenance of the facility</li> <li>(iii) Necessary training to ULB staff dealing with STP.</li> <li>(iv) Extended contractor period for O&amp;M, proper transfer of facility to ULB with adequate technical know-how on O&amp;M and hands-on training to ULB staff</li> <li>(v) Provision for online monitoring of crucial wastewater quality parameters at the inlet and outlet of the plant (BOD, pH, ammonia etc.,)</li> </ul>	DBOT Contractor and TWADB	Project cost - DB Contractor
Discharge of treated wastewater into Noyyal River	Baseline water quality and impact due to disposal	<ul style="list-style-type: none"> <li>(i) Conduct detailed water quality assessment of receiving water body (Noyyal River) STP discharge point including a control point on upstream</li> <li>(ii) Monitor water quality periodically during operation phase as per the Environmental Monitoring Plan</li> </ul>	DB Contractor and PIU	Project cost - DB Contractor
	Odor nuisance	<ul style="list-style-type: none"> <li>(i) Site layout design of STP within allocated 75 acre land, maintaining adequate buffer to the closest housing area (Government police / RAF housing colony) in the northern boundary.</li> <li>(ii) Providing a green buffer zone of 15-20 m wide all around the STP with trees in multi-rows and land scaping. This will act as a visual screen around the facility and will improve the aesthetic appearance. Treated wastewater will be used for land scaping</li> </ul>	DBOT Contractor and TWADB	Project cost - DB Contractor
	Sludge disposal	<ul style="list-style-type: none"> <li>(i) Prepare sludge management plan to ensure safe collection, adequate treatment prior to reuse / disposal</li> <li>(ii) Conduct periodic testing of sludge to check its quality according to set standards for reuse as manure/soil conditioner</li> <li>(iii) Provide training on safe handling of sludge, along with proper apparatus and personnel protection equipment (PPEs) to workers</li> </ul>	DBOT Contractor and TWADB	Project cost - DB Contractor
Sewer network	Nuisance due to leaks, overflows, contamination of water supplies, occupation health and safety of workers, etc.	<ul style="list-style-type: none"> <li>(i) Limit the sewer depth where possible</li> <li>(ii) Sewers shall be laid away from water supply lines and drains (at least 1 m.), if not possible, sewer lines shall be laid below the water lines</li> <li>(iii) In all cases, the sewer line should be laid deeper than the water pipeline (the difference between top of the sewer and bottom of water pipeline should be at least 300 mm)</li> <li>(iv) In unavoidable cases, where sewers are to be laid close to storm water drains, appropriate pipe material (that has no or least infiltration risk) shall be selected (stoneware pipes shall be avoided)</li> </ul>	PIU/CCMC	Project Costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost Source and of Funds
		(v) For shallower sewers and especially in narrow roads, use small inspection chambers in lieu of manholes; (vi) Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize silt/garbage entry (vii) Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulfide generation		
Sewage pumping stations	Odor nuisance	<b>Measures specific (additional) to New Pumping Station near household area</b> (i) Maintain maximum buffer distance from the nearest residences to the pumping station wells; (ii) Locate pumping station as far as away from the road (iii) Develop green buffer zone around the facility with a combination of tall and densely growing trees in multi rows as per the land availability to control odor and also act as visual shield, and improve aesthetical appearance <b>Design measures</b> (i) Proposed wells to be closed using RCC slabs. Design of RCC slab to consider both superimposed loads (human and equipment loads) and severe corrosion risk from sewer gas from within wells. (ii) RCC Slab to be designed and fixed in a modular manner such that access to pumps / appurtenances and other equipment can be provided for maintenance / replacement / renewal purposes. (iii) Since human intervention is involved and safety shall be primary and critical consideration, additional protection by way of a metallised grating / grill work shall be provided over the sections (or full cross section if required) where workers will stand / work for inspection and repair/O&M purposes. (iv) Provision of passive gas ventilation arrangement by providing a take-off vent from top of well by positioning vent in such a way that cover slab fitment / movement / drawl if required for maintenance purposes is not compromised. (v) Height of vent to be provided appropriately and a minimum 2 m above the lintel level (top level) of window(s) / passageways / doors in the nearby adjoining buildings. Provision of odor control / mitigation system as per site conditions / requirements <ul style="list-style-type: none"> <li>• Suitable granular activated carbon filter with bird-screen fitted at the vent outlet to control odor. Size of GAC (including material size) should be selected based on the vent diameter and expelled air flow rate expected.</li> </ul> (vii) Submersible sewage pumps of suitable rating, minimum submergence requirements, open impeller with cutting-tearing arrangement and high strength-corrosion resistant heavy duty construction shall be proposed.	TWADB/CCMC	Project Costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost Source and of Funds
		<p>(viii) In locations / cases where sewage flow in the present to intermediate design stage is envisaged to be low, position of the submersible pumps and design of the collection well floor by providing necessary side benching / sloped flooring to allow for higher submergence during low flow shall be made to ensure regular pump operation and avoid sewage stagnation beyond the permissible limit.</p> <p>(ix) Diesel Generators shall be provided for all pump stations and in cases of lift stations with space for control room. In cases of lift manholes (road-side or road-center type structures with only provision of kerb-side kiosk), an electrical cut-out provision shall be made for connecting an Emergency Mobile / Skid Mounted Diesel Generator for pumping out during long period of electricity supply interruption.</p> <p>(x) Develop standard operating procedures / operational manual for operation and maintenance of lifting and pump stations; this shall include measures for emerge situations</p> <p>(xi) Provide training to the staff in SOPs and emergency procedures</p> <p>(xii) Periodically monitor odor generation at pumping stations</p>		
	Sewage pumping and lifting stations located close to houses	<p>(i) For sewage pumping stations which are located adjacent to houses with a buffer distance of less than 20 m from the sewage wells to nearest house/property boundary, a suitable arrangement such to capture the gaseous emissions from the wells and treat via scrubber/activated carbon filter before letting out into the ambient air; such system should be designed appropriately to meet the likely emissions/flow rate of respective pumping stations</p> <p>(ii) For lifting stations, the above arrangement should be provided where the buffer distance between sewage well and nearest house/property is less than 10 m.</p>		
	Noise	<p>(i) Procure good quality latest technology high pressure pumps that guarantee controlled noise at a level of around 80dB(A) at a distance of 1 m</p> <p>(ii) Use appropriate building materials and construction techniques for pump houses which can absorb sound rather than reflect noise</p> <p>(iii) Use acoustic enclosures – manufacturer specified, for all pumps, motors</p> <p>(iv) Procure only CPCB approved generators to meet air emission and noise level requirements</p> <p>(v) Provide sound mufflers for ventilators in the plant rooms; and sound proof doors</p> <p>(vi) Provide ear plugs designated for noise reduction to workers</p>	PIU/CCMC	
Sewerage system	Energy consumption	<p>(i) Using low-noise and energy efficient pumping systems</p> <p>(ii) Efficient Pumping system operation</p> <p>(iii) Installation of Variable Frequency Drives (VFDs)</p>	PIU/CCMC	Project Costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
	Tree cutting	(i) Minimize removal of trees by adopting to site condition and with appropriate layout design/alignment (ii) Obtain prior permission for tree cutting (iii) Plant and maintain 10 trees for each tree that is removed	PIU/CCMC	Project Costs

**Table 15: Pre-Construction Stage Environmental Impacts and Mitigation Measures**

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Cost and Source of Funds
Submission of updated Environmental Management Plan (EMP) / SEP; EMP implementation and reporting	Unsatisfactory compliance to EMP	(i) Appoint Environmental Health and Safety (EHS) Supervisor to ensure EMP implementation. (ii) Submission of updated EMP/ SEP. (ii) Timely submission monthly of monitoring reports including documentary evidence on EMP implementation such as photographs.	Contractor	Contractor cost
Utilities	Telephone lines, electric poles and wires, water lines within proposed project area	(i) Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase; and (ii) Require construction contractors to prepare a contingency plan to include actions to be taken in case of unintentional interruption of services.	Contractor in coordination with PIU	Project cost-
Construction work camps, stockpile areas, storage areas, and disposal areas.	Conflicts with local community; disruption to traffic flow and sensitive receptors	(i) Prioritize areas within or nearest possible vacant space in the project location; (ii) If it is deemed necessary to locate elsewhere, consider sites that will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems; (iii) Do not consider residential areas; (iv) Take extreme care in selecting sites to avoid direct disposal to water body which will inconvenience the community. (v) For excess spoil disposal, ensure (a) site shall be selected preferably from barren, infertile lands. In case agricultural land needs to be selected, written consent from landowners (not lessees) will be obtained; (b) debris disposal site shall be at least 200 m away from surface water bodies; (c) no residential areas shall be located within 50 m downwind side of the site; and (d) site is minimum 250 m away from sensitive locations like settlements, ponds/lakes or other water bodies.	Contractor to finalize locations in consultation and approval of PIU	Project cost-
Sources of Materials	Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution.	(i) Obtain construction materials only from the existing government approved quarries with prior approval of PIU (ii) PIU to review, and ensure that proposed quarry sources have all necessary clearances/ permissions in place prior to approval (iii) Contractor to submit to PIU on a monthly basis documentation on material obtained from each sources (quarry/ borrow pit) (iv) No new borrow areas, quarries etc shall be developed., for the project	Contractor to prepare list of approved quarry sites and sources of materials with the approval of PIU	Contractor cos

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Cost and Source of Funds
Submission of updated Environmental Management Plan (EMP) / SEP; EMP implementation and reporting	Unsatisfactory compliance to EMP	(i) Appoint Environmental Health and Safety (EHS) Supervisor to ensure EMP implementation. (ii) Submission of updated EMP/ SEP. (ii) Timely submission monthly of monitoring reports including documentary evidence on EMP implementation such as photographs.	Contractor	Contractor cost
Consents, permits, clearances, No Objection Certificates (NOCs), etc.	Failure to obtain necessary consents, permits, NOCs, etc. can result to design revisions and/or stoppage of works	(i) Obtain all necessary consents, permits, clearance, NOCs, etc. prior to award of civil works. (i) Ensure that all necessary approvals for construction to be obtained by contractor are in place before start of construction (ii) Acknowledge in writing and provide report on compliance all obtained consents, permits, clearance, NOCs, etc.	CC and PIU	Cost of obtaining all consents, permits, clearance, NOCs, etc. prior to start of civil works responsibility of PIU.
Chance finds	Damage to disturbance artifacts	(i) Construction contractors to follow these measures in conducting any excavation work (ii) Create awareness among the workers, supervisors and engineers about the chance finds during excavation work (iii) Stop work immediately to allow further investigation if any finds are suspected; (iv) Inform State Archaeological Department if a find is suspected, and taking any action they require to ensure its removal or protection in situ.	CC and PIU	Contractor cost
Temporary economic impacts	Disruption to vendors, hawkers on ROW during sewer laying works	(i) Contractor is required to provide notice to the shop owners of the need to shift kiosk/wares displayed on ROW as soon as the work plan is ready, with minimum 7 working days. (iii) No works can be commenced unless 100% shifted in sections ready for implementation.	CC and PIU	Contractor / PIU

**Table 16: Construction Stage Environmental Impacts and Mitigation Measures**

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
EMP Implementation Training	Irreversible impact to the environment, workers, and community	(i) Project manager and all key workers will be required to undergo training on EMP implementation including spoils/waste management, Standard operating procedures (SOP) for construction works; occupational health and safety (OH and S), core labor laws, applicable environmental laws, etc.	Contractor	Contractor cost
Air Quality	Dust, emissions from construction vehicles, equipment, and machinery used for installation of pipelines resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons.	<p><b>For all construction works</b></p> <p>(i) Provide a dust screen (6 m high) around the construction sites of pumping and lifting stations and STP; ; provide 2 m high barricades for the sewer works</p> <p>(ii) Damp down the soil and any stockpiled material on site by water sprinkling; (3-4 times a day before the start of work, 1-2 times in between, and at the end of the day); when working in the roads there should permanently be one person responsible for directing when water sprinkling needs to take place to stop the dust moving;</p> <p>(iii) Reduce the need to sprinkle water by stabilizing surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition</p> <p>(iv) Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process</p> <p>(v) Cover the soil stocked at the sites with tarpaulins, and surround by dust screens.</p> <p>(vi) Control access to work area, prevent unnecessary movement of vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation</p> <p>(vii) Use tarpaulins to cover the loose material (soil, sand, aggregate etc.,) when transported by open trucks;</p> <p>(viii) Control dust generation while unloading the loose material (particularly aggregate, sand, soil) at the site by sprinkling water and unloading inside the barricaded area; minimize the drop height when moving the excavated soil.</p> <p>(ix) Clean wheels and undercarriage of haul trucks prior to leaving construction site</p> <p>(x) Ensure that all the construction equipment, machinery are fitted with pollution control devices, which are operating correctly, and have a valid pollution under control (PUC) certificate</p> <p>(xi) no vehicles or plant to be left idling at site generators to be at placed maximum distance from properties</p>	Contractor	Contractor cost



Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<p><b>For sewer works</b></p> <ul style="list-style-type: none"> <li>(i) Barricade the construction area using hard barricades (of 2 m height) on both sides</li> <li>(ii) Initiate site clearance and excavation work only after barricading of the site is done</li> <li>(iii) Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes etc.), to the barricaded area</li> <li>(iv) Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area</li> <li>(v) Undertake the work section wise: a 500 section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones</li> <li>(vi) Conduct work sequentially - excavation, sewer laying, backfilling; testing section-wise (for a minimum length as possible) so that backfilling, stabilization of soil can be done.</li> <li>(vii) Remove the excavated soil of first section to the disposal site; as the work progresses sequentially, by the time second section is excavated, the first section will be ready for back filling, use the freshly excavated soil for back filling, this will avoid stocking of material, and minimize the dust.</li> <li>(viii) Backfilled trench at any completed section after removal of barricading will be the main source of dust pollution. The traffic, pedestrian movement and wind will generate dust from backfilled section. Road restoration shall be undertaken immediately.</li> <li>(ix) Immediately consolidate the backfilled soil and restore the road surface; if immediate road restoration is not possible, provide a layer of plain cement concrete (PCC) of suitable mix on the backfilled trench so that dust generation, erosion is arrested and it will also provide a smooth riding surface for the traffic until the road is properly restored. Backfilled trench without any road restoration is a major source of dust.</li> </ul>		
Surface water quality	Mobilization of settled silt materials, and chemical contamination from fuels and lubricants during construction can contaminate nearby surface water quality.	<ul style="list-style-type: none"> <li>(i) All earthworks be conducted during the dry season to prevent the problem of soil/silt run-off during rains</li> <li>(ii) 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 (at least 100 m)</li> <li>(iii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, only designated disposal areas shall be used;</li> <li>(iv) Install temporary silt traps, oil traps, or sedimentation basins along the drainage leading to the water bodies;</li> </ul>	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
	Ponding of water in the pits/foundation excavations	<p>(v) Place storage areas (with impermeable surface) 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)</p> <p>(vi) Store fuel, construction chemicals etc., on an impervious floor, also avoid spillage by careful handling; provide spill collection sets for effective spill management</p> <p>(vii) Dispose any wastes generated by construction activities in designated sites;</p> <p>(viii) Conduct surface quality inspection according to the Environmental Management Plan (EMP).</p>		
	Water accumulation in trenches/pits	<p>(i) As far as possible control the entry of runoff from upper areas into the excavated pits, and work area by creation of temporary drains or bunds around the periphery of work area</p> <p>(ii) Pump out the water collected in the pits / excavations to a temporary sedimentation pond; dispose off only clarified water into drainage channels/streams after sedimentation in the temporary ponds</p> <p>Consider safety aspects related to pit collapse due to accumulation of water</p>	Contractor	Contractor cost
Noise Levels	Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people	<p>(i) Plan activities in consultation with PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; ; especially near schools and other sensitive receptors</p> <p>(ii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and use portable street barriers to minimize sound impact to surrounding sensitive receptor; and</p> <p>(iii) Maintain maximum sound levels not exceeding 80 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s.</p> <p>(iv) Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity; if any building at risk, structural survey be completed prior to work, to provide baseline in case any issues from vibration, and if building is structurally unsound that measures taken to avoid any further damage</p> <p>(v) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach;</p>	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(vi) Consult local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as night times, religious and cultural festivals.		
Landscape and aesthetics – waste generation	Impacts due to excess excavated earth, excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items.	<p>(i) Prepare and implement a Construction Waste Management Plan (refer Appendix 3)</p> <p>(ii) As far as possible utilize the debris and excess soil in construction purpose, for example for raising the ground level or construction of access roads etc.,</p> <p>(iii) Avoid stockpiling any excess spoils at the site for long time. Excess excavated soils should be disposed off to approved designated areas immediately</p> <p>(iv) If disposal is required, the site shall be selected preferably from barren, infertile lands; sites should be located away from residential areas, forests, water bodies and any other sensitive land uses</p> <p>(v) Domestic solid wastes should be properly segregated in biodegradable and non-biodegradable for collection and disposal to designated solid waste disposal site; create a compost pit (with impermeable bottom and sides) at workers camp sites for disposal of biodegradable waste; non-biodegradable / recyclable material shall be collected separately and sold in the local recycling material market</p> <p>(vi) Residual and hazardous wastes such as oils, fuels, and lubricants shall be disposed off via licensed (by TNPCB) third parties;</p> <p>(vii) Prohibit burning of construction and/or domestic waste;</p> <p>(viii) Ensure that wastes are not haphazardly thrown in and around the project site; provide proper collection bins, and create awareness to use the dust bins, , recycle waste material where possible</p> <p>(ix) Conduct site clearance and restoration to original condition after the completion of construction work; PIU to ensure that site is properly restored prior to issuing of construction completion certificate</p>	Contractor	Contractor cost
Accessibility and traffic disruptions	Traffic problems and conflicts near project locations and haul road	<p><b>Sewer works</b></p> <p>(i) Prepare a sewer work implementation plan in each zone separately and undertake the work accordingly; ensure that for each road where the work is being undertaken there is an alternative road for the traffic diversion; take up the work in sequential way so that public inconvenience is minimal; prepare traffic management plans for each section (refer sample in Appendix 6)</p>	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<p>(ii) Plan the sewer work in coordination with the traffic police; provide temporary diversions, where necessary with clear signage and effectively communicate with general public</p> <p>(iii) Avoiding conducting work in all roads in a colony at one go; it will render all roads unusable due to excavations at the same time, creating large scale inconvenience</p> <p>(iv) Undertake the work section wise: a 500 section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones</p> <p>(v) Confine work areas in the road carriageway to the minimum possible extent; all the activities, including material and waste/surplus soil stocking should be confined to this area. Proper barricading should be provided; avoid material/surplus soil stocking in congested areas – immediately removed from site/ or brought to the as and when required</p> <p>(vi) Limit the width of trench excavation as much as possible by adopting best construction practices; adopt vertical cutting approach with proper shoring and bracing; this is especially to be practiced in narrow roads and deeper sewers; if they deep trenches are excavated with slopes, the roads may render completely unusable during the construction period</p> <p>(vii) Leave spaces for access between mounds of soil to maintain access to the houses/properties; access to any house or property shall not be blocked completely; alternative arrangements, at least to maintain pedestrian access at all times to be provided</p> <p>(viii) Provide pedestrian access in all the locations; provide wooden/metal planks with safety rails over the open trenches at each house to maintain the access.</p> <p>(ix) Inform the affected local population in advance about the work schedule, a week before, and a day before to start of work</p> <p>(x) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum.</p> <p>(xi) Keep the site free from all unnecessary obstructions;</p> <p>(xii) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints. Provide information to the public through media – newspapers and local cable television (TV) services</p> <p>(xiii) At work site, public information/caution boards shall be provided including contact for public complaints</p>		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<p><b>Hauling (material, waste/debris and equipment) activities</b></p> <ul style="list-style-type: none"> <li>(i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites</li> <li>(ii) Schedule transport and hauling activities during non-peak hours; (peak hours 7 to 10 AM and 4 to 7 PM);</li> <li>(iii) Locate entry and exit points in areas where there is low potential for traffic congestion;</li> <li>(iv) Drive vehicles in a considerate manner</li> <li>(v) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.</li> </ul>		
Socio-Economic Loss of access to houses and business	Loss of income	<ul style="list-style-type: none"> <li>(i) Inform all businesses and residents about the nature and duration of any work well in advance so that they can make necessary preparations;</li> <li>(ii) Do not block any access; leave spaces for access between barricades/mounds of excavated soil and other stored materials and machinery, and providing footbridges so that people can crossover open trenches</li> <li>(iii) Barricade the construction area and regulate movement of people and vehicles in the vicinity, and maintain the surroundings safely with proper direction boards, lighting and security personnel – people should feel safe to move around</li> <li>(iv) Control dust generation</li> <li>(v) Immediately consolidate the backfilled soil and restore the road surface; this will also avoid any business loss due to dust and access inconvenience of construction work.</li> <li>(vi) Employee best construction practices, speed up construction work with better equipment, increase workforce, etc., in the areas with predominantly commercial, and with sensitive features like hospitals, and schools;</li> <li>(vii) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and</li> <li>(viii) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.</li> </ul>	Contractor	Contractor cost
Socio-Economic - Employment	Generation of temporary employment and increase in local revenue	<ul style="list-style-type: none"> <li>(i) Employ local labor force as far as possible</li> <li>(iii) Comply with labor laws</li> </ul>	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
Occupational Health and Safety	Occupational hazards which can arise during work	<ul style="list-style-type: none"> <li>(i) Follow all national, state and local labor laws (indicative list is in Appendix 2);</li> <li>(ii) Develop and implement site-specific occupational health and safety (OH and S) Plan informed by OHS risk assessment seeking to avoid, minimise and mitigate risk, which shall include measures such as: (a) safe and documented construction procedures to be followed for all site activities; (b) ensuring all workers are provided with and use personal protective equipment; (c) OH and S Training for all site personnel, (d) excluding public from the work sites; and (e) documentation of work-related accidents; Follow International Standards such as the World Bank Group's Environment, Health and Safety Guidelines<sup>5</sup>.</li> <li>(iii) Ensure that qualified first-aid is provided at all times. Equipped first-aid stations shall be easily accessible throughout the sites;</li> <li>(iv) Secure all installations from unauthorized intrusion and accident risks</li> <li>(v) Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;</li> <li>(vi) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;</li> <li>(vii) Ensure the visibility of workers through their use of high visibility vests and other PPE when working in or walking through heavy equipment operating areas;</li> <li>(viii) Ensure moving equipment is outfitted with audible back-up alarms;</li> <li>(ix) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and</li> <li>(x) Disallow worker exposure to noise level greater than 85 dBA for duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.</li> <li>(xi) Provide supplies of potable drinking water;</li> <li>(xii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances</li> </ul>	Contractor	Contractor cost

<sup>5</sup> <http://www.ifc.org/wps/wcm/connect/a99ab8804365b27aa60fb6d3e9bda932/EHS-Guidelines+101-Webinar.pdf?MOD=AJPERES>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians during material and waste transportation	<ul style="list-style-type: none"> <li>(i) Consult PIU before locating project offices, sheds, and construction plants;</li> <li>(ii) Select a camp site away from residential areas (at least 100m buffer shall be maintained) or locate the camp site within the existing facilities of City Corporation</li> <li>(iii) Avoid tree cutting for setting up camp facilities</li> <li>(iv) Provide a proper fencing/compound wall for camp sites</li> <li>(v) Camp site shall not be located near (100 m) water bodies, flood plains flood prone/low lying areas, or any ecologically, socially, archeologically sensitive areas</li> <li>(vi) Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit</li> <li>(vii) Ensure conditions of livability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be used as accommodation for workers</li> <li>(viii) Camp shall be provided with proper drainage, there shall not be any water accumulation</li> <li>(ix) Provide drinking water, water for other uses, and sanitation facilities for employees; ; drinking water should be regularly tested to confirm that drinking water standards are met</li> <li>(x) Prohibit employees from cutting of trees for firewood; contractor should provide cooking fuel (cooking gas); fire wood not allowed</li> <li>(xi) Train employees in the storage and handling of materials which can potentially cause soil contamination</li> <li>(xii) Wastewater from the camps shall be disposed properly either into sewer system; if sewer system is not available, provide on-site sanitation with septic tank and soak pit arrangements (100 m away from surface water body or groundwater well)</li> <li>(xiii) Recover used oil and lubricants and reuse or remove from the site;</li> <li>(xiv) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; provide a compost pit for bio degradable waste, and non-biodegradable / recyclable waste shall be collected and sold in local market</li> <li>(xv) Remove all wreckage, rubbish, or temporary structures which are no longer required; and</li> </ul>	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(xvi) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to PIU; PIU to review and approve camp clearance and closure of work site		
Work Camps and worksites	<p>Temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants</p> <p>Unsanitary and poor living conditions for workers</p>	<p>(i) As far as possible located the camp site within the work sites (at STP or large pumping station sites); if any camp to be established outside these, then select a camp site away from residential areas (at least 100 m buffer shall be maintained)</p> <p>(ii) Avoid tree cutting for setting up camp facilities</p> <p>(iii) Ensure that a proper compound wall is provided, and erect a wind/dust screen around</p> <p>(iv) Camp site shall not be located near (100 m) water bodies, flood plains flood prone/low lying areas, or any ecologically, socially, archeologically sensitive areas</p> <p>(v) Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit</p> <p>(vi) Provide proper temporary accommodation with proper materials, adequate lighting and ventilation, appropriate facilities for winters and summers; ensure conditions of livability at work camps are maintained at the highest standards possible at all times;</p> <p>(vii) Consult PIU before locating project offices, sheds, and construction plants;</p> <p>(viii) Minimize removal of vegetation and disallow cutting of trees</p> <p>(ix) Ensure conditions of livability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be allowed as accommodation for workers</p> <p>(x) Camp shall be provided with proper drainage, there shall not be any water accumulation</p> <p>(xi) Provide drinking water, water for other uses, and sanitation facilities for employees</p> <p>(xii) Prohibit employees from cutting of trees for firewood; contractor should be provide proper facilities including cooking fuel (oil or gas; fire wood not allowed)</p> <p>(xiii) Train employees in the storage and handling of materials which can potentially cause soil contamination</p> <p>(xiv) Recover used oil and lubricants and reuse or remove from the site</p> <p>(xv) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;</p>	Contractor	Contractor cost



Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<p>provide a compost pit for biodegradable waste, and non-biodegradable / recyclable waste shall be collected and sold in local market</p> <p>(xvi) Remove all wreckage, rubbish, or temporary structures which are no longer required</p> <p>(xvii) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to PIU; PIU to review and approve camp clearance and closure of work site</p>		
Post-construction clean-up	Damage due to debris, spoils, excess construction materials	<p>(i) Remove all spoils wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and</p> <p>(ii) All excavated roads shall be reinstated to original condition.</p> <p>(iii) All disrupted utilities restored</p> <p>(iv) All affected structures rehabilitated/compensated</p> <p>(v) The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up.</p> <p>(vi) All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be top soiled and regressed using the guidelines set out in the revegetation specification that forms part of this document.</p> <p>(vii) The contractor must arrange the cancellation of all temporary services.</p> <p>(viii) Request PIU to report in writing that worksites and camps have been vacated and restored to pre-project conditions before acceptance of work.</p>	Contractor	Contractor cost

**Table 17: Operation Stage Environmental Impacts and Mitigation Measures**

<b>Field</b>	<b>Anticipated Impact</b>	<b>Mitigation Measures</b>	<b>Responsible for Mitigation</b>	<b>Cost and Source of Funds</b>
STP operation – malfunction and effect on efficiency	Public health, safety and environmental impacts	<p>(i) Ensure proper knowledge transfer, hands-on training to municipal staff engaged in STP operation has been provided by contractor prior to handover of facility</p> <p>(ii) Ensure continuous uninterrupted power supply</p> <p>(iii) Operate and maintain the facility following standard operating procedures of operational manual</p> <p>(iv) Undertake preventive and periodic maintenance activities as required</p> <p>(v) Maintain the mechanical / electrical parts as per the maintenance plan to avoid any hazards</p> <p>(vi) Conduct periodic training to workers</p> <p>(vii) Ensure that all safety apparatus at STP including personal protection equipment are in good condition all times; and are at easily accessible and identifiable place; periodically check the equipment, and conduct mock drills to deal with emergency situations</p> <p>(viii) Implement sludge management plan at the STP. sludge management to collect, treat and dispose the accumulated sludge safely; sludge will be tested periodically for heavy metal concentration.</p> <p>(ix) No wastewater from industrial premises (including domestic wastewater) shall be allowed to dispose into municipal sewers</p> <p>(x) Monitor regularly and ensure that there is no illegal discharge through manholes or inspection chambers; conduct public awareness programs; in coordination with TNPCB</p> <p>(vii) Conduct regular wastewater quality monitoring (at inlet and at outlet of STP) to ensure that the treated effluent quality complies with the standards</p> <ul style="list-style-type: none"> <li>• (viii) Conduct periodic testing of dried sludge/compost to check presence of heavy metals and confirming stipulated concentrations to use as compost</li> </ul>	DBOT Contractor and PIU / CCMC	Operating costs
Operation of sewage lifting and pumping stations	Odor nuisance	<p>(i) Strictly follow standard operating procedures / operational manual for operation and maintenance of lifting and pump stations</p> <p>(ii) Ensure that operating staff is properly trained, and have clear understanding of odor issues vis-à-vis its related with operational practices</p> <p>(iii) Ensure that pumping cycles are properly followed; and there is no buildup of sewage beyond design volume in the wells</p> <p>(iv) Conduct H<sub>2</sub>S monitoring periodically</p>	PIU and CCMC	Operating costs
Operation and maintenance of sewerage system	Blocks, overflows, system malfunction, occupational health and safety	<p>(i) Establish regular maintenance program, including:</p> <ul style="list-style-type: none"> <li>• Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas</li> <li>• Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include</li> </ul>	PIU and CCMC	Operating costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<p>cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration; and</p> <ul style="list-style-type: none"> <li>• Monitoring of sewer flow to identify potential inflows and outflows</li> <li>• Conduct repairs on priority based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages);</li> </ul> <p>(ii) Maintain records; review previous sewer maintenance records to help identify "hot spots" or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed;</p> <p>(iii) When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.</p> <p>(iv) Prohibit/prevent disposal of wastewater/effluent from industrial units in the sewers; ensure regular checking to ensure no illegal entry of industrial wastewater into sewers</p> <p>(v) Develop an Emergency Response System for the sewerage system leaks, burst and overflows, etc.</p> <p>(vi) Provide necessary health and safety training to the staff in sewer cleaning and maintenance</p> <p>(vii) Provide all necessary personnel protection equipment</p> <p>(viii) Do not conduct manual cleaning of sewers; for personnel engaged sewer maintenance work, there is a risk due to oxygen deficiency and harmful gaseous emissions (hydrogen sulphide, methane, etc.); provide for adequate equipment (including oxygen masks) for emergency use</p>		

