

Initial Environmental Examination

Document Stage: Draft
Project Number: 49107-005
July 2019

IND: Tamil Nadu Urban Flagship Investment Program
(Tranche 2) – Underground Sewerage System in
Tiruchirappalli City

CURRENCY EQUIVALENTS

(as of 4 July 2019)

Currency Unit	–	Indian rupee (₹)
₹1.00	–	\$0.0145
\$1.00	=	₹ 68.7685

ABBREVIATIONS

ADB	–	Asian Development Bank
ASI	–	Archeological Survey of India
CI	–	cast iron
CMSC	–	construction management and supervision consultant
CPCB	–	central pollution control board
CTE	–	consent to establishment
CTO	–	consent to operation
DWC	–	double wall corrugated
EAC	–	expert appraisal committee
EHS	–	environmental health and safety
EIA	–	environmental impact assessment
EMP	–	environmental management plan
ESS	–	environmental and social safeguards
GOTN	–	Government of Tamil Nadu
IEE	–	initial environmental examination
MOEFCC	–	Ministry of Environment, Forest and Climate Change
NOC	–	no objection certificate
PIU	–	program implementation unit
PMU	–	program management unit
REA	–	rapid environmental assessment
ROW	–	right-of-way
SEIAA	–	State Environmental Impact Assessment Authority
SIDCO	–	Small Industries Development Corporation
SPS	–	Safeguard Policy Statement, 2009
STP	–	sewage treatment plant
TCC	–	Tiruchirappalli City Corporation
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
WTP	–	water treatment plant

WEIGHTS AND MEASURES

°C	–	degree Celsius
km	–	kilometer
lpcd	–	liters per capita per day
m	–	meter
Mgd	–	million gallons per day
MLD	–	million liters per day
mm	–	millimeter
km ²	–	square kilometer

NOTE

In this report, "\$" refers to United States dollars.

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EXECUTIVE SUMMARY

On 28 September 2018, the Asian Development Bank (ADB) approved a multitranche financing facility (MFF) for the Tamil Nadu Urban Flagship Investment Program (TNUFIP) for an amount not exceeding \$500 million. The program will develop priority water supply, sewerage, and drainage infrastructure in at least 10 cities in strategic industrial corridors in Tamil Nadu. The Municipal Administration and Water Supply Department (MAWS), acting through Tamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL), is the executing agency. Urban local bodies (ULBs) are the implementing agencies for the subprojects. Project 2 will support priority water supply and/or sewerage infrastructure in five cities (Ambur, Madurai, Tiruchirappalli, Tiruppur, Vellore) and governance improvement in 10 project ULBs.

The Subproject. The subproject on underground sewerage system (UGSS) is proposed to be implemented in Tiruchirappalli, which is one of the largest city in the state of Tamil Nadu. Under the Phase II UGSS scheme, a section of the Tiruchirappalli City is already covered under ongoing UGSS subproject in TNUFIP Tranche 1. In the remaining areas, the provision for UGSS has been proposed under the ADB-funded TNUFIP Tranche 2. These areas are located in eastern, southern and south-western part of the Tiruchirappalli City Municipal Corporation (TCMC). The subproject under Phase III of UGSS of TCMC includes the following project components: (i) sewage collection system (327 kilometers [km] length of sewers and 12,389 manholes), (ii) lift stations, (iii) 7 pump stations, (iv) 20.93 km length pumping main sewers, and (vii) 32,000 house service connections. Treatment facility (STP) to treat collected wastewater is already proposed and considered in Phase II UGSS scheme.

Program implementation arrangements. The MAWS of the Government of Tamil Nadu acting through the TNUIFSL is the state-level executing agency. A program 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 ULBs. The TCMC is the implementing agency for this subproject. A program implementation unit (PIU) will be established in TCMC headed by a full-time Project Manager (executive engineer or above) and comprising dedicated full-time staff of the TCMC 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 the environmental management plan (EMP) and environmental assessment review framework (EARF). Environmental Specialist of the CMSC will assist PIU in implementation of subproject in compliance with EMP and EARF, and will carry out all necessary tasks.

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 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 (REA) checklist for Sewerage. The potential negative impacts were identified in relation to pre-construction, construction and operation phases.

Categorization. Based on results of the assessment and ADB SPS, 2009, the subproject is classified as environmental category "B", i.e., the subproject is judged to be unlikely to have

significant environmental impacts and accordingly, this initial environmental examination (IEE) is prepared.

Description of the Environment. Subproject components are located in Tiruchirappalli City, an urban area surrounded by land that was converted for agricultural use many years ago. Tiruchirappalli is bound on the north by Namakkal District, northeast by Perambalur District, east by Thanjavur District, southeast by Pudukottai District, south by Sivaganga and Madurai Districts, southwest by Dindigul District and on the west by Karur District. The city is known for its educational institutions, industries, temples, commercial and tourist hub of Tamil Nadu. The most prominent landmark is the Archeological Survey of India (ASI) protected Rock Fort Temple and Erumbeeswarar Temple.

The district has a tropical climate. The normal annual rainfall over the district varies from about 730 millimeter (mm) to about 900 mm. Tiruchirappalli falls under Cauvery River Basin. The Cauvery River is the most important River in the district and the tributaries of Cauvery, i.e., Coleroon River, Koraiyar river, Ariyar, Malattar channel and Uyyakondan canal also drain in Tiruchirappalli. The river splits into two branches, the northern branch being called the Coleroon (Kollidam) and the southern branch called Cauvery River. Ponnaniar, Uppamodai and Siddhayalli reservoirs are mainly used for irrigation purposes in this region. All the channels except Cauvery are ephemeral in nature. With respective seismicity, as per the Modified Mercalli (MM) intensity scale, which measures the impact of the earthquakes on the surface of the earth, the subproject area comes under Low Damage Risk Zone II. There are no sensitive areas like forest or protected areas in the project area or nearby project area.

Potential environmental impacts and mitigation measures. The subproject is unlikely to cause significant environmental impacts 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; and (iii) predicted impacts are site-specific and likely to be associated with the construction process.

In this draft 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 to minimize the environmental impacts. Sewage pumping and lifting stations are likely to generate odor. Lifting stations are comparatively small, handle low volumes of sewage, and therefore odor nuisance is limited. Although utmost care is taken to locate pumping and lifting stations away from the households, due to design considerations and land constraints, the SPS-5 at Indira Nagar, SPS-7 at Lurdhu Nagar and SPS-9 Muthu Kumaraswamy Nagar sites are located close to the households. A portion of the UGSS (3.8 km of sewer collection system, 550 m of pumping main, and one pumping station) will be located in the 300 m regulated zone of the ASI site.

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, which includes, odor control measures, appropriately locating sewage wells within site as far as away from the households/ residential areas, developing tree cover, closed facilities, gas collection and treatment facilities, design and operation measures to prevent odor build up, adopting standard operating procedures for operation and maintenance, imparting necessary training, safety and personal protection equipment for workers, etc. No works will be allowed in the 300 m ASI regulated zone until (i) ASI permit has been obtained, and (ii) archeological experts have been appointed to assess the impacts and supervise the works.

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 and pumping stations) 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, 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 sewer works may have adverse, but temporary 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; 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.

Environmental Management Plan. 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) selection of construction methodology near protected monuments in discussion with the ASI, having the excavation observed by person with archaeological knowledge for chance finds, etc.; (ii) proper planning of sewer works to minimize the public inconvenience; (iii) barricading, dust suppression and control measures; (iv) traffic management measures for works along the roads and for hauling activities; (v) provision of walkways and planks over trenches to ensure access will not be impeded; and (vi) 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.

The EMP will be included in the bid and contract 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, an updated EMP / 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.

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, TCMC and TNUIFSL websites. The consultation process will be continued during project implementation as required. A grievance redress mechanism (GRM) is described within the IEE to ensure any public grievances are addressed quickly.

Monitoring and Reporting. Contractor will submit a monthly EMP implementation report to PIU. PIU, with the assistance of CMSC, will monitor the compliance of Contractor, prepare a quarterly environmental monitoring report (QEMR) 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 TCMC and TNUIFSL websites.

Conclusions and Recommendations. Therefore, as per ADB SPS, this subproject is classified as environmental category “B” and does not require further environmental impact assessment. TCMC has to obtain permission from ASI for the subproject components falling within 300 m regulated area of the Erumbeeswarar Temple, an ASI monument. Further, TCMC has to carry out the Corrective Action Plan as suggested in the IEE based on the environmental audit of the existing STP, which is an associated facility for the subproject. This Draft IEE is prepared based on the Detailed Project Report , and if required, it shall be further updated by the PIU during implementation phase for any design changes 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. On 28 September 2018, the Asian Development Bank (ADB) approved a multitranche financing facility (MFF) for the Tamil Nadu Urban Flagship Investment Program (TNUFIP) for an amount not exceeding \$500 million. The program will develop priority water supply, sewerage, and drainage infrastructure in at least 10 cities in strategic industrial corridors in Tamil Nadu. The Municipal Administration and Water Supply Department (MAWS), acting through Tamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL), is the executing agency. Urban local bodies (ULBs) are the implementing agencies for the subprojects.

2. The Government of India is expected to submit a second periodic financing request (PFR) to ADB on 15 June 2019 for a loan amount of \$206 million. The request was planned in the country operations business plan. Project 2 will support priority water supply and/or sewerage infrastructure in five cities (Ambur, Madurai, Tiruchirappalli, Tiruppur, Vellore) and governance improvement in 10 project ULBs.

3. **Impact and outcome.** Project 2 is aligned with the following impacts of the investment program: (i) universal access to basic water and sanitation services achieved; (ii) “world-class” cities and industrial corridors across the state developed; and (iii) water security, reduced vulnerability to climate change in urban areas, achieved. The investment program will have the following outcome: livability and climate resilience in five cities (Ambur, Tiruppur, Vellore, Madurai, and Tiruchirappalli) in priority industrial corridors enhanced.

4. **Output 1: Climate-resilient sewage collection and treatment, and drainage systems developed in four cities.** Works in Tiruchirappalli, Ambur, Tiruppur, and Vellore include: (i) 2 new sewage treatment plants (STPs) with a combined treatment capacity of 72.71 million liters per day (MLD) constructed; (ii) 1 STP (15 MLD capacity) rehabilitated; (iii) 3,000 cubic meters treated wastewater reused per day; (iv) 1,256 km of new sewage collection pipelines constructed, with 100% households connected (152,580 households); (v) 28 pumps and 44 lift stations (combined capacity of 3,690 kW) constructed; and (vi) 8 (2 in each city) all-female community water and sanitation committees formed. The breakdown by city is: (i) in Tiruchirappalli new sewage collection system constructed, (ii) in Ambur new sewage collection system and 16.71 MLD STP constructed with 3,000 cubic meters treated wastewater reused, (iii) in Tiruppur new sewage collection system with new 56 MLD STP constructed and one 15 MLD STP rehabilitated, and (iv) in Vellore new sewage collection system constructed.

5. **Output 2: Water supply systems in two cities improved with smart features.** Works in Tiruppur and Madurai include: (i) 1,260 km of new distribution pipelines commissioned with 100% households connected (188,900 households) in 66 newly established district metering areas (DMAs) with new supervisory control and data acquisition (SCADA) systems to manage and reduce nonrevenue water (NRW); (ii) 66 new storage reservoirs with combined capacity of 92 million liters constructed; (iii) 3 pump stations (combined capacity of 7,225 kW) constructed; (iv) 196 km new transmission mains and 230 km of feeder mains constructed; (v) 3 new intakes and 3 new water treatment plants of combined capacity of 321 MLD constructed; and (vi) 80% of technical staff from each implementing agency of 2 cities trained in NRW reduction including 100% women staff. The breakdown by city is: (i) in Tiruppur, 1,060 km of distribution pipelines in 29 DMAs, 29 storage reservoirs, 2 pump stations (5975 kW), 46 km of transmission mains and 121 km of feeder mains, and a new intake with 196 MLD water treatment plant; and (ii) in Madurai, 200 km of distribution pipelines in 37 DMAs, 37 storage reservoirs, 1 pump station (1250 kW),

150 km transmission mains and 109 km feeder mains, and a new intake structure with 125 MLD water treatment plant.

6. Output 3: Institutional capacity, public awareness, and urban governance strengthened. This includes a performance-based urban governance improvement program implemented for 10 project cities to (i) achieve targeted household connections for water and sewerage projects, (ii) timely completion of projects under the MFF as per the original implementation schedule, (iii) actions in fecal sludge management in areas not covered by centralized sewerage system, (iv) reuse of treated wastewater, and (v) implementation of gender action plan. Governance improvement and awareness consultants recruited under Project 1 will support output 3.

B. Purpose of this IEE Report

7. 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 Sewerage (Appendix 1). The potential negative impacts were then identified in relation to pre-construction, construction and operation phases of the proposed UGSS and results of the assessment show that the subproject is unlikely to cause significant adverse impacts. Thus, this initial environmental examination (IEE) has been prepared in accordance with ADB SPS's requirements for environment category B projects.

8. The prepared IEE is based on the detailed project report (DPR) prepared by Tiruppur City Municipal Corporation (TCMC). 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 (EMP) developed as part of the EMP will require the contractor 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

9. This Report contains the following 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

10. Tiruchirappalli is one of the largest city in the state of Tamil Nadu, located on the Chennai – Dindigul National Highway (NH - 45). It is situated in the center of the state, on the banks of Cauvery River (Figure 1), which flows from west to east along the northern periphery of the city. Tiruchirappalli City, spreading over an area of 146.90 square kilometer (km²), was upgraded from Special Grade Municipality to Corporation in the year 1994. Srirangam, a small island situated in Cauvery River, and is part of the city. In 2011, the corporation limit was expanded eastwards to include adjoining local bodies (four village panchayats of Paappakurichi, Ellakudi, Aalathur and Keelkalkandar Kottai, and Thiruverumbur Town Panchayat), thus. the corporation area increased from 20.33 km² to 167.23 km². TCMC has a population of 916,674 (census 2011) and 65 municipal wards, grouped into four administrative zones namely Srirangam, Ariyamangalam, Golden Rock and K. Abishekapuram.

11. The city has prepared a sewage master plan which proposes to extend the existing underground sewage system (UGSS) to cover all the zones, through a four phase program. Phase I has already been completed and for Phase II works, contract has been awarded and the construction works are in progress. Phase III will be implemented under TNUFIP funded by ADB, which will cover recently added areas in the eastern area and remaining uncovered areas in the erstwhile core city area. Phase III has been divided into 8 sewerage zones based on contour levels and hierarchy of the drain system and their tentative locations arrived at for designing the most cost effective system. The proposed sewage collection system, to the extent possible, has been proposed to convey sewage by gravity.