**Table 18: Construction Stage Environmental Monitoring Plan**

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
Construction disturbances, nuisances, public and worker safety,	All work sites	Implementation of construction stage EMP including dust control, noise control, traffic management, and safety measures. Site inspection checklist to review implementation is appended at Appendix 7	Weekly during construction	Supervising staff and safeguards specialists of CMSC	Staff and consultant costs are part of incremental administration costs
Ambient air quality	5 locations (STP and 4 monitoring locations 50 m downwind direction near sewer and pumping station work sites in the city);	<ul style="list-style-type: none"> <li>PM10, PM2.5 NO2, SO2, CO</li> </ul>	Once before start of construction Quarterly (yearly 4-times) during construction (3year construction period)	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (65 samples x 5000 per sample = 325,000)
Ambient noise	5 locations (STP and 4 monitoring locations near sewer and pumping station work sites in the city);	<ul style="list-style-type: none"> <li>Day time and night time noise levels</li> </ul>	Once before start of construction Quarterly (yearly 4-times) during construction (3year construction period)	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (65 samples x 1500 per sample = 97,500)
Surface water quality	2 locations (Kuruchi Kulam and Noyyal River at proposed STP discharge point)	<ul style="list-style-type: none"> <li>pH, Oil and grease, Cl, F, NO3, TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalinity</li> </ul>	Once before start of construction Half yearly during construction (3year construction period)	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (12samples x 4000 per sample = 48,000)

**Table 19: Operation Stage Environmental Monitoring Plan**

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
Monitoring of treated wastewater quality from STP	Inlet and outlet of STP	Parameters as specified by TNPCB in the consent/disposal standards notified for STPs. •	Monthly Once	CCMC	CCMC Operating Cost
Odor monitoring at STP	2 points (downwind direction) with at STP boundary and at boundary with RAF quarters)	Hydrogen sulphide (H <sub>2</sub> S)	Half yearly (yearly twice) and as and when based on public complaints (throughout the operation phase)	CCMC	O&M Costs
Ambient noise	2 locations (downwind direction) with at STP boundary and at boundary with RAF quarters)	Day time and night time noise levels	Monthly once during operation	VCMC	O&M Costs
River water quality at disposal point	Noyyal River disposal point, (downstream and upstream)	pH, Cl, F, NO <sub>3</sub> , TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalinity,  heavy metals and pesticides	Baseline monitoring prior to start of commissioning  Monthly once during operation  Yearly twice during operation (pre and post monsoon)	CCMC	O and M costs (water quality will be tested at the internal laboratory part of STP)
Odor monitoring at pumping stations	3 points (downwind direction) at all pumping stations: near inlet/suction well; outside the pumping station and at nearest house	Hydrogen sulphide (H <sub>2</sub> S)	Periodical (throughout the operation phase)	CCMC	Handheld H <sub>2</sub> S meters to be procured as part of the project and operated by operating staff
Odor monitoring at lifting stations	2 points (downwind direction) at all lifting stations: near suction well and at nearest house	Hydrogen sulphide (H <sub>2</sub> S) in ambient air •	Periodical (throughout the operation phase)	CCMC	Handheld H <sub>2</sub> S meters to be procured as part of the project and operated by operating staff

<b>Monitoring field</b>	<b>Monitoring location</b>	<b>Monitoring parameters</b>	<b>Frequency</b>	<b>Responsibility</b>	<b>Cost and Source of Funds</b>
Sludge quality and suitability as manure	STP	Analysis for concentration of heavy metals and confirm that value are within the limits for use as compost	Start of operation and Yearly once	CCMC	O and M costs (testing to be done at an accredited external laboratory)

## **B. Implementation Arrangements**

175. The Municipal and Water Supply Department (MAWS) acting through TNUIFSL will be the executing agency. A program steering committee, headed by Principal Secretary, MAWS, GOTN, will provide overall guidance and strategic directions to the program. A program management unit (PMU) for TNUFIP, headed by the Managing Director, TNUIFSL acting as Program Director will be established within TNUIFSL for overall management, planning, implementing, monitoring, reporting, and coordinating TNUFIP. The CMA will act as the Deputy Program Director in the PMU. The project ULBs, represented by respective Municipal Commissioners, will be the implementing agencies for works in cities/towns and will establish program implementing units (PIUs) headed by a municipal engineer as full-time Project Manager. PIUs will comprise of dedicated staff responsible for overseeing implementation of projects on a day-to-day basis. The PIUs will be supported by a contract management and supervision consultant (CMSC) recruited by TNUIFSL. For the institutional capacity, public awareness, and urban governance component, CMA acting through its Commissioner, will establish a PIU and appoint a governance improvement and awareness consultant (GIAC) responsible for supporting these activities.

176. The implementing agency for this subproject is Coimbatore City Municipal Corporation (CCMC). A Project Implementation Unit (PIU) will be established in CCMC headed by full-time a Project Manager (a senior official of CCMC) and comprising dedicated full-time staff from engineering and other departments of CCMC. PIU under the CCMC will be responsible for planning, implementation, monitoring and supervision, and coordination of all activities of subproject. A Construction, Management and Supervision Consultant (CMSC) will be appointed to assist PIU in day-to-day implementation of the subproject.

177. **Safeguards Compliance Responsibilities.** Environmental and Social Safeguards (ESS) managers in the PMU, TNUIFSL will have overall responsibility of safeguard compliance with ADB SPS 2009. ESS Managers report to Vice President in the Projects Wing. At PIU level, a Safeguards Officers will be appointed, who will be an Assistant Engineer rank officer and will coordinate safeguard tasks at PIU. As expert support is available to PIU via CMSC, and the role of Safeguard Officer will be mainly to coordination, overseeing the implementation of safeguard tasks, grievance redress and reporting.

178. **PMU Safeguard Responsibilities.** Key tasks and responsibilities of the PMU for this subproject include the following:

### **179. DPR finalization and Bidding stage:**

- (i) Ensure that all design related measures of the EMP are included designs;
- (ii) Ensure that EMP is included in bidding documents and civil works contracts including requirement for EHS supervisor with the contractor;
- (iii) Ensure that the bid/contract documents include specific provisions requiring contractors to comply with all applicable labor laws and core labor standards;
- (iv) Ensure that staff required for implementation of EMP (EHS officer) is included in the bid requirements;
- (v) Ensure that EMP cost is included in the project cost;
- (vi) Prior to invitation of bids and prior to award of contract ensure that all clearance/permissions as required for implementation of subproject are in place, to the extent possible.

### **180. Construction stage:**

- (i) Prior to start of construction:
  - a. Ensure that all necessary clearances/permissions/licences, including that of contractor's are in place prior to start of construction.
  - b. Provide oversight on environmental management aspects of subprojects and ensure EMPs are implemented by PIUs and contractors.
- (ii) Oversee and provide guidance to the PIU to properly carry out the environmental monitoring as per the EMP.
- (iii) Oversee grievance redress mechanism to address any grievances brought about in a timely manner; ensure that records are properly maintained.
- (iv) Consolidate quarterly environmental monitoring reports from PIU and submit semi-annual monitoring reports to ADB.
- (v) Oversee site closures to ensure that all work/facility sites are restored properly prior to issuing work completion certificate to the contractor.

181. **Operation stage.** Ensure that all clearances as required for operation of project are in place prior to operation, such as consent to operate (CTO) for STP from TNPCB.

182. **PIU Safeguard Responsibilities.** Key tasks and responsibilities of the PIU assisted by CMSC for this subproject include the following:

183. **DPR finalization and Bidding stage:**

- (i) Include design related measures of the EMP in the project design and DPR;
- (ii) Include EMP in the bidding documents and civil works contracts, including requirement of staff (EHS supervisor) with contractor for EMP implementation;
- (iii) Provide necessary budget in the project as IEE for EMO Implementation;
- (iv) Ensure that the bid/contract documents include specific provisions requiring contractors to comply with all applicable labor laws and core labor standards including:
  - a. Labour welfare measures and provision of amenities
  - b. prohibition of child labor as defined in national legislation for construction and maintenance activities;
  - c. equal pay for equal work of equal value regardless of gender, ethnicity, or caste;
  - d. elimination of forced labor;
  - e. the requirement to disseminate information on sexually transmitted diseases, including HIV/AIDS, to employees and local communities surrounding the project sites.
- (v) In the pre-bid meeting, provide insight into EMP measures, and overall compliance requirements to the bidders;
- (vi) Obtain all clearance/permissions as required for implementation of subproject, including consent to establish (CTE) from TNPCB for STP prior to invitation of bids and/or prior to award of contract / prior to construction as appropriate

184. **Construction stage:**

- (i) Identify regulatory clearance requirements and obtain all necessary clearances prior to start of construction; ensure construction work by contractor is conducted in compliance with all government rules and regulations including pollution control, labour welfare and safety etc.;
- (ii) Prior to start of construction organize an induction course for the training of contractors, preparing them on EMP implementation, environmental monitoring,



- and on taking immediate action to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation;
- (iii) Ensure contractor compliance with staff resources as per the IEE/EMP/Bid;
  - (iv) Guide contractor on updating EMP / preparing Site Environmental Plan at the start of the project;
  - (v) Update IEE and EMP; ensure that IEE reflects the final design being implemented by contractor;
  - (vi) Conduct public consultation and information disclosure as necessary
  - (vii) Take necessary action for obtaining rights of way;
  - (viii) Supervise day-to-day EMP implementation on site by contractor, including the environmental monitoring plan;
  - (ix) Supervise ambient environmental monitoring by contractors;
  - (x) Take corrective actions when necessary to ensure no environmental impacts
  - (xi) Submit quarterly environmental monitoring reports to PMU;
  - (xii) Conduct continuous public consultation and awareness;
  - (xiii) Address any grievances brought about through the grievance redress mechanism in a timely manner as per the EMP;
  - (xiv) Monitor Contractor's compliance with the measures set forth in the EMP and any corrective or preventative actions set forth in a safeguards monitoring report that the PMU will prepare from time to time;
  - (xv) Implement corrective or preventative actions in case of non-compliance or new/unanticipated impacts;
  - (xvi) Inform PMU promptly in case if any significant impacts surfaces, which were not identified in the IEE and develop necessary corrective actions as necessary and ensure implementation by the contractors; include all such impacts and suggested actions in the Quarterly Environmental Monitoring Reports;
  - (xvii) Implementation grievance redress system, and undertake appropriate actions to redress the complaints; ensure that complaints/grievances are addressed in a timely manner and resolutions are properly documented;
  - (xviii) Review and approve monthly progress reports submitted by Contractor on EMP compliance;
  - (xix) Prepare quarterly environmental monitoring reports and submit to PMU /TNUIFSL
  - (xx) Provide any assistance in environmental safeguard related tasks as required by PMU to ensure compliance and reporting to ADB.

185. **Operation stage:**

- (i) Obtain all clearances as required for operation of project prior to operation, such as consent to operate (CTO) for STP from TNPCB.
- (ii) Conduct environmental management and monitoring activities as per the EMP.

186. **Contractor's Responsibilities:**

**Bidding stage:**

- (i) Understand the EMP requirements and allocate necessary resources (budget, staff, etc.);
- (ii) Understand the regulatory compliance requirements related to labour welfare, safety, environment etc.

**Construction stage:**

- (i) Mobilize EHS Supervisor prior to start of work;
- (ii) Prepare SEMP and submit to PIU;

- (iii) Ensure that all regulatory clearances (both project related and contractor related) are in place prior start of the construction work;
- (iv) Confirm with PIU availability of rights of way at all project sites prior to start of work.
- (v) Prepare and submit:
  - a. Construction waste management (CWM) plan (sample is in Appendix 3)
  - b. Traffic management (TM) plan (sample is Appendix 6).
  - c. OHS Plan, pollution control plan, dust emergency response plan
- (vi) Implement the mitigation measures as per the EMP including CWM and TM Plans;
- (vii) Follow the EMP measures/guidelines for establishment of temporary construction camps, construction waste disposal sites, and material borrow areas, etc.,
- (viii) Implement EMP and ensure compliance with all the mitigation and enhancement measures;
- (ix) Conduct environmental monitoring (air, noise, water etc.,) as per the EMP
- (x) Undertake immediate action as suggested by PIU to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation;
- (xi) Submit monthly progress reports on EMP implementation to PIU;
- (xii) Act promptly on public complaints and grievances related to construction work and redress in a timely manner in coordination with PIU and CMSC;
- (xiii) Comply with applicable government rules and regulations.

### C. Training Needs

187. The following Table 20 presents the outline of capacity building program to ensure EMP implementation. These capacity building and trainings will be conducted at the offices of PMU and PIU by the environmental safeguards specialist of PMU/PIU and their consultants, which are part of project implementation set-up, and therefore no separate or additional costs are envisaged. Adequate costs are already considered in project's capacity building program. The detailed program and specific modules will be customized for the available skill set after assessing the capabilities of the target participants and the requirements of the project by the PMU.