B. Existing Sewerage System

12. The existing UGSS covers most of the highly populated old town areas with gravity collection and pumping to the waste stabilization ponds and STP located at Panjappur on the southern periphery of TCMC with effluent discharged to Koraiyar River and ultimately to the Cauvery River. Sewage generated from other areas (not having UGSS) within TCMC limit is discharged to open drains which ultimately discharge into the network of channels including the Uyyakondan, Koraiyar and Thirumanjana Cauvery which finally reaches the Cauvery and Coleroon Rivers. Details of sewerage schemes implemented till date in TCMC are presented below:

- (i) **Srirangam UGSS Scheme (1956).** Srirangam (erstwhile municipality) was the first area to be provided with UGSS in 1956. Gravity based UGSS with three pump stations were constructed. Sewage was conveyed to the sewage pond at Panjapparai.
- (ii) **Tiruchi UGSS Scheme (1987).** This scheme was implemented during 1987-1992 covering the highly populated areas (covering seven blocks constituting the core area) of current TCMC. Sewage was conveyed through a network of pumping stations to the main pumping station at Promenade Road and from there, to the lagoons/ STP at Panjappur, about 7 km south of city along the Tiruchirappalli – Madurai - Tuticorin Highway (NH-45B).
- (iii) **National River Action Plan (NRAP) Scheme (1995 / 1996).** Under this Government of India scheme, intervention measures for abatement of pollution of Cauvery River was implemented in Tiruchirappalli. Interceptor collectors in major open drains within the city limits were constructed and the sewage is pumped to the lagoons/STP for treatment and disposal.

- (iv) **UGSS Augmentation Scheme under National River Conservation Plan (NRCP), 2008.** Under this Government of India scheme, augmentation of the UGSS commenced in 2003 and was completed in 2008. This scheme essentially covered old town area of Srirangam, Golden Rock zone (erstwhile Golden Rock Municipal area also known as “Ponmalai” and subsequently merged into TCMC) and areas in Tiruchirappalli. The island of Srirangam was fully covered, with a network of sub-pumping stations (5 nos.) and lift stations (6 nos.) which were needed due to sub-surface conditions, sandy with high groundwater table, which precluded laying of sewers at depths greater than 3m. Sewage from Srirangam is pumped across Cauvery River along Chennai – Dindigul National Highway (NH45) to the Golden Rock Pump Station (GRPS-1) in the city. Sewage from areas in the city is conveyed to GRPS – 2 along the National Highway 45 By-Pass Road. Sewage from both the aforementioned GRPS is conveyed through individual pumping mains to the MPS – II at Anna Stadium and ultimately to the STP at Panjappur.
- (v) There are two STP's located at Panjapur totaling 88 MLD capacity (58 MLD + 30 MLD). The 58 MLD treatment plant which is commissioned in 2008 is in good working condition. However, the 30 MLD treatment plant has to be rehabilitated due to connectivity issues between ponds and damages of bund formation.

13. At present, about 31% of total TCMC area is covered with sewerage system, which serve about 52% of the total TCMC population. The city, situated on the south bank of Cauvery River, comprises a network of storm water drains and channels which convey runoff and partially treated wastewater from septic tank and sullage pit overflows to Cauvery River. City is prone to flooding during monsoon season due to flash floods in Cauvery and Coleroon Rivers. Increasing urbanization from regional industrial growth and expansion of city limits by inclusion of adjoining sub-urban and rural local bodies has further increased the demand for proper UGSS service. The zones which require UGSS coverage are as follows: (i) East Zone – Ariyamangalam east and north-east of the core town area, (ii) West Zone – K. Abhisekapuram west and south of the core town area, and (iii) South Zone – Golden Rock to south and south-east of core town area.

14. The Sewage Master Plan of TCMC includes three remaining phases for UGSS expansion as follows: Phase II – East Zone and left-out area in core area ; Phase III – South Zone and South-East zone and Phase IV – Eastern and South-western Zone. It is proposed that Phase II and III will be implemented under TNUFIP, with Phase II and III implemented under Tranches 1 and 2, respectively. Phase IV is expected to be implemented subsequently. This subproject therefore focuses on Phase III, presently uncovered areas in the old city, and extended areas in the eastern part of the city. The overall coverage, in terms of population, by Phase III completion will be about 75%. The balance will be covered under Phases IV.

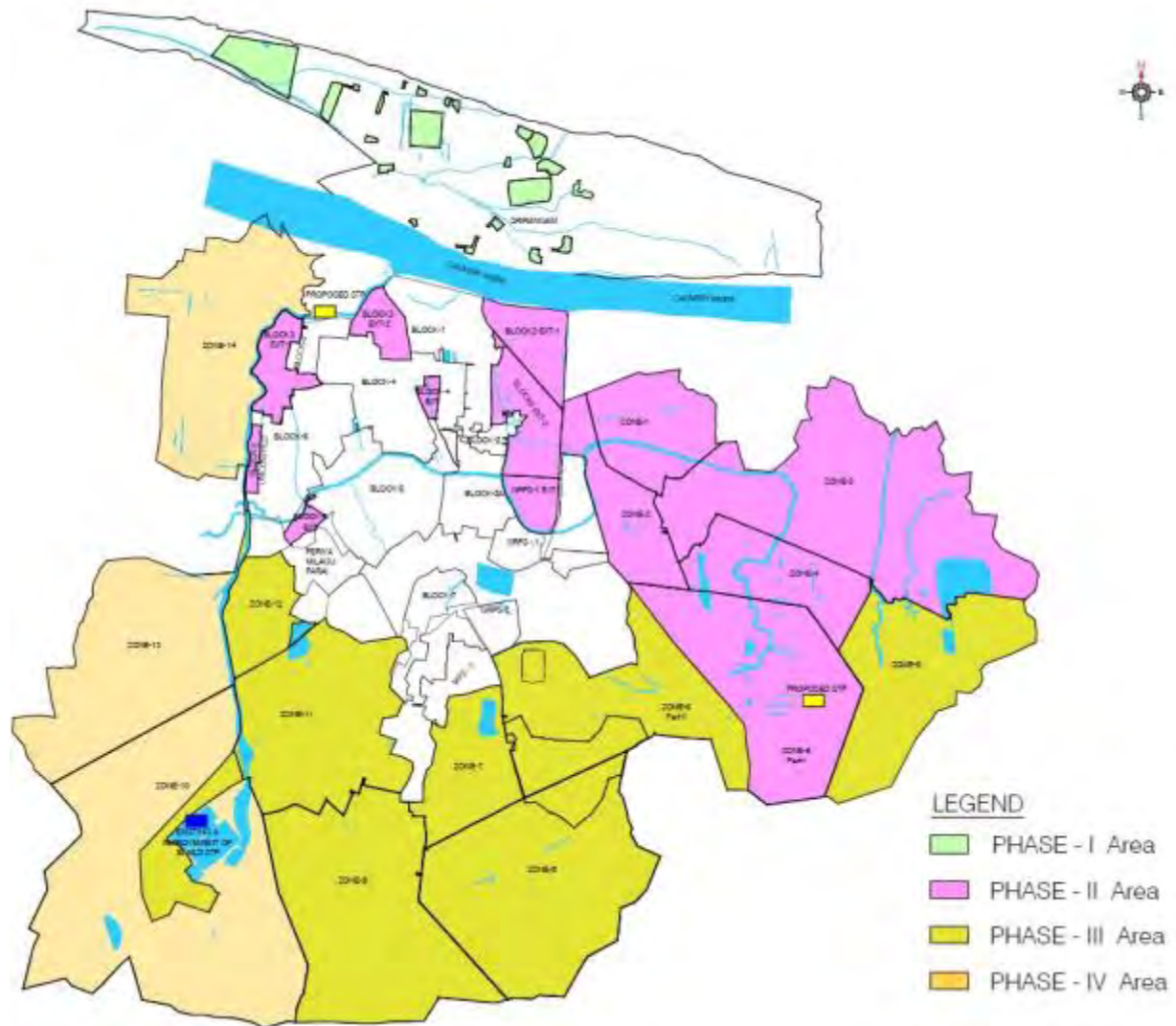
15. Under Phase II, totally four zones (zones 1 to 4) and part of zone 6 is considered at eastern zones and 8 number of left-out pockets (areas) are also considered in the core area. The sewage flow from Zones 1 to 4 and part of Zone flow will go to the proposed (under Phase II scheme) 37 MLD capacity STP at Keelakalkandarkottai (out of 37 MLD, 28 MLD will come under Phase II and remaining 9 MLD, from remaining part of Zone 6 and Zone 5, will come under Phase III scheme). Similarly, sewage flow from the eight left-out pockets (areas) will reach the existing 88 MLD STP at Panjapur. The following components are part of Phase II scheme: (i) sewage collection system (315 km length of sewers); (ii) 24 sewage lift stations; (iii) 5 new sewage pumping station; (iv) pumping main sewers; (v) 12,159 manholes (24 km length); (vi) rehabilitation of existing 30 MLD STP at Panjappur and construction of a new STP (37 MLD) at