**Table 20: Outline Capacity Building Program on EMP Implementation**

Description	Target Participants and Venue	Estimate (₹)	Cost and Source of Funds
1. Introduction and Sensitization to Environmental Issues (1 day) - ADB Safeguards Policy Statement - Government of India and Tamil Nadu applicable safeguard laws, regulations and policies including but not limited to core labor standards, OH and S, etc. - Incorporation of EMP into the project design and contracts - Monitoring, reporting and corrective action planning	All staff and consultants involved in the project  At PMU (combined program for all PIU)	-	Included in the overall program cost

Description	Target Participants and Venue	Estimate (₹)	Cost and Source of Funds
2. EMP implementation (1/2 day) - EMP mitigation and monitoring measures - Roles and responsibilities - Public relations, - Consultations - Grievance redress - Monitoring and corrective action planning - Reporting and disclosure - Construction site standard operating procedures (SOP) -- Chance find (archeological) protocol - AC pipe protocol - Traffic management plan - Waste management plan - Site clean-up and restoration	All PIU staff, contractor staff and consultants involved in the subproject  At PIU	-	To be conducted by CSMC at the PIU office; part of project implementation cost
3. Contractors Orientation to Workers (1/2 day) - Environment, health and safety in project construction	Once before start of work, and thereafter regular briefing every month once. Daily briefing on safety prior to start of work  All workers (including unskilled laborers)	-	Contractors' EHS officer to conduct program, with guidance of CMSC

#### D. Monitoring and Reporting

188. Immediately after mobilization and prior to commencement of the works, the contractor will submit a compliance report to PIU that all identified pre-construction mitigation measures as detailed in the EMP are undertaken. Contractor should confirm that the staff for EMP implementation (EHS supervisor) is mobilized. PIU will review, and approve the report and permit commencement of works.

189. During construction, results from internal monitoring by the contractor will be reflected in their monthly EMP implementation reports to the PIU. CMSC will monitor, review and advise contractors for corrective actions if necessary. Quarterly report summarizing compliance and corrective measures, if any, taken will be prepared by CMSC team at PIU and submitted to PMU (Report format is at Appendix 8). During operation, PIU will conduct management and monitoring actions as per the operation stage EMP, and submit to PMU an annual report.

190. Based on PIU Quarterly monitoring reports and oversight visits to subproject work sites, PMU will submit semi-annual Environmental Monitoring Report (EMR). Once concurrence from the ADB is received the report will be disclosed on TNUIFSL, PMU and CCMC websites.

191. ADB will review project performance against the TNUFIP commitments as agreed in the legal documents (loan and project agreements, etc.). The extent of ADB's monitoring and supervision activities will be commensurate with the project's risks and impacts. Monitoring and supervising of social and environmental safeguards will be integrated into the project performance management system

### E. Environmental Management Plan Implementation Cost

192. Most of the mitigation measures require the contractors to adopt good site practices, which should be part of their normal procedures already, so there are unlikely to be major costs associated with compliance. The costs which are specific to EMP implementation and are not covered elsewhere in the projects are given below.

**Table 21: Cost Estimates to Implement the Environmental Management Plan**

	Particulars	Stages	Unit	Total Number	Rate (₹)	Cost (₹)	Costs Covered By
<b>A. Implementation staff</b>							
1	EHS Supervisor	Construction	per month	36	35,000	1,260,000	Civil work contract
<b>Subtotal (A)</b>						<b>1,260,000</b>	
<b>B. Mitigation Measures</b>							
1	Providing odor control system sewage pumping and lifting stations (gas capturing and treatment at required stations) and handheld H2S meters for monitoring	Design	Lump sum provision	-	-	10,000,000	Provisional sums of contract (PIU)
2	Consent for establishments and consent for operation from TNPCB	Pre construction	Lump sum			200,000	Project costs (PIU)
3	Provision for tree cutting and compensatory plantation measures (1: 5 ratio replantation)	Construction	Per tree	100	1,000	100,000	Project costs (PIU)
4	Preparation of plans traffic management plan, waste (spoils) management plan etc., ), traffic management at work sites (Pavement Markings, Channelizing Devices, Arrow Panels and Warning Lights)	Construction	Lump sum	-	-	250,000	Civil works contract
5	Safety barricading	Construction	Lump sum	Lumpsum		2,000,000	Civil works contract
<b>Subtotal (B)</b>						<b>12,550,000</b>	
<b>C. Monitoring Measures</b>							
1	Air quality monitoring	Construction	per sample	65	5,000	325,000	
2	Noise levels monitoring	Construction	Per sample	65	1,500	97,500	
3	Surface water monitoring	Construction	Per sample	12	4,000	48,000	
<b>Subtotal (C)</b>						<b>470,500</b>	
<b>D. Capacity Building</b>							
1.	Training on EMP implementation	Pre-construction					- Part of PIU and PMU , consultant tasks
2.	Contractors Orientation to Workers on EMP implementation	Prior to dispatch to worksite					- Civil works contractor cost
<b>Subtotal (D)</b>							
<b>Total (A+B+C+D)</b>						<b>₹ 14,280,500</b>	

Contractor Cost - 3,980,500  
 PIU Cost -10,300,000

## IX. CONCLUSION AND RECOMMENDATIONS

193. The process described in this document has assessed the environmental impacts of all elements of the proposed underground sewerage subproject in Kuruchi and Kuniyamuthur areas of Coimbatore City Municipal Corporation. All potential impacts were identified in relation to pre-construction, construction, and operation phases. Planning principles and design considerations have been reviewed and incorporated into the site planning and design process wherever possible; thus, environmental impacts as being due to the project design or location were not significant. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result significant measures have already been included in the designs for the infrastructure. This means that the number of impacts and their significance has already been reduced by amending the design. Various design related measures suggested for: STP treatment process design to meet disposal standards, ensuring efficient treatment, rehabilitation of existing STP to ensure proper treatment and sludge management, odor control at pumping stations, uninterrupted power supply provision; standard operating procedures for operation and maintenance; and imparting necessary training for ULB staff; providing necessary safety no manual cleaning of sewers, and personal protection equipment for workers (protection against oxygen deficiency, harmful gaseous emissions) and sludge handling, and development of green buffer zone around the sewage treatment plant.

194. The site selected for STP is located within a vast parcel of land owned by CCMC in the southern eastern outskirts of the city, which was earmarked for waste management facilities, and in which a solid waste management facility and an old STP are already located. Site is located outside the city. Considering the current and future development around the facility, various measures are included in the subproject design, including: design of a compact, superior process with low odor potential; sensitive layout design by maintaining adequate distance from the boundary, so that SPT is deep inside the campus with tree cover around, etc.,. All the lifting and pumping station sites are situated on government owned vacant land parcels, and sewers will be laid on the public roads. Therefore subproject do not involve any private land acquisition.

195. Sewage and pumping stations sites, which collect sewage from the sewer network and pump to higher level to convey to sewage to STP for safe treatment and disposal, are located within or near residential areas, which it will serve. These facilities may generate odor and may cause nuisance to nearby households. Site selection is done with utmost care to located as far as away from the houses, however, given design considerations and land constraints, some of the sites identified are close to the houses. Various site planning, green buffer and design related measures are included in the project to prevent and control odor generation. These include: appropriately locating sewage wells within site maintaining maximum distance from the nearby houses; developing tree cover; closed facilities; design and operation measures to prevent odor; and, providing gas collection and treatment facilities. Periodical odor monitoring is proposed at pumping and lifting stations.

196. STP malfunction or decrease in treatment efficiency will have adverse impacts. This will result in release of untreated or partially treated wastewater that will pollute environment and cause public health issues. STP would be designed by the DBOT contractor to meet the disposal standards and disposal is proposed into River Noyyal Required measures to ensure that sewage system is operated and maintained with designed efficiency are to be included in the design and operation by the contractor. . Proper sludge management system to collect, treat and dispose safety will be followed. Periodic monitoring of dried sludge to check suitability as a manure is suggested.

197. Except sewer works, all other construction activities will be confined to the selected sites, and the interference with the general public and community around is minimal. There will be temporary negative impacts, arising mainly from construction dust and noise, hauling of construction material, waste and equipment on local roads (traffic, dust, safety etc.), mining of construction material, occupation health and safety aspects. Sewer line works will be conducted along public roads in an urban area congested with people, activities and traffic, subproject is likely to significant impacts during construction. Impacts mainly arise from the construction dust and noise; from the disturbance of residents, businesses, traffic by the construction work, safety risk to workers, public and nearby buildings due to deep trench excavations, especially in narrow roads, dust, access impediment to houses and business, disposal of large quantities of construction waste, etc. These are all general impacts of construction in urban areas, and there are well developed methods of mitigation that are suggested in the EMP.

198. Once the new system is operating, the facilities will operate with routine maintenance, which should not affect the environment. Improved system operation will comply with the O&M manual and standard operating procedures to be developed for all the activities.

199. Mitigation will be assured by a program of environmental monitoring conducted during construction and operation to ensure that all measures are implemented, and to determine whether the environment is protected as intended. This will include observations on- and off-site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported to the PMU. There will also be longer-term surveys to monitor treatment efficiency of STP (raw and treated sewage quality), sludge and odor. Mitigation and monitoring measures, along with the project agency responsible for such actions, form part of the Environmental Management Plan.

180. Stakeholders were involved in developing the IEE through face-to-face discussions, on site meetings, and a city level consultation workshop, which was conducted for larger public participation in the project. Views expressed by the stakeholders were incorporated into the IEE and the planning and development of the project. The IEE will be made available at public locations and will be disclosed to a wider audience via the PMU, CCMC and ADB websites. The consultation process will be continued during project implementation, as necessary, to ensure that stakeholders are engaged in the project and have the opportunity to participate in its development and implementation.

200. The project's grievance redress mechanism will provide the citizens with a platform for redress their grievances, and describes the informal and formal channels, time frame, and mechanisms for resolving complaints about environmental performance.

201. The EMP will assist the project agencies and contractor in mitigating the environmental impacts, and guide them in the environmentally sound execution of the proposed project. A copy of the updated EMP/ SEP shall be kept on-site during the construction period at all times. The EMP shall be made binding on all contractors operating on the site, and will be included in the contractual clauses to ensure compliance to the conditions set out in this document.

202. The citizens of the Coimbatore City will be the major beneficiaries of this subproject. The new sewerage system will remove the human waste from those areas served by the network rapidly and treated to an acceptable standard, and treated wastewater is utilized beneficial purposes. In addition to improved environmental conditions, the subproject will improve the overall public health in the project area. Diseases of poor sanitation, such as diarrhea and dysentery,

should be reduced, so people should spend less on healthcare and lose fewer working days due to illness, so their economic status should also improve, as well as their overall health.

203. Therefore, as per ADB SPS, the project is classified as environmental category B and does not require further environmental impact assessment. However, to conform to government guidelines STP requires consent to establish (CTE) and consent to operate (CTO) from Tamil Nadu Pollution Control Board. CTE shall be obtained prior to construction.

204. This IEE shall be updated by PIU during the implementation phase to reflect any changes, amendments and will be reviewed and approved by PMU

## Appendix 1: RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

### Sewerage

**Instructions:**

- This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional and Sustainable Development Department.
- This checklist is to be completed with the assistance of an Environment Specialist in a Regional Department.
- This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on (i) involuntary resettlement, (ii) indigenous peoples planning, (iii) poverty reduction, (iv) participation, and (v) gender and development.
- Answer the questions assuming the “without mitigation” case. The purpose is to identify potential impacts. Use the “remarks” section to discuss any anticipated mitigation measures.

Country/Project Title: India/Tamil Nadu Urban Flagship Investment Program –  
Underground Sewerage Subproject for Kuruchi and Kuniyamuthure  
Areas of Coimbatore City Municipal Corporation

Sector Division: Urban Development

Screening Questions	Yes/No	Remarks
<b>A. Project Siting</b> <b>Is the project area...</b>		
• Densely populated?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Subproject activities are located in the outer areas of Coimbatore city, which were originally municipalities. Old habitation areas within these municipalities have density residential pockets, with narrow and congested roads. Newly developing residential areas have low density and well planned layouts. Agriculture is still practiced in the outer areas.
• Heavy with development activities?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	It is a developing area; urban expansion is considerable
• Adjacent to or within any environmentally sensitive areas?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	-
• Cultural heritage site	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	-
• Protected Area	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	-
• Wetland	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	-
• Mangrove	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	-
• Estuarine	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	-
• Buffer zone of protected area	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	-
• Special area for protecting biodiversity	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	-
• Bay	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	-
<b>B. Potential Environmental Impacts</b> <b>Will the Project cause...</b>		
Sewerage		
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	No historical or cultural sites in the subproject area
▪ interference with other utilities and blocking of access to buildings; nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Few sewage lifting and pump stations are located close to the house, and odor may create nuisance. Necessary measures are included to prevent and control odor; no net negative impacts envisaged
▪ dislocation or involuntary resettlement of people?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Do not involve land acquisition or resettlement



<ul style="list-style-type: none"> <li>▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?</li> </ul>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	No such possibilities; sewerage system will cover entire population including urban poor; In fact, it will have positive health impact due to improved sanitation condition.
<ul style="list-style-type: none"> <li>▪ impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?</li> </ul>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Adequate capacity sewage treatment facility is being development under this subproject;
<ul style="list-style-type: none"> <li>▪ overflows and flooding of neighboring properties with raw sewage?</li> </ul>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Sewerage system has been designed considering the population growth. It has been designed to accommodate sewage until design year. Design considers standard peak factors and therefore no such impact envisaged.
<ul style="list-style-type: none"> <li>▪ environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?</li> </ul>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Proper sludge collection, treatment and disposal process is part of STP; sewerage system caters only domestic sewage; no industrial effluent is allowed into sewers
<ul style="list-style-type: none"> <li>▪ noise and vibration due to blasting and other civil works?</li> </ul>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	No blasting activities envisaged. Temporary nuisance/disturbance due to construction activities will be minimized with appropriate mitigation measures.
<ul style="list-style-type: none"> <li>▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, and biological hazards during project construction and operation?</li> </ul>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	In appropriate handling of sludge may have occupational health hazard. All necessary safety precautions will be taken to avoid any risk.
<ul style="list-style-type: none"> <li>▪ discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?</li> </ul>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	There are no sources of hazardous material that will find its way into the sewers. Wastewater other than domestic will not be discharged into the sewers.
<ul style="list-style-type: none"> <li>▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?</li> </ul>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Due to technical constraints and land availability, some pumping stations are located close to houses, however, necessary measures are included in site planning, design and operation. No net negative impacts envisaged
<ul style="list-style-type: none"> <li>▪ road blocking and temporary flooding due to land excavation during the rainy season?</li> </ul>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Complete road block are not envisaged; in narrow roads, traffic may be diverted but access will be ensure for pedestrians. All necessary precautions will be taken to prevent flooding during construction; flooding is unlikely as work will be mostly be conducted during dry season.
<ul style="list-style-type: none"> <li>▪ noise and dust from construction activities?</li> </ul>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	No major noise generating activities like rock blasting is envisaged. As the sewers will be lain on the road surface, cutting open of road surface using pneumatic drills will produce noise. Appropriate measures are suggested to minimize impact. Dust will be temporary and will be controlled with proper measures.
<ul style="list-style-type: none"> <li>▪ traffic disturbances due to construction material transport and wastes?</li> </ul>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Proper planning, such as selection of routes and scheduling to avoid peak traffic hours, will be carried out in consultation with concerned authorities
<ul style="list-style-type: none"> <li>▪ temporary silt runoff due to construction?</li> </ul>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Earthworks will not be conducted during rains; plain topography and moderate to low rains, so no such impact envisaged
<ul style="list-style-type: none"> <li>▪ hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?</li> </ul>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	A chance of failure of sewerage system is very remote; proper design and standard operating procedures will be followed in O&M; necessary equipment and training to workers will be provided
<ul style="list-style-type: none"> <li>▪ deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?</li> </ul>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	The STP design include adequate sludge treatment facilities

<ul style="list-style-type: none"> <li>▪ contamination of surface and ground waters due to sludge disposal on land?</li> </ul>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	The STP design include adequate sludge treatment facilities and the dried sludge will be utilized as manure
<ul style="list-style-type: none"> <li>▪ Health and safety hazards to workers from toxic gases and hazardous materials which maybe contained in confined areas, sewage flow and exposure to pathogens in untreated sewage and unstabilized sludge?</li> </ul>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Manual cleaning of sewers and facilities will be avoided. All necessary health and safety training and necessary personal protection equipment will be given to workers and staff during operation of sewerage system
<ul style="list-style-type: none"> <li>▪ Large population increase during project construction and operation that causes increased burden on social infrastructure (such as sanitation system)?</li> </ul>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	No such impact anticipated; local communities in the vicinity of the project would be employed as much as possible.
<ul style="list-style-type: none"> <li>▪ Social conflicts between construction workers from other areas and community workers?</li> </ul>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	No such impact anticipated; local communities in the vicinity of the project would be employed as much as possible.
<ul style="list-style-type: none"> <li>▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?</li> </ul>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Not applicable. Construction/operation will not involve use of explosives and chemicals.
<ul style="list-style-type: none"> <li>▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?</li> </ul>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Operational area will be clearly demarcated and access will be controlled. Only worker and project concerned members will be allowed to visit the construction sites.

<b>Climate Change and Disaster Risk Questions</b>	Yes	No	Remarks
The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.			
Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes?	√		Moderate earth quake risk zone (Zone III)
Could changes in temperature, precipitation, or extreme events patterns over the Project lifespan affect technical or financial sustainability (e.g., changes in rainfall patterns disrupt reliability of water supply; sea level rise creates salinity intrusion into proposed water supply source)?		√	No
Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g., high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		√	No
Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by using water from a vulnerable source that is relied upon by many user groups, or encouraging settlement in earthquake zones)?		√	No

## **Appendix 2: SALIENT FEATURES OF MAJOR LABOR LAWS APPLICABLE TO ESTABLISHMENTS ENGAGED IN CONSTRUCTION OF CIVIL WORKS**

- (i) Workmen Compensation Act, 1923 - The Act provides for compensation in case of injury by accident arising out of and during the course of employment.
- (ii) Payment of Gratuity Act, 1972 - Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years' service or more or on death at the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.
- (iii) Employees' PF and Miscellaneous Provisions Act, 1952 - The Act provides for monthly contributions by the employer plus workers @10 % or 8.33 %. The benefits payable under the Act are: (a) Pension or family pension on retirement or death as the case may be; (b) deposit linked insurance on the death in harness of the worker; (c) payment of PF accumulation on retirement/death etc.
- (iv) Maternity Benefit Act, 1951 - The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.
- (v) Contract Labor (Regulation and Abolition) Act, 1970 - The Act provides for certain welfare measures to be provided by the Contractor to contract labor and in case the Contractor fails to provide, the same are required to be provided by the Principal Employer by Law. The principal employer is required to take Certificate of Registration and the Contractor is required to take a License from the designated Officer. The Act is applicable to the establishments or Contractor of principal employer if they employ 20 or more contract labor.
- (vi) Minimum Wages Act, 1948 - The employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment. Construction of Buildings, Roads, Runways are scheduled employment.
- (vii) Payment of Wages Act, 1936 - It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.
- (viii) Equal Remuneration Act, 1979 - The Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees in the matters of transfers, training and promotions etc.
- (ix) Payment of Bonus Act, 1965 - The Act is applicable to all establishments employing 20 or more workmen. The Act provides for payments of annual bonus subject to a minimum of 8.33 % of wages and maximum of 20 % of wages to employees drawing Rs. 3,500/- per month or less. The bonus to be paid to employees getting 2,500/- per month or above up to Rs.3,500/- per month shall be worked out by taking wages as Rs.2,500/- per month only. The Act does not apply to certain establishments. The newly set up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of the Act.
- (x) Industrial Disputes Act, 1947 - The Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.

(xi) Industrial Employment (Standing Orders) Act, 1946 - It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the States and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the employer on matters provided in the Act and get the same certified by the designated Authority.

(xii) Trade Unions Act, 1926 - The Act lays down the procedure for registration of trade unions of workmen and employees. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities.

(xiii) Child Labor (Prohibition and Regulation) Act, 1986 - The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of child labor is prohibited in Building and Construction Industry.

(xiv) Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979 - The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The inter-state migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home up to the establishment and back, etc.

(xv) The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Cess Act of 1996 - All the establishments who carry on any building or other construction work and employ 10 or more workers are covered under this Act. All such establishments are required to pay Cess at rate not exceeding 2% of the cost of construction as may be notified by the Government. The employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for workers near the workplace etc. The employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.

### **Appendix 3: SAMPLE OUTLINE SPOILS (CONSTRUCTION WASTE) MANAGEMENT PLAN**

- The Spoil Management Plan should be site specific and be part of the monthly Construction Management Plan.
- The contractor, in consultation with the PIU, has to find out appropriate location/s for the disposal of the excess soil generated. The spoils should be deposited only at these sites.
- Further precautions need to be taken in case of the contaminated spoils
- The vehicle carrying the spoil should be covered properly.
- The spoils generating from each site should be removed on the same day or immediately after the work is complete. The site / road should be restored to the original condition.

#### **I. Spoils information**

The spoil information contains the details like a) The type / material, b) Potential contamination by that type, c) Expected volume (site / component specific), d) Spoil Classification etc.

#### **II. Spoils management**

The Spoil Management section gives the details of a) Transportation of spoil b) disposal site details c) Precautions taken d) Volume of contaminated spoil, if present, d) Suggested reuse of disposal of the spoil

#### **III. Documentation**

The Volume of Spoil Generated (Site Specific, Date Wise), Site Disposed, Reuse / Disposal Details Should Be Documented Properly.

**Appendix 4: PUBLIC INFORMATION NOTICE TEMPLATE**

**Public Announcement**  
**Providing Underground Sewerage System Coimbatore City**  
**Coimbatore City Municipal Corporation**

Under this project, works are being conducted by xxxx Contractor to provide sewerage network in Coimbatore

As part of this, works for laying pipeline / sewerage network will be taken up in ----- road---  
-/ street/ lane ..... From.....to (provide dates).

We request you to kindly co-operate for smooth implementation of the works.

We also request you to drive vehicles / pedestrians to walk carefully

Inconvenience caused is regretted.

PIU - Contact No.

Contractor – Contact no.

**Appendix 5: SAMPLE GRIEVANCE REGISTRATION FORM**

(To be available in Tamil and English)

The \_\_\_\_\_ Project welcomes complaints, suggestions, queries, and comments regarding project implementation. We encourage persons with grievance to provide their name and contact information to enable us to get in touch with you for clarification and feedback.

Should you choose to include your personal details but want that information to remain confidential, please inform us by writing/typing \*(CONFIDENTIAL)\* above your name. Thank you.

Date	Place of registration	Project Town			
		Project:			
Contact information/personal details					
Name		Gender	* Male * Female	Age	
Home address					
Place					
Phone no.					
E-mail					
Complaint/suggestion/comment/question Please provide the details (who, what, where, and how) of your grievance below:					
If included as attachment/note/letter, please tick here:					
How do you want us to reach you for feedback or update on your comment/grievance?					

**FOR OFFICIAL USE ONLY**

Registered by: (Name of official registering grievance)	
Mode of communication: Note/letter E-mail Verbal/telephonic	
Reviewed by: (Names/positions of officials reviewing grievance)	
Action taken:	
Whether action taken disclosed:	Yes No
Means of disclosure:	

## Appendix 6: SAMPLE OUTLINE TRAFFIC MANAGEMENT PLAN

### A. Principles for TMP around the Water Pipes Construction Sites

1. One of the prime objectives of this TMP is to ensure the safety of all the road users along the work zone, and to address the following issues:

- (i) the safety of pedestrians, bicyclists, and motorists travelling through the construction zone;
- (ii) protection of work crews from hazards associated with moving traffic;
- (iii) mitigation of the adverse impact on road capacity and delays to the road users;
- (iv) maintenance of access to adjoining properties; and
- (v) addressing issues that may delay the project.

### B. Operating Policies for TMP

2. The following principles will help promote safe and efficient movement for all road users (motorists, bicyclists, and pedestrians, including persons with disabilities) through and around work zones while reasonably protecting workers and equipment.

- (i) Make traffic safety and temporary traffic control an integral and high-priority element of project from planning through design, construction, and maintenance.
- (ii) Inhibit traffic movement as little as possible.
- (iii) Provide clear and positive guidance to drivers, bicyclists, and pedestrians as they approach and travel through the temporary traffic control zone.
- (iv) Inspect traffic control elements routinely, both day and night, and make modifications when necessary.
- (v) Pay increased attention to roadside safety in the vicinity of temporary traffic control zones.
- (vi) Train all persons that select, place, and maintain temporary traffic control devices.
- (vii) Keep the public well informed.
- (viii) Make appropriate accommodation for abutting property owners, residents, businesses, emergency services, railroads, commercial vehicles, and transit operations.

3. **Figure A2 to Figure A12** illustrates the operating policy for TMP for the construction of water pipes and the sewers along various types of roads.

### C. Analyze the impact due to street closure

4. Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

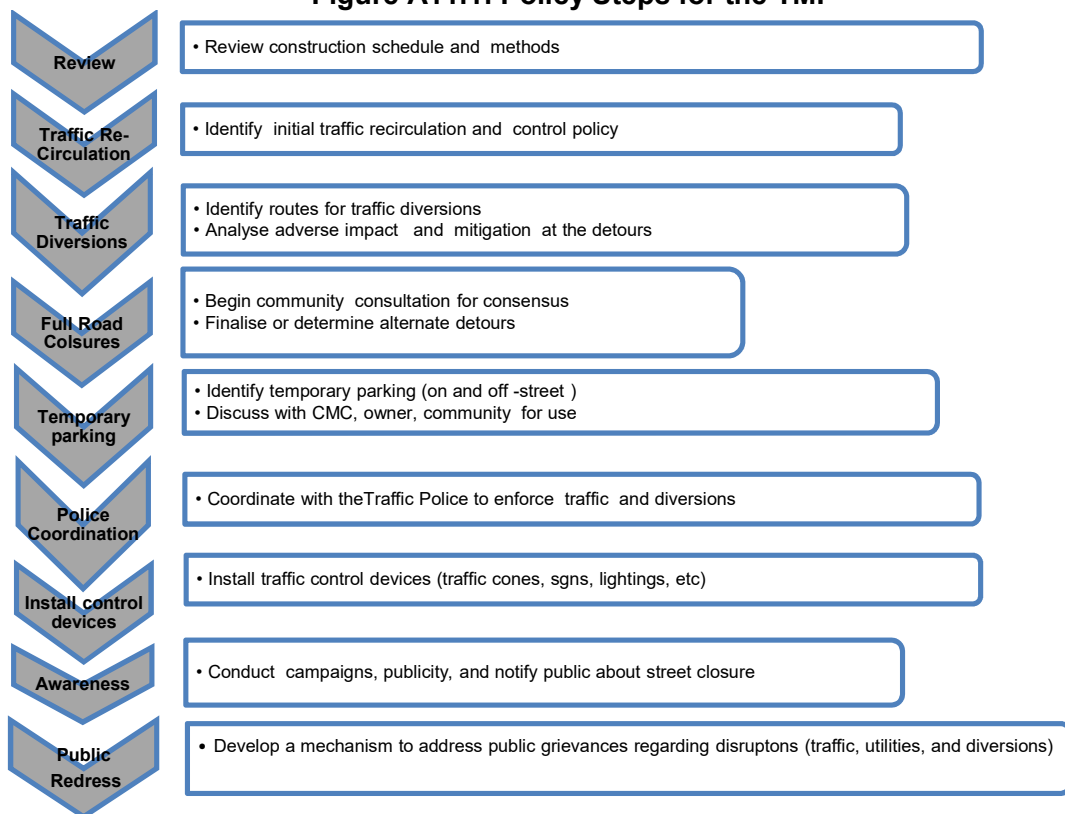
- (i) approval from the ULB/Public Works Department (PWD) to use the local streets as detours;
- (ii) consultation with businesses, community members, traffic police, PWD, etc, regarding the mitigation measures necessary at the detours where the road is diverted during the construction;
- (iii) determining of the maximum number of days allowed for road closure, and incorporation of such provisions into the contract documents;
- (iv) determining if additional traffic control or temporary improvements are needed along the detour route;
- (v) considering how access will be provided to the worksite;



- (vi) contacting emergency service, school officials, and transit authorities to determine if there are impacts to their operations; and
- (vii) developing a notification program to the public so that the closure is not a surprise. As part of this program, the public should be advised of alternate routes that commuters can take or will have to take as result of the traffic diversion.

5. If full road-closure of certain streets within the area is not feasible due to inadequate capacity of the detour street or public opposition, the full closure can be restricted to weekends with the construction commencing on Saturday night and ending on Monday morning prior to the morning peak period.

**Figure A11.1: Policy Steps for the TMP**



**D. Public awareness and notifications**

6. As per discussions in the previous sections, there will be travel delays during the constructions, as is the case with most construction projects, albeit on a reduced scale if utilities and traffic management are properly coordinated. There are additional grounds for travel delays in the area, as most of the streets lack sufficient capacity to accommodate additional traffic from diverted traffic as a result of street closures to accommodate the works.

6. The awareness campaign and the prior notification for the public will be a continuous activity which the project will carry out to compensate for the above delays and minimize public claims as result of these problems. These activities will take place sufficiently in advance of the time when the roadblocks or traffic diversions take place at the particular streets. The reason for

this is to allow sufficient time for the public and residents to understand the changes to their travel plans. The project will notify the public about the roadblocks and traffic diversion through public notices, ward level meetings and city level meeting with the elected representatives.