Keelakalkandhar kottai; (vii) the treated wastewater disposal into Uyyakondan canal, flowing at 2.7 km from the STP (Keelakalkandhar kottai) site; and (viii) 44,569 house service connections. It covers Eastern zones of Trichy and sewerage left-out areas in the core area.

16. Phase I scheme has been recently commissioned. Phase II scheme has been split into three contract packages, two packages comprising collection network, pumping stations and lifting stations, and the third package comprising STP under design, build, operate and transfer (DBOT) mode. All the three packages have been awarded and the construction works are in progress.

17. **Existing situation in subproject area (South Zone and Southeast).** At present in South Zone and Southeast zone, sanitation is based on septic tanks and sullage/ soak pits. During the monsoon season the capacity of these on site facilities is exceeded causing sullage and septic tank overflow to enter open drains that discharge into the Uyyakondan canal, Koraiyaru and water bodies. This major storm water drain traverses the entire width of TCMC towards the eastern boundary and ultimately reaches Cauvery River. Additionally, low-lying high density areas in the city town area also discharge untreated sewage to Koraiyar River. Therefore, TCMC has identified the wards in the southern zone (Ponamalai), south-western zone (K. Abishekapuram) and Thiruverumbur area of Eastern part of city as high priority areas to be covered by UGSS through this Phase III scheme in order to abate pollution of major channels, such as Uyyakondan Channel, Koraiyar River and Cauvery River.

Figure 1: Location of Subproject



C. Proposed Project

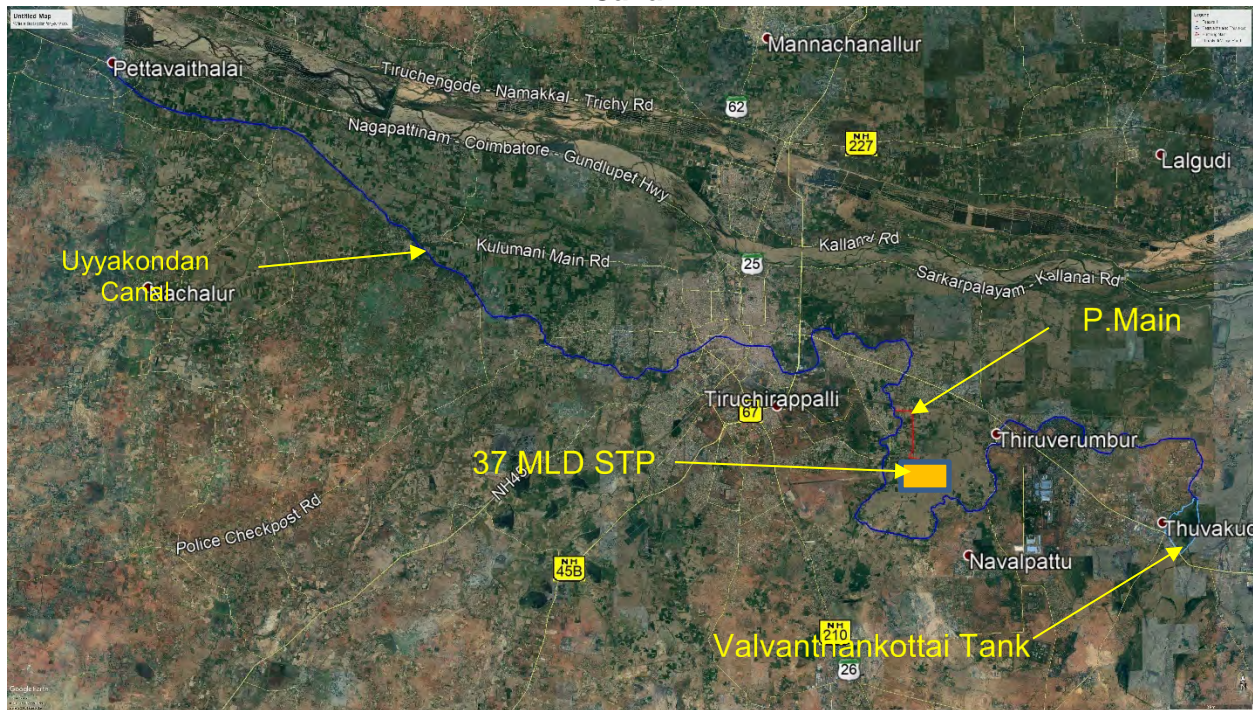
18. This subproject shall provide underground sewerage system in areas within ULB limits, tagged as Phase III scheme areas located south and southeast of Phase II scheme areas. Under Phase III it is proposed to cover all areas in Ponmalai and K. Abishekapuram Zones and Thiruverumbur area within ULB limits. Collection system for Phase-III has been divided into eight sewer subzones, 6 to 9 are in the Ponmalai Zone, 10 to 12 are in the K. Abishekapuram Zone and Sewer subzone 5 is in parts of Ponmalai and Ariyamangalam Zones. Sewer sub-zoning is done for design of the collection system to maximize gravity flow. Collection/command area of the sewer sub-one is designed to be collected at a sewage pumping station (SPS) where gravity collection is not feasible. Intermediate pumping to avoid significant depth of excavation or to provide sewerage in low-lying or counter-sloped areas has been achieved using lift stations. System is designed as a separate underground system catering only to domestic wastewater. Storm water 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 110 liters per capital per day, based on sewage generation rate of 80% of water supply and considering infiltration per Central Public Health and Environmental Engineering Organization norms.

19. Proposed subproject (Phase III) includes (i) sewage collection system (327 km), (ii) 11 sewage lift stations, (iii) 7 sewage pumping station, (iv) pumping main for 20.93 km length, (v) 12,389 manholes, and (vii) 32,000 house service connections.

20. Connecting to STPs: No new or augmentation work in STPs is proposed under this Phase-III subproject. The flow of zone -5 and part of zone-6 (9 MLD) will reach 37 MLD Keelakal kandar kottai STP (these two zonal flows area already considered in proposed STP design capacity at Keelakalkandar Kottai) and the sewage flow of zone 7 to zone 12 (28 MLD) will flow to the existing 88 MLD STP at Panjappur. The nature and size of the various components of the subproject is shows in Table 1. Location of subproject components and conceptual layout plans are shown in Figure 3 to Figure 10.