7. The PIU will also conduct an awareness campaign to educate the public about the following issues:

- (i) traffic control devices in place at the work zones (signs, traffic cones, barriers, etc.);
- (ii) defensive driving behaviour along the work zones; and
- (iii) reduced speeds enforced at the work zones and traffic diversions.

8. It may be necessary to conduct the awareness programs/campaigns on road safety during construction.

9. The campaign will cater to all types of target groups i.e. children, adults, and drivers. Therefore, these campaigns will be conducted in schools and community centers. In addition, the project will publish a brochure for public information. These brochures will be widely circulated around the area and will also be available at the PIU, and the contractor's site office. The text of the brochure should be concise to be effective, with a lot of graphics. It will serve the following purpose:

- (i) explain why the brochure was prepared, along with a brief description of the project;
- (ii) advise the public to expect the unexpected;
- (iii) educate the public about the various traffic control devices and safety measures adopted at the work zones;
- (iv) educate the public about the safe road user behaviour to emulate at the work zones;
- (v) tell the public how to stay informed or where to inquire about road safety issues at the work zones (name, telephone, mobile number of the contact person; and
- (vi) indicate the office hours of relevant offices.

#### **E. Install traffic control devices at the work zones and traffic diversion routes**

10. The purpose of installing traffic control devices at the work zones is to delineate these areas to warn, inform, and direct the road users about a hazard ahead, and to protect them as well as the workers. As proper delineation is a key to achieve the above objective, it is important to install good traffic signs at the work zones. The following traffic control devices are used in work zones:

- (i) Signs
- (ii) Pavement Markings
- (iii) Channelizing Devices
- (iv) Arrow Panels
- (v) Warning Lights

11. Procedures for installing traffic control devices at any work zone vary, depending on road configuration, location of the work, construction activity, duration, traffic speed and volume, and pedestrian traffic. Work will take place along major roads, and the minor internal roads. As such, the traffic volume and road geometry vary. The main roads carry considerable traffic; internal roads in the new city areas are wide but in old city roads very narrow and carry considerable traffic. However, regardless of where the construction takes place, all the work zones should be

cordoned off, and traffic shifted away at least with traffic cones, barricades, and temporary signs (temporary “STOP” and “GO”).

12. **Figure A11.2 to Figure A11.6** illustrates a typical set-up for installing traffic control devices at the work zone of the area, depending on the location of work on the road way, and road geometrics:

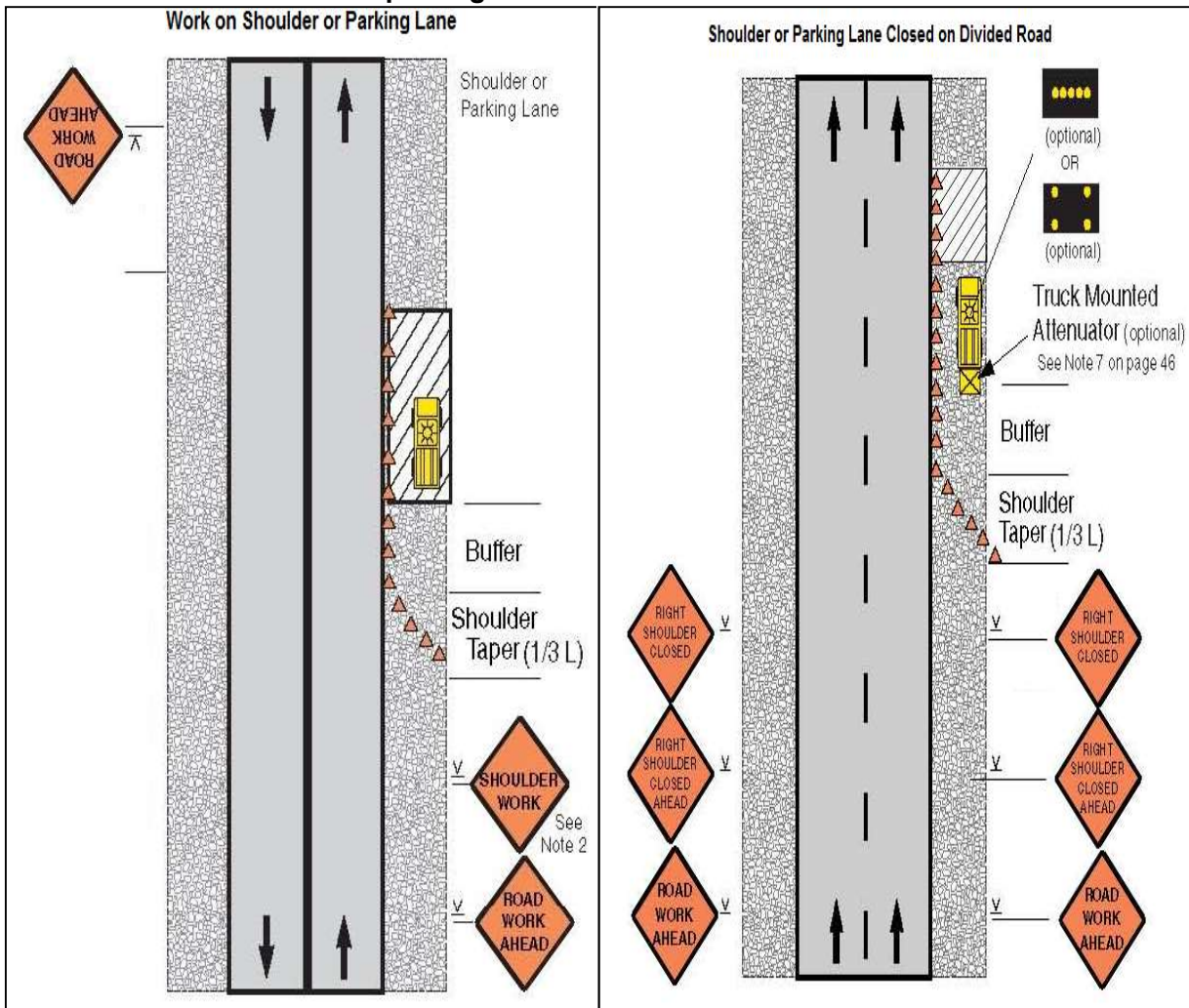
- Work on shoulder or parking lane
- Shoulder or parking lane closed on divided road
- Work in Travel lane
- Lane closure on road with low volume
- Street closure with detour

13. The work zone should take into consideration the space required for a buffer zone between the workers and the traffic (lateral and longitudinal) and the transition space required for delineation, as applicable. For the works, a 30 cm clearance between the traffic and the temporary STOP and GO signs should be provided. In addition, at least 60 cm is necessary to install the temporary traffic signs and cones.

14. Traffic police should regulate traffic away from the work zone and enforce the traffic diversion result from full street closure in certain areas during construction. Flaggers/ personnel should be equipped with reflective jackets at all times and have traffic control batons (preferably the LED type) for regulating the traffic during night time.

16. In addition to the delineation devices, all the construction workers should wear fluorescent safety vests and helmets in order to be visible to the motorists at all times. There should be provision for lighting beacons and illumination for night constructions.

**Figure A11.2 and A11.3: Work on shoulder or parking lane and Shoulder or parking lane closed on divided road**



**Figure A11.4 and A11.5: Work in Travel Lane and Lane Closure on Road with Low Volume**

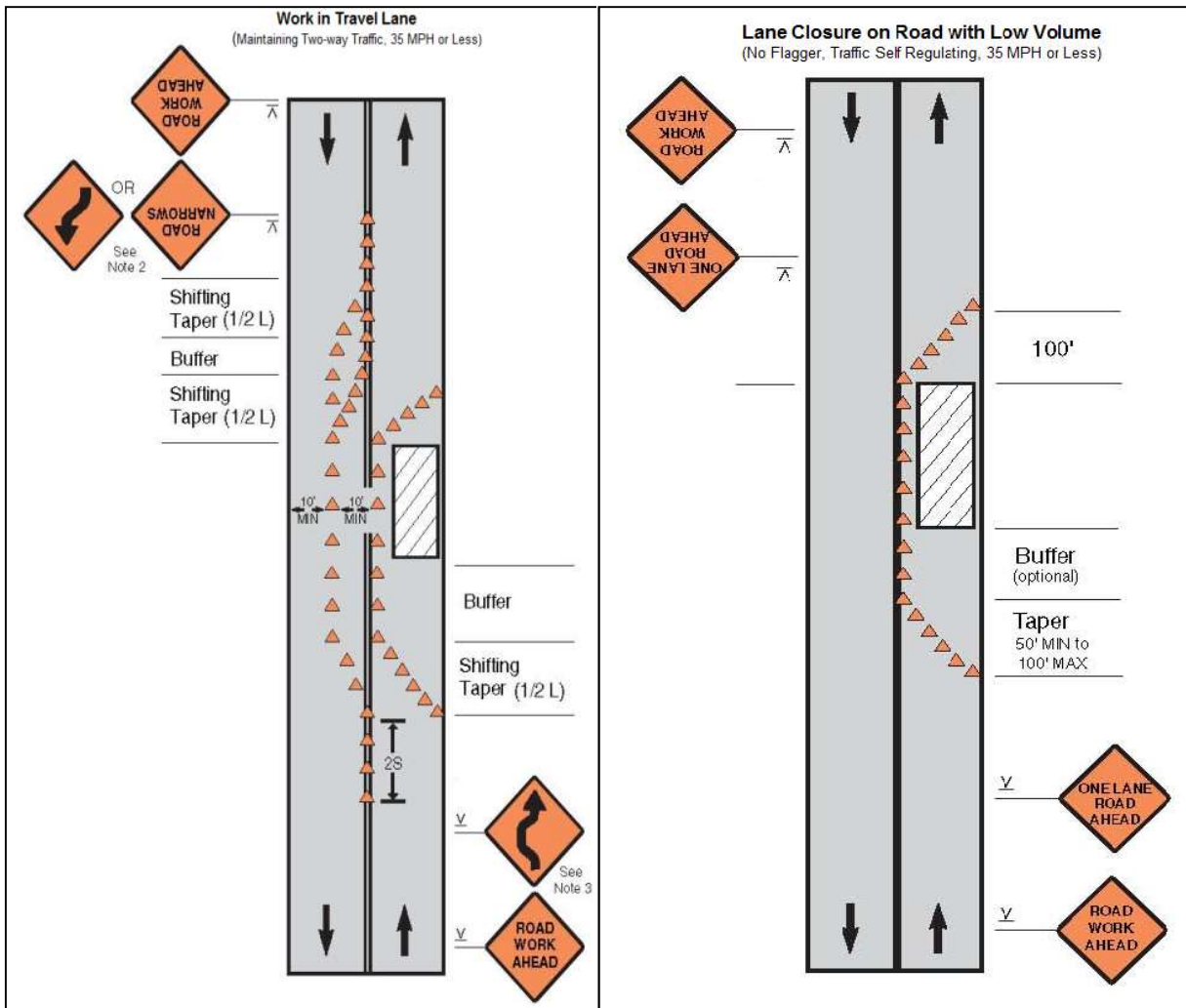
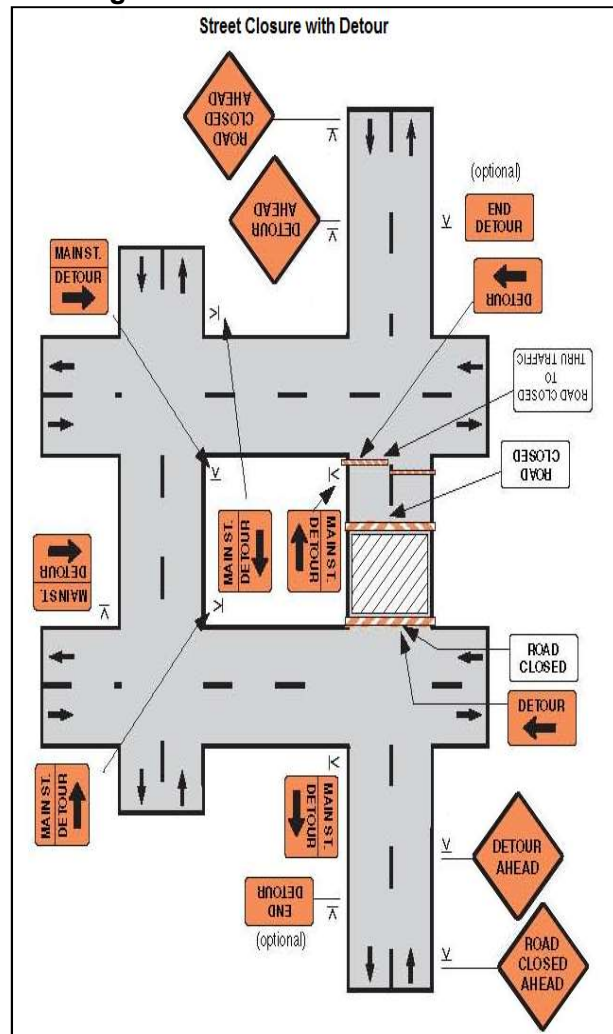


Figure A11.6: Street Closure with Detour



### Appendix 7: SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name \_\_\_\_\_  
 Contract Number \_\_\_\_\_

NAME: \_\_\_\_\_ DATE: \_\_\_\_\_  
 TITLE: \_\_\_\_\_ DMA: \_\_\_\_\_  
 LOCATION: \_\_\_\_\_ GROUP: \_\_\_\_\_

WEATHER: \_\_\_\_\_

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

Monitoring Items	Compliance
<b>Compliance marked as Yes / No / Not applicable (NA) / Partially Implemented (PI)</b>	
EHS supervisor appointed by contractor and available on site	
Construction site management plan (spoils, safety, schedule, equipment etc.,) prepared	
Traffic management plan prepared	
Dust is under control	
Excavated soil properly placed within minimum space	
Construction area is confined; no traffic/pedestrian entry observed	
Surplus soil/debris/waste is disposed without delay	
Construction material (sand/gravel/aggregate) brought to site as and when required only	
Tarpaulins used to cover sand and other loose material when transported by vehicles	
After unloading, wheels and undercarriage of vehicles cleaned prior to leaving the site	
No AC pipes disturbed/removed during excavation	
No chance finds encountered during excavation	
Work is planned in consultation with traffic police	
Work is not being conducted during heavy traffic	
Work at a stretch is completed within a day (excavation, pipe laying and backfilling)	
Pipe trenches are not kept open unduly	
Road is not completely closed; work is conducted on edge; at least one line is kept open	
Road is closed; alternative route provided and public informed, information board provided	
Pedestrian access to houses is not blocked due to pipe laying	
Spaces left in between trenches for access	
Wooden planks/metal sheets provided across trench for pedestrian	
No public/unauthorized entry observed in work site	
Children safety measures (barricades, security) in place at works in residential areas	
Prior public information provided about the work, schedule and disturbances	
Caution/warning board provided on site	
Guards with red flag provided during work at busy roads	
Workers using appropriate PPE (boots, gloves, helmets, ear muffs etc)	
Workers conducting or near heavy noise work is provided with ear muffs	
Contractor is following standard and safe construction practices	
Deep excavation is conducted with land slip/protection measures	
First aid facilities are available on site and workers informed	
Drinking water provided at the site	
Toilet facility provided at the site	