21. The treated waste water will be carried by the Uyyakondan Canal, which is an irrigation feeder from River Cauvery. The canal starts from Pettavaithali and it travels 18 km inside Corporation boundary. Finally it leads to Vazhavandhankottai Tank at Thuvakudi. The design flow of Canal is about 498 Cumecs. The treated water from the STP, Keelakalkandar kottai is about 37 MLD. The carrying capacity of the canal has been checked and confirmed to accommodate the additional flow of treated water from STP. The calculation details and drawings are as follows:

Figure 2: Google Earth Image showing sewage treatment plant location and Uyyakondan Canal



Design calculation of Uyyakondan Capacity Analysis:

Total design flow from the feeder canal of River Cauvery	=	450.000	Cumecs
Total flow from the STP	=	37.000	MLD
	=	0.428	Cumecs
Total flow into the Surplus canal including flow from STP (Qi)	=	450.428	Cumecs

Capacity calculations for the surplus canal:

Minimum Breadth of the channel	B	=	30	m
Minimum Depth of the channel	d	=	2.5	m
Area	A	B x d =	75	m ²
Perimeter	P	B + 2d =	35	m
Hydraulic radius = (A/P)	R	=	2.14	m
Average Slope	S	=	1 in 400	
Rugosity coefficient	n	=	0.013	
Velocity	V	=	(1/n)*R^{2/3} * S^{1/2}	
		=	6.39	m/s
Discharge Q=AV	Qc	=	479.457	m ³ /s

Since Qc > Qi, Hence Safe

D. Implementation Schedule

22. The works will take about 36 months to complete. The detailed implementation schedule (including pre-construction, construction, commissioning, and operation phases) will be provided in the updated IEE during implementation period.

Table 1: Proposed Subproject Components

Table 11: Proposed 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	327 km 200-700 mm diameter sewers		Sewers will be laid underground in the roads and internal streets in the project area comprising 8 sewerage sub-zones (Ponmalai Zone – 4; and K.Abishekapuram - 3 and part of Ponmalai and Ariyamangalam zones – 1) Sewer lines will be laid in the center 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 in the service roads, and where service roads are unavailable, will be laid along the edge of the road, but mostly within the black top portion. For the roads 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 mostly on main roads (300–700 mm), while the tertiary sewers of small size (200 mm to 300 mm dia) that collect wastewater through house sewer connections will be laid in all streets in the subproject area. Trench size to bury the sewer will be of 0.8 m to 1.6 m wide and 1.2 m to 5 m deep (6 m in small terminal stretches near pump stations) <

Infrastructure	Function	Description	Location																																											
Sewage lift stations (LS)	Lifting station is a small pumping station to lift the sewage to higher level and discharge into a ridge manhole for transporting to the pumping station. Lifting station has a collection well with submersible pumps accommodated inside. The screen arrangement is provided in the previous manhole to the lift station.	11 nos. <i>Components of LS</i> <ul style="list-style-type: none">Lift well (circular)Non-clog submersible pump setsControl panel box <i>Lift stations are essentially proposed as enlarged manholes (either road-side on available land or on road center by enlarging a collection system manhole) fitted with two sewage pumps (small capacity) and a curb or road-side wall mounted Pump Control Panel.</i>	Lift well will be constructed on the road (similar to manholes) where the sewer 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: <table><tr><th>Sl. No.</th><th>Zone No</th><th>New Number</th><th>Location Name</th></tr><tr><td>1</td><td rowspan="2">5</td><td>LS-5 a</td><td>VOC Nagar 3rd street ,Pagavathipuram</td></tr><tr><td>2</td><td>LS-5 b</td><td>Suruli Kovil 1st street , Thiruverumbur</td></tr><tr><td>3</td><td>7</td><td>LS-7a</td><td>Thirumurugan Nagar, near Kajamalai Main Road</td></tr><tr><td>4</td><td>8</td><td>LS-8a</td><td>Sri Sai Nagar, back side of SBIOA school</td></tr><tr><td>5</td><td>9</td><td>LS-9a</td><td>Kaling Nagar, Near Sathanur Road Railway crossing</td></tr><tr><td>6</td><td rowspan="5">11</td><td>LS – 11 b</td><td>Kamarajar Street, KK Nagar</td></tr><tr><td>7</td><td>LS-11 c</td><td>Anbier Nagar, Near underpass of Madurai bye pass road</td></tr><tr><td>8</td><td>LS-11 d</td><td>Indiragandhi Nagar, Ramachandra Nagar Road</td></tr><tr><td>9</td><td>LS-11 e</td><td>Rajivgandhi Nagar,Madurai Main Road</td></tr><tr><td>10</td><td>LS-11 f</td><td>Near Craward weekly market,Madurai Main Road</td></tr><tr><td>11</td><td>12</td><td>LS – 12 a</td><td>Ashok nagar west, karumandapam</td></tr></table>	Sl. No.	Zone No	New Number	Location Name	1	5	LS-5 a	VOC Nagar 3rd street ,Pagavathipuram	2	LS-5 b	Suruli Kovil 1st street , Thiruverumbur	3	7	LS-7a	Thirumurugan Nagar, near Kajamalai Main Road	4	8	LS-8a	Sri Sai Nagar, back side of SBIOA school	5	9	LS-9a	Kaling Nagar, Near Sathanur Road Railway crossing	6	11	LS – 11 b	Kamarajar Street, KK Nagar	7	LS-11 c	Anbier Nagar, Near underpass of Madurai bye pass road	8	LS-11 d	Indiragandhi Nagar, Ramachandra Nagar Road	9	LS-11 e	Rajivgandhi Nagar,Madurai Main Road	10	LS-11 f	Near Craward weekly market,Madurai Main Road	11	12	LS – 12 a	Ashok nagar west, karumandapam
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Sewage pumping stations (SPS)	Collect sewage and pump to main pumping stations	7 nos. (1 main and 6 sub) <i>Components of SPS</i> <ul style="list-style-type: none">Inlet chamberScreen chamberGrit wellSuction wellPump room (3 x 2 m²)Non-clog submersible pump sets	Sewage pump stations are proposed at following locations: <table><tr><th>SPS No</th><th>Location Name</th></tr><tr><td>SPS - 5</td><td>Indira Nagar</td></tr><tr><td>SPS - 7</td><td>Lurdhu Nagar (JK nagar Extension)</td></tr><tr><td>SPS - 8</td><td>Viman vihar,Kulavaipatty</td></tr><tr><td>SPS - 9</td><td>Muthu Kumaraswamy Nagar, K.Sathanur</td></tr><tr><td>SPS - 10</td><td>Panjapur</td></tr><tr><td>SPS - 11</td><td>Karumandapam Crematorium campus, Karumandapam</td></tr><tr><td>SPS-12</td><td>Natchatra nagar (Karumandapam)</td></tr></table>	SPS No	Location Name	SPS - 5	Indira Nagar	SPS - 7	Lurdhu Nagar (JK nagar Extension)	SPS - 8	Viman vihar,Kulavaipatty	SPS - 9	Muthu Kumaraswamy Nagar, K.Sathanur	SPS - 10	Panjapur	SPS - 11	Karumandapam Crematorium campus, Karumandapam	SPS-12	Natchatra nagar (Karumandapam)																											
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Infrastructure	Function	Description	Location																												
Pumping main sewers	Transfer sewage from SPS to another SPS or to STP	20.93 km <i>150-500 mm diameter CI sewers</i> <table border="1"> <thead> <tr> <th>Pipe Diameter</th><th>Materials</th><th>Length in m</th><th>%</th></tr> </thead> <tbody> <tr> <td>150 mm</td><td>CI</td><td>705</td><td>3.4</td></tr> <tr> <td>200 mm</td><td>CI</td><td>1650</td><td>7.9</td></tr> <tr> <td>300 mm</td><td>CI</td><td>7580</td><td>36.2</td></tr> <tr> <td>400 mm</td><td>CI</td><td>2015</td><td>9.6</td></tr> <tr> <td>500 mm</td><td>CI</td><td>8975</td><td>42.9</td></tr> <tr> <td colspan="2">Total</td><td>20,925</td><td></td></tr> </tbody> </table>	Pipe Diameter	Materials	Length in m	%	150 mm	CI	705	3.4	200 mm	CI	1650	7.9	300 mm	CI	7580	36.2	400 mm	CI	2015	9.6	500 mm	CI	8975	42.9	Total		20,925		Pumping main will be laid along the main roads, and the internal roads connecting sewage pumping stations and STP. Sewers will be laid underground in the road carriage way. Pumping mains include: main sewers from one main SPS to existing STP at Panjapur and one SPS (at Zone 5) will pump to proposed STP at keelakalkandhar kottai via SPS-4 ; from sub-SPS and Lift Stations to main SPS and STPs; and from Lift Stations (11 nos.) within collection system to proposed MPS/ SPS .
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Pipe Carrying Bridge (PCB)	Transfer sewage from SPS-9 to existing STP	–A Pipe Carrying Bridge is proposed across Koraiyar River for carrying sewage from SPS-9 to existing STP . The length of PCB is about 140 m (having 24 No of Pillars) and the vertical clearance from HFL is 1.25 m.	Koraiyar River																												
Connecting to Sewage Treatment Plants (STP)	Treatment of collected wastewater to comply with disposal standards		The flow of zone -5 (by pumping main length of 2.01 km) and part of zone-6 (9 MLD) by gravity main will reach 37 MLD Keelakal kandar kottai STP (these two zones flows already considered in STP at Keelakalkandar Kottai) and the sewage flow of zone 7 to zone 12 (28 MLD) will flow to 88 MLD Panjapur (adequate treatment capacity available). The following pumping mains (3 nos.) linked to existing STP. <ol style="list-style-type: none"> 1. From SPS- 10 to STP around 60 m pumping main 2. From SPS-9 to STP around 3.180 km pumping main 3. From SPS-11 to STP around 5.70 km pumping main. Note: Only interconnection of flow from newly covered areas under the proposed Phase-III Scheme is covered under Tranche 2 subproject. New STP (37 MLD cap.) at Keelakanlkandhar kottai and improvement works to existing 30 MLD STP at Panjapur are proposed to be implemented under Phase –II scheme.																												
House service connections	Collect sewage from individual houses and convey into network	<ul style="list-style-type: none"> • 32,000 nos. (domestic and non-domestic) 	At each household, connected to wastewater outlet drain																												

DWCP = double wall corrugated pipe, MLD = million liters per day, NH = national highway, SH = state highway, uPVC = unplasticized polyvinyl chloride.

Figure 3: Layout Plan on Revenue Map for Sewage pumping stations 5

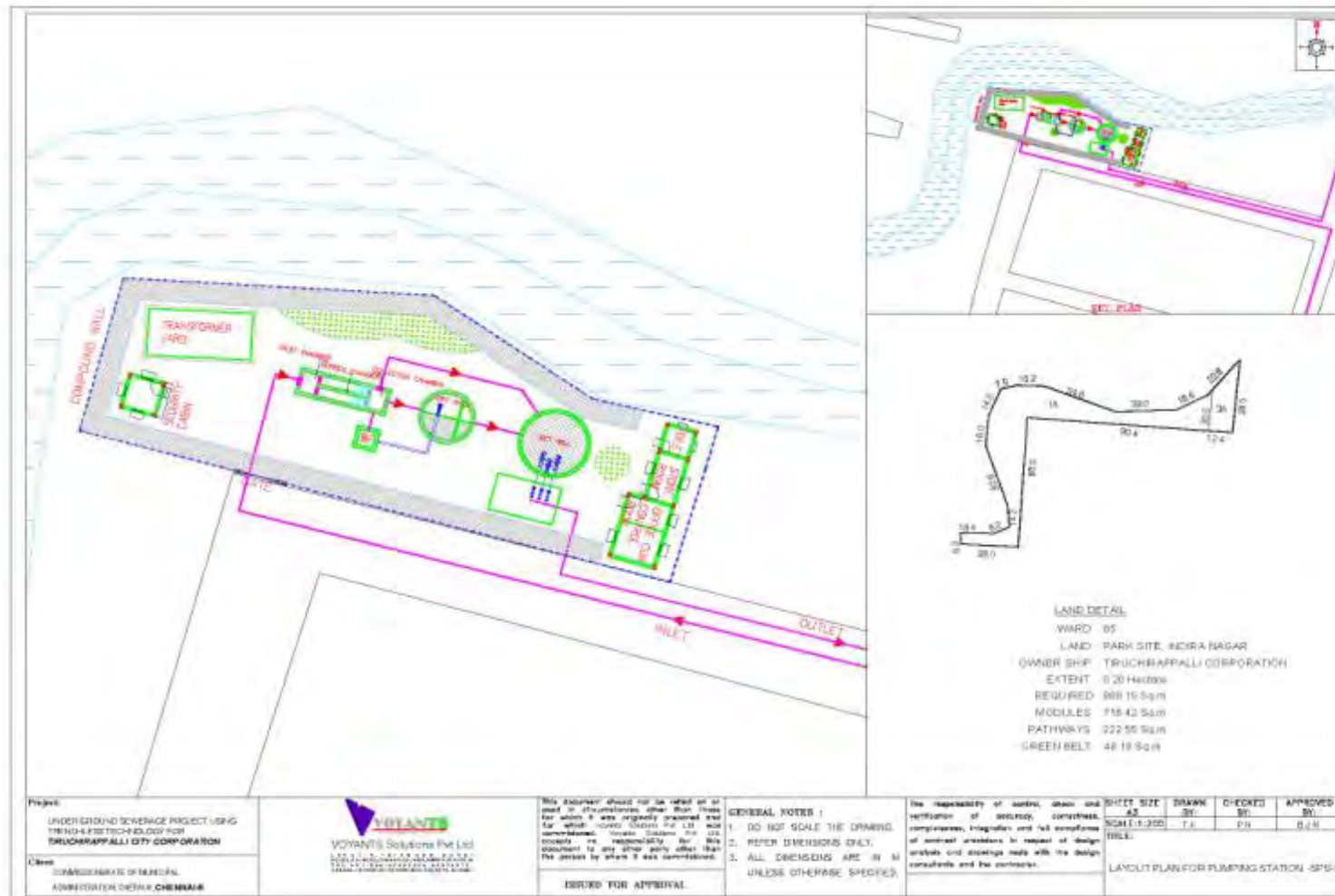