Monitoring Items	Compliance
Separate toilet facility is provided for women workers	
Workers camps are maintained cleanly	
Adequate toilet and bath facilities provided	
Contractor employed local workers as far as possible	
Workers camp set up with the permission of PIU	
Adequate housing provided	
Sufficient water provided for drinking/washing/bath	
No noisy work is conducted in the nights	
Local people informed of noisy work	
No blasting activity conducted	
Pneumatic drills or other equipment creating vibration is not used near old/risky buildings	

Signature

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**Sign off**

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**Name**  
**Position**

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**Name**  
**Position**



**Appendix 8: SEMI-ANNUAL ENVIRONMENTAL MONITORING REPORT TEMPLATE**

1. INTRODUCTION

Overall project description and objectives

Environmental category as per ADB Safeguard Policy Statement, 2009

Environmental category of each subproject as per national laws and regulations

Project Safeguards Team

Name	Designation/Office	Email Address	Contact Number
1. PMU			
2. PIUs			
3. Consultants			

- Overall project and sub-project progress and status
- Description of subprojects (package-wise) and status of implementation (preliminary, detailed design, on-going construction, completed, and/or O&M stage)

Package Number	Components/List of Works	Status of Implementation (Preliminary Design/On-going Design/On-going Construction/Completed/O&M) <sup>6</sup>	Contract Status (specify if under bidding or contract awarded)	If On-going Construction	
				%Physical Progress	Expected Completion Date

2. COMPLIANCE STATUS WITH NATIONAL/STATE/LOCAL STATUTORY ENVIRONMENTAL REQUIREMENTS<sup>7</sup>

<sup>6</sup> If on-going construction, include %physical progress and expected date of completion  
<sup>7</sup> All statutory clearance/s, no-objection certificates, permit/s, etc. should be obtained prior to award of contract/s. Attach as appendix all clearance obtained during the reporting period. If already reported, specify in the "remarks"

Package No.	Subproject Name	Statutory Environmental Requirements <sup>8</sup>	Status of Compliance <sup>9</sup>	Validity if obtained	Action Required	Specific Conditions that will require environmental monitoring as per Environment Clearance, Consent/Permit to Establish <sup>10</sup>

3. COMPLIANCE STATUS WITH ENVIRONMENTAL LOAN COVENANTS

No. (List schedule and paragraph number of Loan Agreement)	Covenant	Status of Compliance	Action Required

4. COMPLIANCE STATUS WITH THE ENVIRONMENTAL MANAGEMENT PLAN (REFER TO EMP TABLES IN APPROVED IEE/S)

- Confirm if IEE/s require contractors to submit site-specific EMP/construction EMPs. If not, describe the methodology of monitoring each package under implementation.

**Package-wise Implementation Status**

Package Number	Components	Design Status (Preliminary Design Stage/Detailed Design Completed)	Final IEE based on Detailed Design				Site-specific EMP (or Construction EMP) approved by Project Director? (Yes/No)	Remarks
			Not yet due (detailed design not yet completed)	Submitted to ADB (Provide Date of Submission)	Disclosed on project website (Provide Link)	Final IEE provided to Contractor/s (Yes/No)		

- Identify the role/s of Safeguards Team including schedule of on-site verification of reports submitted by consultants and contractors.
- For each package, provide name/s and contact details of contractor/s' nodal person/s for environmental safeguards.

column.

<sup>8</sup> Specify (environmental clearance? Permit/consent to establish? Forest clearance? Etc.)

<sup>9</sup> Specify if obtained, submitted and awaiting approval, application not yet submitted

<sup>10</sup> Example: Environmental Clearance requires ambient air quality monitoring, Forest Clearance/Tree-cutting Permit requires 2 trees for every tree, etc.

- Include as appendix all supporting documents including **signed** monthly environmental site inspection reports prepared by consultants and/or contractors.
- With reference to approved EMP/site-specific EMP/construction EMP, complete the table below
- Provide the monitoring results as per the parameters outlined in the approved EMP (or site-specific EMP/construction EMP when applicable).
- In addition to the table on EMP implementation, the main text of the report should discuss in details the following items:
  - (i) **Grievance Redress Mechanism.** Provide information on establishment of grievance redress mechanism and capacity of grievance redress committee to address project-related issues/complaints. Include as appendix Notification of the GRM (town-wise if applicable).
  - (ii) **Complaints Received during the Reporting Period.** Provide information on number, nature, and resolution of complaints received during reporting period. Attach records as per GRM in the approved IEE. Identify safeguards team member/s involved in the GRM process. Attach minutes of meetings (ensure English translation is provided).
    - Confirm if any dust was noted to escape the site boundaries and identify dust suppression techniques followed for site/s.
    - Identify muddy water was escaping site boundaries or muddy tracks were seen on adjacent roads.
    - Identify type of erosion and sediment control measures installed on site/s, condition of erosion and sediment control measures including if these were intact following heavy rain;
    - Identify designated areas for concrete works, chemical storage, construction materials, and refueling. Attach photographs of each area.
    - Confirm spill kits on site and site procedure for handling emergencies.
    - Identify any chemical stored on site and provide information on storage condition. Attach photograph.
    - Describe management of stockpiles (construction materials, excavated soils, spoils, etc.). Provide photographs.
    - Describe management of solid and liquid wastes on-site (quantity generated, transport, storage and disposal). Provide photographs.
    - Provide information on barricades, signages, and on-site boards. Provide photographs.
    - Provide information on
    - Checking if there are any activities being under taken out of working hours and how that is being managed.

**Summary of Environmental Monitoring Activities (for the Reporting Period)<sup>11</sup>**

<b>Impacts (List from IEE)</b>	<b>Mitigation Measures (List from IEE)</b>	<b>Parameters Monitored (As a minimum those identified in the IEE should be monitored)</b>	<b>Method of Monitoring</b>	<b>Location of Monitoring</b>	<b>Date of Monitoring Conducted</b>	<b>Name of Person Who Conducted the Monitoring</b>
<b>Design Phase</b>						
<b>Pre-Construction Phase</b>						
<b>Construction Phase</b>						
<b>Operational Phase</b>						

<sup>11</sup> Attach Laboratory Results and Sampling Map/Locations



Site No.	Date of Sampling	Site Location	Parameters (Monitoring Results)					
			pH	Conductivity $\mu\text{S/cm}$	BOD mg/L	TSS mg/L	TN mg/L	TP mg/L

**Noise Quality Results**

Site No.	Date of Testing	Site Location	LA <sub>eq</sub> (dBA) (Government Standard)	
			Day Time	Night Time

Site No.	Date of Testing	Site Location	LA <sub>eq</sub> (dBA) (Monitoring Results)	
			Day Time	Night Time

7. SUMMARY OF KEY ISSUES AND REMEDIAL ACTIONS

- Summary of follow up time-bound actions to be taken within a set timeframe.

APPENDIXES

- Photos
- Summary of consultations
- Copies of environmental clearances and permits
- Sample of environmental site inspection report
- Other

### Appendix 9: DETAILS OF PUBLIC CONSULTATIONS

Minutes of the Public Consultation Conducted on 17.11.2017 at Coimbatore Corporation, South Zone, Kuniyamuthur and Coimbatore Corporation Branch Office Podanur for The Proposed Underground Sewerage Scheme (UGSS) in Added Areas of Coimbatore City Municipal Corporation Namely Kuniyamuthur and Kuruchi by Tamil Nadu Water Supply and Drainage Board and Coimbatore City Municipal Corporation

The Public Consultation commenced at 11.00 AM with officials from TWAD Board, Coimbatore and Coimbatore City Municipal Corporation (CCMC). The public/residents of the area and the residential association members were present at the meeting based on prior public notice given in newspapers about the details of the public consultation. The list of participants and residents participated in public opinion hearing meeting is as entered in the attendance register. The copy of Attendance register is attached herewith as Annexure - I for your reference.

Officials of TWAD and CCMC welcomed the gathering and outlined the procedure for Public Consultation. They described that the TWAD Board and CCMC have proposed to develop the Under Ground Sewerage Scheme for Added Areas of Coimbatore City Municipal Corporation namely Kuniyamuthur and Kuruchi. They requested the gathered public to express their views and opinions. This was followed by description of the project in detail. The summary of the project details was also circulated to the gathering.

The following details regarding the scheme were shared with the public:

The proposed UGSS will consist of 11 pumping stations, 19 lifting stations and a STP at Vellalore out of which 5 pumping stations are proposed in Kuniyamuthur and 6 pumping stations in Kuruchi areas. The project area is divided into 13 Zones for better implementation. The sewer network will cover all the streets in the Corporation areas of Kuniyamuthur (Wards 87-93) and Kuruchi (93-100 wards). The proposed project will collect the sewage from residential, commercial and institutional areas. The entire sewage in the Kuniyamuthur will be collected to the Main Pumping Station in the Chinnasudikadu. The sewage will be pumped to Sewage Treatment Plant at Vellalore for treatment and disposal. Also, the entire sewage collected in Kuruchi will be directly pumped to STP at Vellalore. The STP will be executed on DBOOT (design, build, own, operate and transfer) basis and the process will provide the treated waste water in line with the discharge standards prescribed by Tamil Nadu Pollution Control Board (TNPCB). After treatment, the treated sewage will be used for agricultural purposes. The proposal will prevent pollution of the natural water bodies present in the area, due to discharge of sewage.

Following this, the TWAD and CCMC Officials invited the public/residents to express their views, concerns and queries. Also, they requested the public/residents to introduce themselves before expressing their views and raising questions.

The views and questions of the public/residents and clarifications given by the Officials are detailed below:

	<b>The views and questions of the public / Stakeholders</b>	<b>Clarification given by the Officials of TWAD/CCMC</b>
1.	The proposed location of the 5 pumping stations.	The pumping stations are proposed in Gayathri Nagar, Nethaji Nagar, ChinnaSudukadu, Sathya Nagar and Punga Nagar.
2.	Time period of the project i.e., start and end time of the project	The project will be started after the tender process i.e., about six months from today.

	<b>The views and questions of the public / Stakeholders</b>	<b>Clarification given by the Officials of TWAD/CCMC</b>
3.	They have requested many times in the past to the Corporation for sewerage system for their locality and the current situation in their locality is stagnation of storm water during rainy season, whether the current proposal will provide a solution for this.	The present proposal will cover the entire areas of Kuniyamuthur without skipping any of the streets. Thus, their locality will be provided with a sewerage system by this scheme. Also, a separate Detailed Project Report will be carried out for the storm water management.
4.	Questioned about whether there will be any impact to the surrounding peoples in the ChinnaSudukadu because of proposed main pumping station.	The Main Pumping station will be placed beyond the residential units and the proper green belt will be provided in the pumping station so that there will not be any impact to peoples in this locality.
5.	About the project cost and the implementation of project whether increase in the taxes of the households in the project area.	The individual households will have to pay taxes for the sewerage connection as like that of water connection. Also, the tax payment will be calculated based on the type and built-up area of houses.
6.	About the sizes of the pipes used and durability of the pipes.	The sizes of pipes are calculated based on the ultimate period population calculated for 2050. Thus there will not be any resizing of pipes required until the year 2050.
7.	Kuniyamuthur consist of 7 wards, whether all the wards are included in the present proposal.	As said earlier, the proposal covers all the main roads, streets in the 7 wards.
8.	About the implementation schedule of the project proposal	The construction and trial run for the project proposal will be about 3 years.
9.	During implementation whether the connections to the household will be given based on type of houses i.e., only for R.C. houses or on what basis.	The connections will be given to all households in the proposed project area. Only the amount taxed will vary based on the type or built-up area of the house.
10.	Clarification about the inclusion of Government Officers Colony, Ward No. 88 in the project proposal. This Colony consist of about 135 houses and they have requested for sewerage scheme many times in Corporation.	As said earlier, all the houses in the Kuniyamuthur will be covered in this proposal which includes the Government Officers Colony.
11.	Whether the public fund is included in the design and construction phase of project cost.	The project cost is about Rs. 442 Crores. Out of which 33 % will be granted by Government of India, 20 % will be granted by Government of Tamil Nadu and 47 % will be provided by Urban Local Body i.e., Coimbatore City Municipal Corporation. Taxes will be collected from public/residents only during the operation phase.
12.	Whether Under Ground Sewerage Scheme and Storm Water drain are the same.	UGSS will collect only sewage and the storm water will be collected in separate open drain that will be connected to the water bodies.
13.	Whether the proposal will collect grey water and black water	The scheme will collect both the grey and black water from the residential, commercial and institutional areas in the project area
14.	Proposed pumping station will have any odor problems in the vicinity of the area.	There will not be any odor problem as the pumping stations are proposed with development of greenbelt around the periphery.



	<b>The views and questions of the public / Stakeholders</b>	<b>Clarification given by the Officials of TWAD/CCMC</b>
		In addition the pumping stations will be fitted with odor control devices.
15.	The current situation of Thrivalluvar Residency, Ward No. 87 is the open flow of septic sewage and stagnation of the same in some areas. The peoples of the locality thank the officials if the proposed scheme will relieve them of this problem.	The officials of TWAD and CCMC told them proposed scheme will serve the purpose and the received the thanks happily.
16.	There is no proper provision of storm water drain in their locality (Ward No.90). The laid drains are not continuous.	There is separate team working on storm water drain. The detailed project report is being prepared and the storm water drain will be laid at the earliest.
17.	There is no provision of sewage network in Ward No. 90.	As said earlier, the present project proposal will cover entire Corporation areas of Kuniyamuthur and Kuruchi.
18.	Implementation of project schedule.	The current proposal of UGSS will be available to the public within 3 years of time.
19.	If any discontinuity in the project proposal which will contribute disturbances to the public where should we contact. Kindly give the authorized person's name, designation and address.	The concerned authority for this project proposal is the Coimbatore City Municipal Corporation and it is requested to contact CCMC officials in their locality directly if there are any disturbances to the public/residents. If no action taken then they can contact the Regional Offices of CCMC.
20.	Need clarification about any deposit needed for sewerage connection or taxes to be paid.	The deposit and the taxes will be calculated based on type and built-up area of the project. Also, the deposit and taxes will be based on the bye-law passed by Government of Tamil Nadu.
21.	On What basis chambers will be laid and Distance between the chambers	The chambers will be laid at 30 m interval for easy inspection purpose.
22.	Pipe quality and diameter of the pipes	The pipes will be laid based on IS standard so that the durability of pipes will be ensured. The diameter will be vary based on the quantity calculated.
23.	Whether household connections will be given on any priority i.e., Old Kuniyamuthur and New Kuniyamuthur.	The household connections will be given to all the houses in Corporation areas of Kuniyamuthur and Kuruchi.
24.	At present there are no sewer and storm water drain facilities in our locality (Ward No. 93) and we are facing many problems. The proposed sewer network will come into operation only after 3 years. What will happen for this 3 years.	We will provide temporary facilities for collection of sewage so that there will not be any problems in your locality.
25.	There are many vacant sites in our locality and this proposal will work if the sites are constructed with residential units.	The sizes of pipes are calculated based on the ultimate period population projected for 2050. This will take into account any increase in residents in the project area.
26.	The proposal is for the added areas of Coimbatore City Municipal Corporation of Kuniyamuthur and Kurchi. The information about the public consultation has not reached the peoples in the locality. Giving advertisement in News Paper alone is not	All the regulations for conducting the public hearing have been followed. Kindly give your opinions for the proposal.

	<b>The views and questions of the public / Stakeholders</b>	<b>Clarification given by the Officials of TWAD/CCMC</b>
	sufficient. Thus, the public consultation should be postponed and conducted again after informing all the peoples.	
27.	The STP is proposed in the Composting yard at Vellalore. Already, there is an odor issue in the surrounding locality due to solid waste. Proposing the STP in the same location will increase the odor. Kindly relocate the location of STP.	The odor from the solid waste is being taken under control by following Engineering Standards. Also, there will not be any odor problem. Since the STP area will be buffered with a Greenbelt and there will be installation of odor electronic devices for odor control.
28.	Whether there will be any impact on ground water by proposing the STP in Vellalore.	There will not be any impact in ground water since all the sewage generated are collected through sewer network and treated in STP tanks which are above ground. Also, the treated sewage will match the discharge standards prescribed by TNPCB.
29.	The project area consist of many residential associations, NGO's. The present attendance with respect to project area and project cost is not sufficient.	We all thank for your views and we can arrange for one more meeting with all residential associations, NGO's in the project area.

The officials of TWAD and CCMC concluded the Public Consultation with vote of thanks.

Copy of the photographs and copy of the News Paper advertisement of the entire proceedings are enclosed.





**Photographs of Public Consultation in Kuniyamuthur on 17.11.2017 for proposed UGSS in Kunuiyamuthur and Kuruchi**



**Photographs of Public Consultation in Kuniyamuthur on 17.11.2017 for proposed UGSS in Kunuiyamuthur and Kuruchi**



Photographs of Public Consultation in Kuniyamuthur on 17.11.2017 for proposed UGSS in Kunuiyamuthur and Kuruchi



**Photographs of Public Consultation in Kuniyamuthur on 17.11.2017 for proposed UGSS in Kunuiyamuthur and Kuruchi**



News Paper Advertisement



## குறிச்சியில் பாதாள சாக்கடை இன்று கருத்துக்கேட்டபு கூட்டம்

கோவை, நவ. 17-

குறிச்சி, குனியமுத்துார் பகுதியில் பாதாள சாக்கடை திட்டம் செயல்படுத்துவது தொடர்பாக, பொதுமக்களிடம் இன்று கருத்து கேட்கப்படுகிறது.

கோவையில் பழைய மாநகராட்சி பகுதியில், பாதாள சாக்கடை திட்டம் செயல்பாட்டில் உள்ளது. விடுபட்ட பகுதிகளில் குழாய் பதித்து, இணைப்பு வழங்கப்படுகிறது. குறிச்சி மற்றும் குனியமுத்துாரில், 87வது வார்டு முதல், 100வது வார்டு வரையிலான பகுதிகளில், ரூ.445 கோடியில் பாதாள சாக்கடை திட்டம் செயல்படுத்தப்பட உள்ளது. மேலும், வெள்ளலூர் கழிவு நீர் பண்ணை வளாகத்தில், சுத்திகரிப்பு மையம் கட்ட முடிவு செய்யப்பட்டுள்ளது.

இதுதொடர்பாக பயனாளிகள் கருத்துக்களை கேட்கும் கலந்தாய்வு கூட்டம், குனியமுத்துார் தெற்கு மண்டல அலுவலகத்தில் இன்று காலை, 11:00 மணிக்கும்; போத்தனூர் சத்திரம் வீதியில் உள்ள மாநகராட்சி அலுவலகத்தில், 12:00 மணிக்கும் நடக்கிறது. குடிநீர் வடிகால் வாரியம் மற்றும் மாநகராட்சி அதிகாரிகள் பங்கேற்கின்றனர். பொதுமக்கள் தங்களது கருத்துக்களை தெரிவிக்கலாம் என, மாநகராட்சி அறிவித்துள்ளது.

16 NOV 2017 THE INDIAN EXPRESS

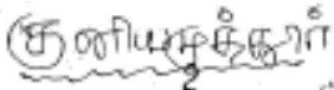
### Meeting with public to sort out UGDS issues

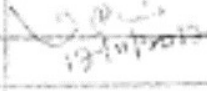
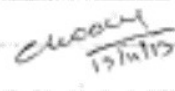
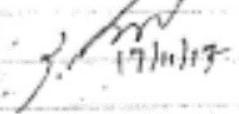


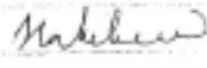
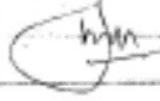
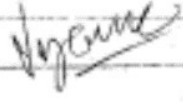
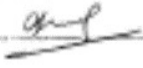
Coimbatore: Coimbatore City Municipal Corporation (CCMC) is organizing a grievance meeting at Kunyamuthur central zone office and Podanur Kutchi zone office in which issues related to the proposed Under Ground Drainage (UGD) works will be discussed on Friday. Sources said that on Friday, the meeting would start at 11 am in Kunyamuthur central zone office and at 12pm in Podanur Kutchi zone office on Sathiyam street. CCMC officials expect public to air their suggestions before framing the Detailed Project Report (DPR) to execute the UGD works in Kutchi and Kunyamuthur, between ward 97 and 100, with the help of TN Water Supply and Drainage Board.

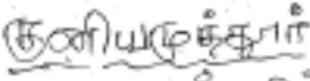


## Attendance Register

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<p>குறிச்சி மன்றம் குறியிடப்பட்டது பகுதிகளுக்கான பாதாள சாக்கடை கட்டிடம்</p>	
<p>பொதுமக்களின் கருத்துக்கேள்விக் கூட்டம்</p>	
<p>உருகை</p>	
<p>பகுதி</p>	
<p>நாள்: 17-11-2017</p>	

  
 17.11.2017  
 ವಿಜಯನಗರ ಸರ್ಕಾರದ ಅಧಿಕಾರಿಗಳ ಪಟ್ಟಿ

S.No.	Name	Address & Phone NO.	Signature
1)	V. Parvathi	9443793223 City Engineer (W) Coimbatore Corporation.	 17/11/17
2)	C. CHOCALANNA	9443062889 Superintending Engineer, TWRD Bd 936	 17/11/17
3	P. Basappa	9442427827 • EETWAD/MPD/Coimbatore	
4.	T. Ganave	Executive Engineer. 9442204113 Cm.C	 17/11/17
5	C. Sundarraj	AEE/c Coimbatore Corp	 17/11/17
6.	D. Senthil Kumar	AEE/TWAD/PE/Coimbatore	
7.	S. LAKSHMANAN.	AEE/TWAD/MP/Thondamuthur	
8.	S. Sampath Kumar	consultant / TWAD	
9	M.K. Vajjayani Rajan Nagar		
10	V. Samp Kumar	Rajaji Nagar, WBB 9442113789	

<p style="text-align: center;">             ದುರಗ್ಯ ಕೀರ್ತಿಯ ಕಾರ್ಯಕ್ರಮದ ಅಧ್ಯಕ್ಷರುಗಳ ಪಟ್ಟಿ         </p>		<p>17.11.2017</p> <p>3</p>
S.No.	Name Address & Phone No.	Signature
11	R. RADHAKRISHNAN 16 Mysore Bank Colony 9442160621	R. Radhakrishnan
12	S. G. GOPAL Rangasamy Nagar 9365407708	S. G. Gopal
13	N. Manoj Kumar Rangasamy Naidu Nagar 9894161082	N. Manoj Kumar
14	S.P.R. RAJINDARAN cmrta member Rangasamy Naidu Welfare Association 8012950300	S.P.R. Rajindaran
15	A. NATARAJAN President/Founder Rangasamy Naidu Nagar Welfare Association 9629620147	A. Natarajan
16	M. Shanmugasundaram B-12, Puda, CBSE 9842160621	M. Shanmugasundaram
17	K.K. Parameswari Rangasamy Naidu Nagar, Kumbalur 9842160621	K.K. Parameswari
18	N. Abdul Kalam Rangasamy Naidu Nagar 32nd Street Kumbalur, CBE. 8. 9360390853	N. Abdul Kalam 17/11/17
19	C. Dhandapani 10/3, Nagesappa Cross 1st Street, Kalathuppalaya, Kovvur (02) CBE. H2. 9360390853 91809 19009 Anthe Dhandapani	C. Dhandapani 11/11/2017











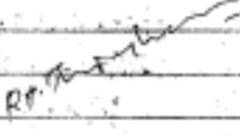

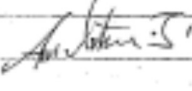
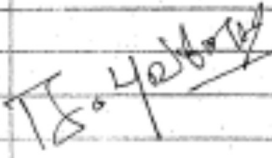
17-11-17

புதியபுதிய  
புதிதில்தொடர் செய்துகொடுக்க செய்துகொடுக்க

S.NO	Name	Address & Phone	Signature
36.	M. Anandhan	91, P. N. S. Road	M. Anandhan
37.	V. MOHAN	Secretary, Bharathi Naga Welfare Association Kumiamuthu Coimbatore-8 9842576771	V. Mohan
38	A. K. NAZIR	33, BEYONDHAVAN CIRCLE Kunjiyamuthu, CB-2. Cell. 7010068433, 8015013336	A. K. Nazir
39	F. Vannothkumar	9865658842 MADHAVI BAVAN, 13, Ranga Swamy Naidu Nigan Kunjiyamuthu, CB-2.	
40	G. Hemalatha	9868260000 Rajasekhar Naidu Nigan Kunjiyamuthu Ward 93	



17.11.2017		செய்தியை	
பெரிய நகரங்களில் உள்ள பகுதிகளில் உள்ளவர்கள்			
Sl. No	Name	Address / Phone no	Signature
1	P Balasubramanian	Sri Sathyanarayana Nagar Kodaikanal 98540 74121	
2	V. Jayaraj/Laney, Vice President	Venkatasabandhan Village Residents Welfare Associations, Kuvichi. 9750163383	
3	V. Kumar	Office bearer, V.C.P. Nagar Residents Assn, Kuvichi, 9952412995	
4	K. Mani Supt.	South Zone CML. 9942997274	
5	M. TAJUDEEN	EE TWTB Rd. 94435 7773.	
6	S. Gnanapriya	St. P. 1 Street with Government Dispensary Street Chennai 600 9944654383	

Sl No	Name Address Phone No	Signature
7	K.S. Mohan 79/Sy.0. Sri Ram Nagar Podanur.	S. Lakshmi
8	R.P. Thyagha Kumar 79, Vittal Nagar, Ganagasarpuram, Pottanur Coimbatore-23 9677387651	
9	K. Anandakrishnan C.P. (Cm) Dharmam Dunakuram (Dharmam) 9843171447	
10	AMALANATHAN. J. NO. 11-A. Joseph. villa. Annesamipilli street Back side of police quarters 9486436898.	
11	K. Anandakrishnan 29- BEASAMPAKUN BEASAMPAKUN (PO) BEASAMPAKUN - 23 9894153333	

17.11.2017

பெரியபாளையம் காவல்துறை நிலையம்

சாட்சிகள்

17-11-2017

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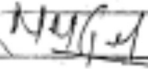
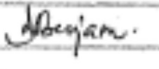
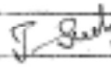
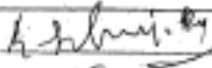
10 மாவட்டங்களில் இருந்து தேர்வு செய்யப்பட்டவர்கள்

(குறிப்பு)

Sl no	Name	Address / Phone No	Signature
12	P. M. K. M. V. S.	P. M. K. M. V. S. S. EDWARD, Work Street	
13	A. Venugopalakrishnan	President JAMS Residential Welfare Association, 1/249 A2, Braganza Rd, Ilorin, Seremban, III St, Perak, CBE 9442241069	
14	S. D. Lakshmi	சென்னை சென்னை அருகில் உள்ள இடம் சென்னை 9487070650	
15	Y. Srinivasan	Y. Srinivasan P. Srinivasan, 3rd floor Gungun, 8925635580	
16	R. M. G. G. G.	R. M. G. G. G. 9360359051	
17	R. Srinivasan	R. Srinivasan - 7502990711	

17.11.2017

தமிழ்நாடு மருத்துவமனைகள் சங்கம்

S.No	Name	Address & Phone no	Signature
18	D. Jayaraman	5, சந்திரசேகர அம்பலம் சூரியசுப்பிரமணியம் 8754119205	
19	D. Jayaraman	தஞ்சை: திரைபுலியேசுவரி அம்பலம் 23/A சிவசாமியேசுவரி குவாட்ரான்: 9894732079	
20	M. Lakshminarayana	9443655984 தஞ்சை 950006 அம்பலம் மாரிமுத்துசுப்பிரமணியம் தஞ்சை, குவாட்ரான்.	
21	Dr. S. Benjamin	9445005999 Jr. Secretary, New York Avenue Welfare Association.	
22	J. Suresh	33 Stairy Road, Chingampalam Chennai - 641023	
23	A. S. Srinivasan	11/2, Kadachanai Road, Porur, Chennai 9791312354	

17.11.2011. 12

சென்னை மாநகராட்சி கட்டுப்பாட்டுத்துறை

No	Name, Address & Phone no	Signature
24	K. Vellumayandi 94868 11325 (Rtd) S. B. Police	K. Vellum.
25	K. Mani ASmk 98949 96376 V.S. Vik. Nagar 1 <sup>st</sup> Street Podanur.	K. Mani
24	S. Abu 8807449470 M.C.R. Street Podanur	S. Abu
27	L. Sathya 4466 84476659 Panchayat Office Road 2 <sup>nd</sup> Street. Podanur	L. Sathya
28	G. Srinivasan 9649500000 Srinivasan Room 23 9944227992	G. Srinivasan
29	R. Karthikeyan 44 G. Karthikeyan Podanur (P.O.) 986-23 9092238800	R. Karthikeyan