Figure 4: Layout Plan on revenue map for Sewage pumping stations 7



Figure 5: Layout Plan on Revenue Map for Sewage pumping stations 8

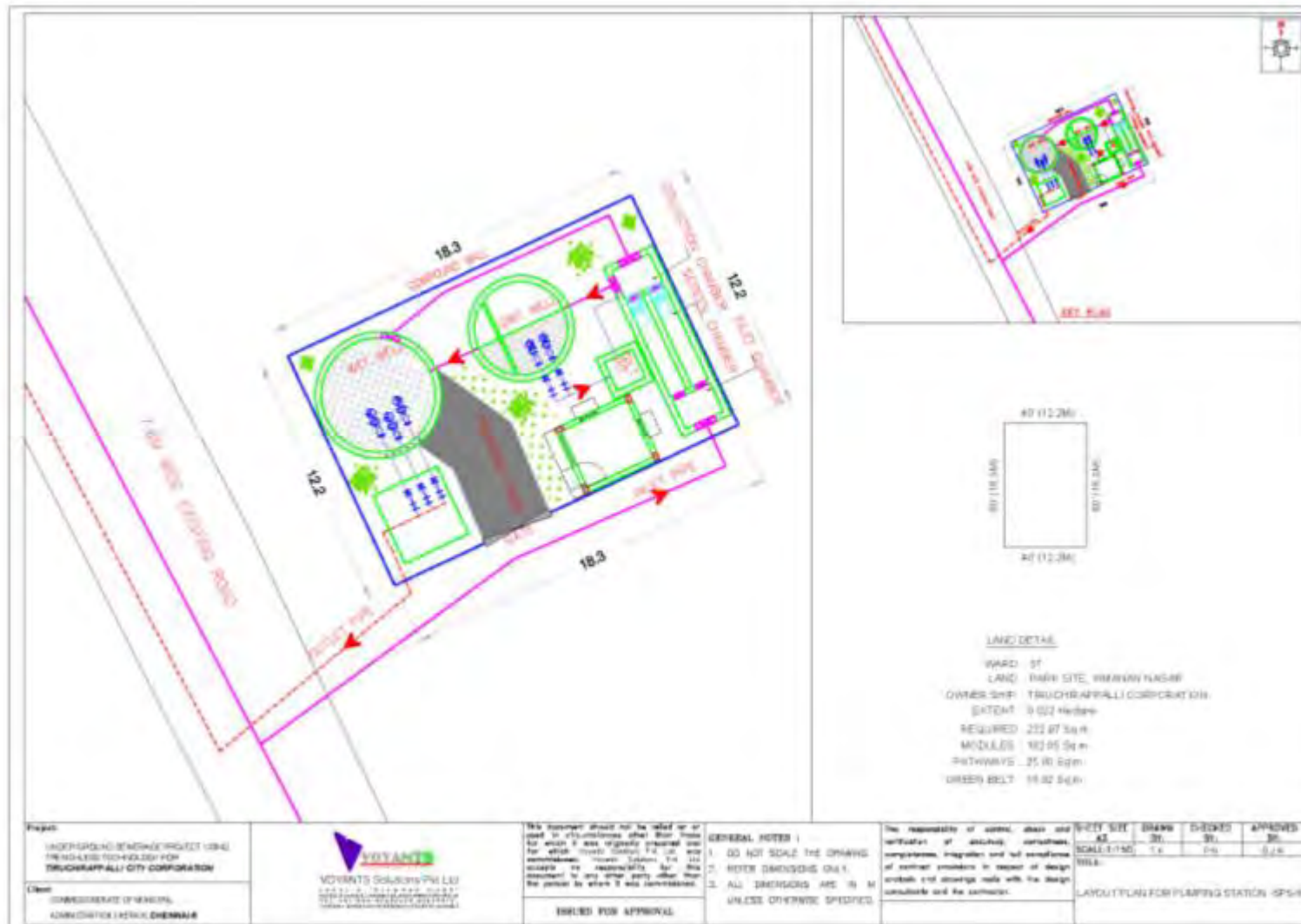


Figure 6: Layout Plan on revenue map for Sewage pumping stations 9

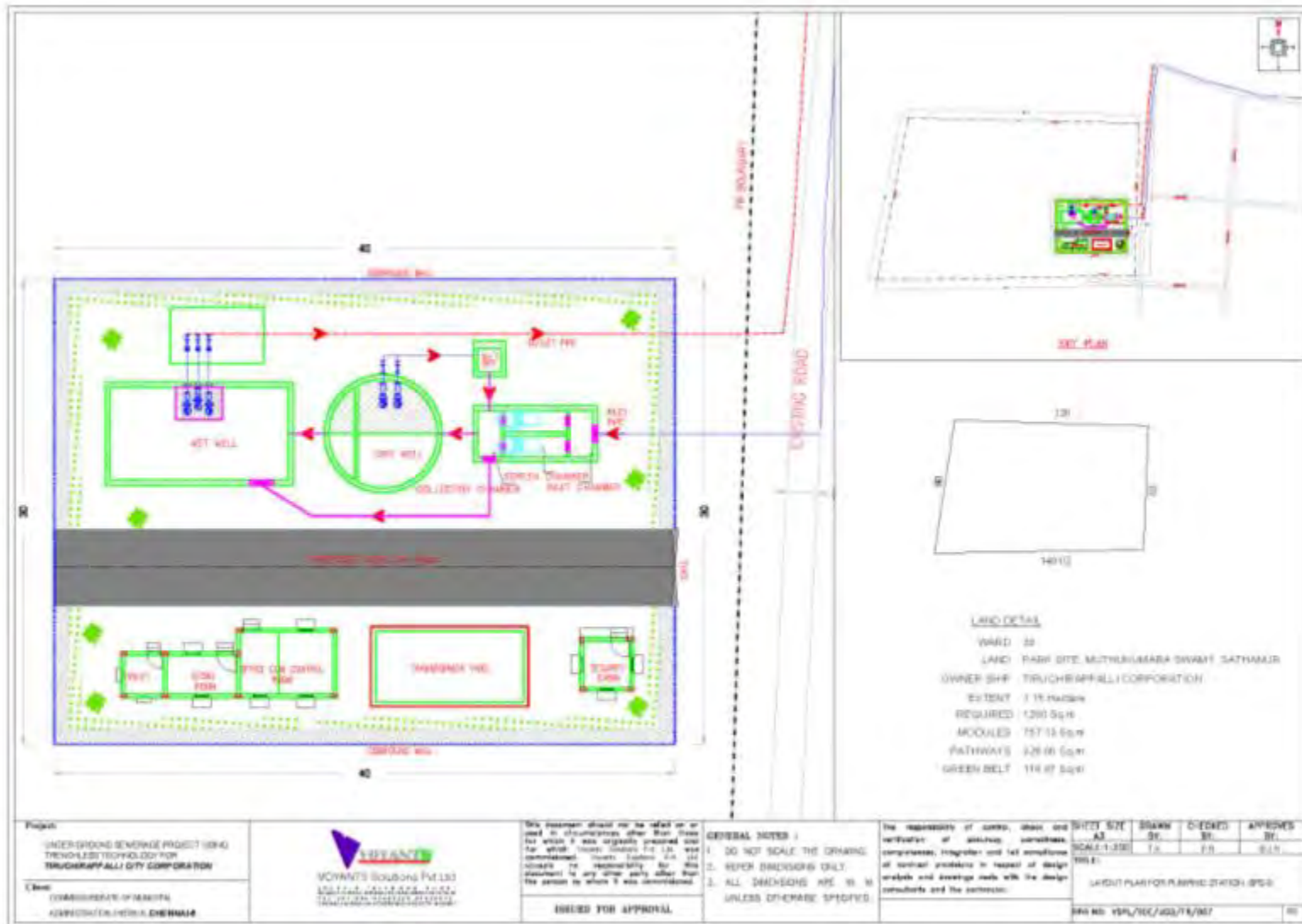


Figure 7: Layout Plan on Revenue Map for Sewage pumping stations 10

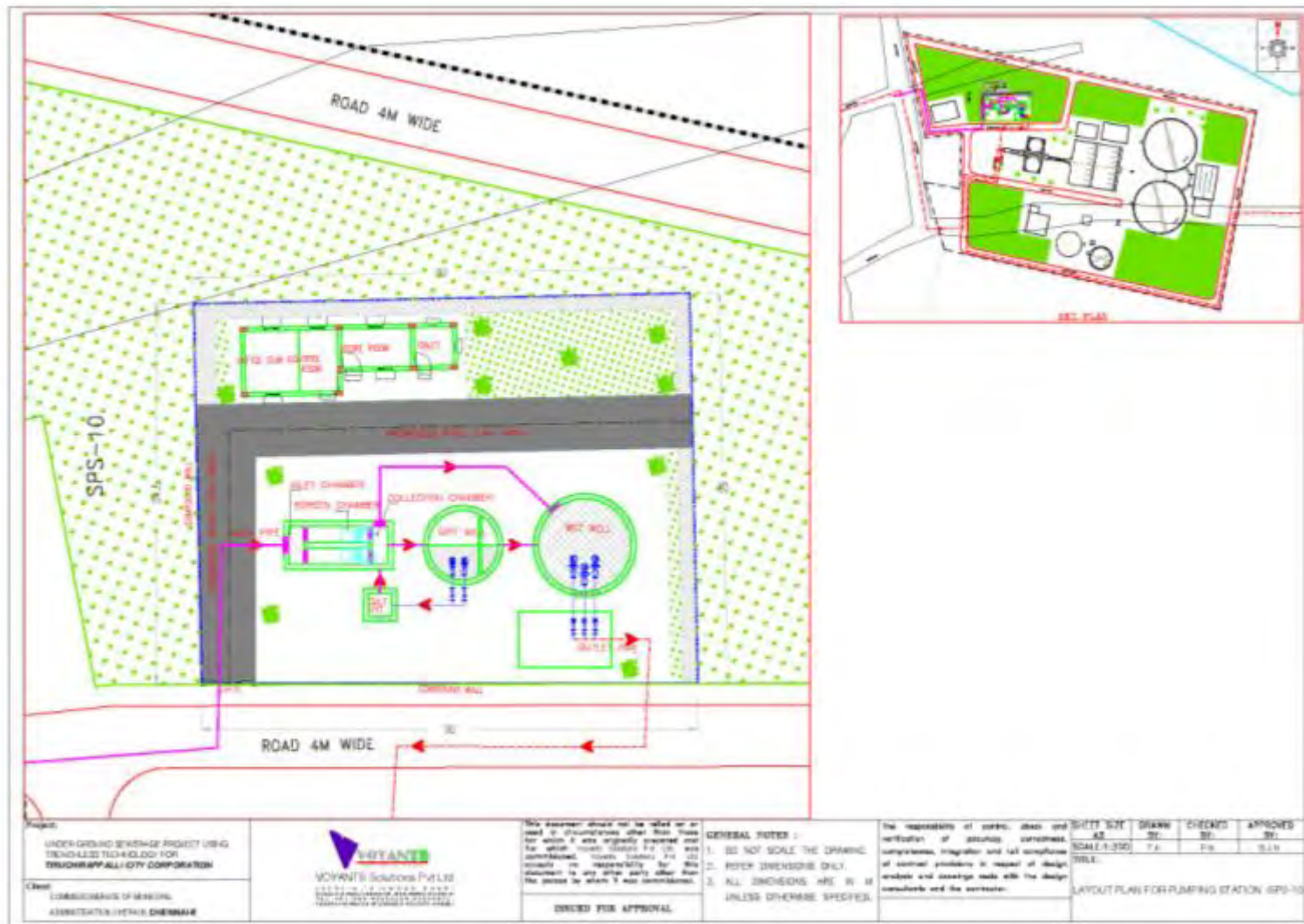


Figure 8: Layout Plan on Revenue Map for Sewage pumping stations 11

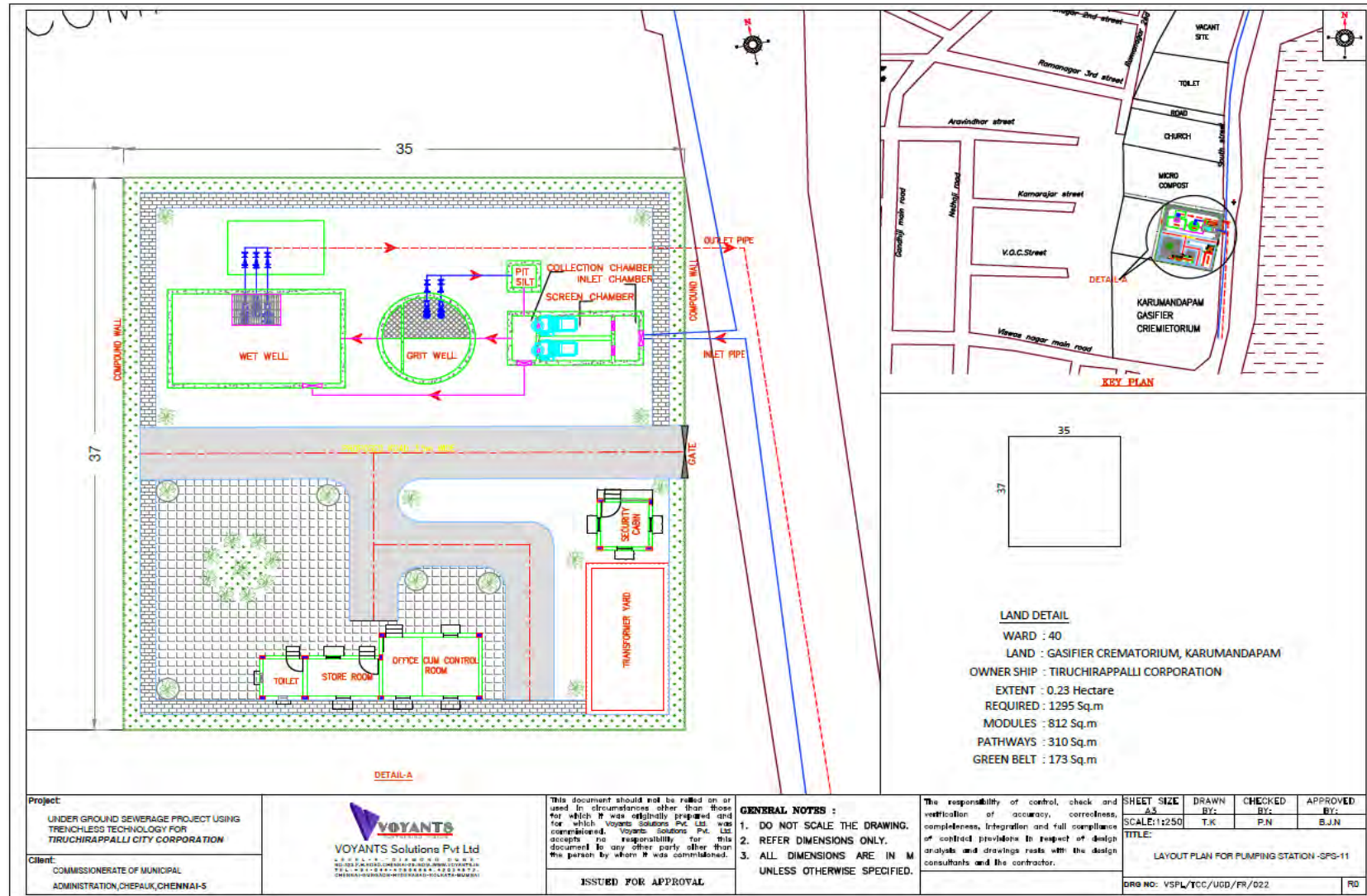
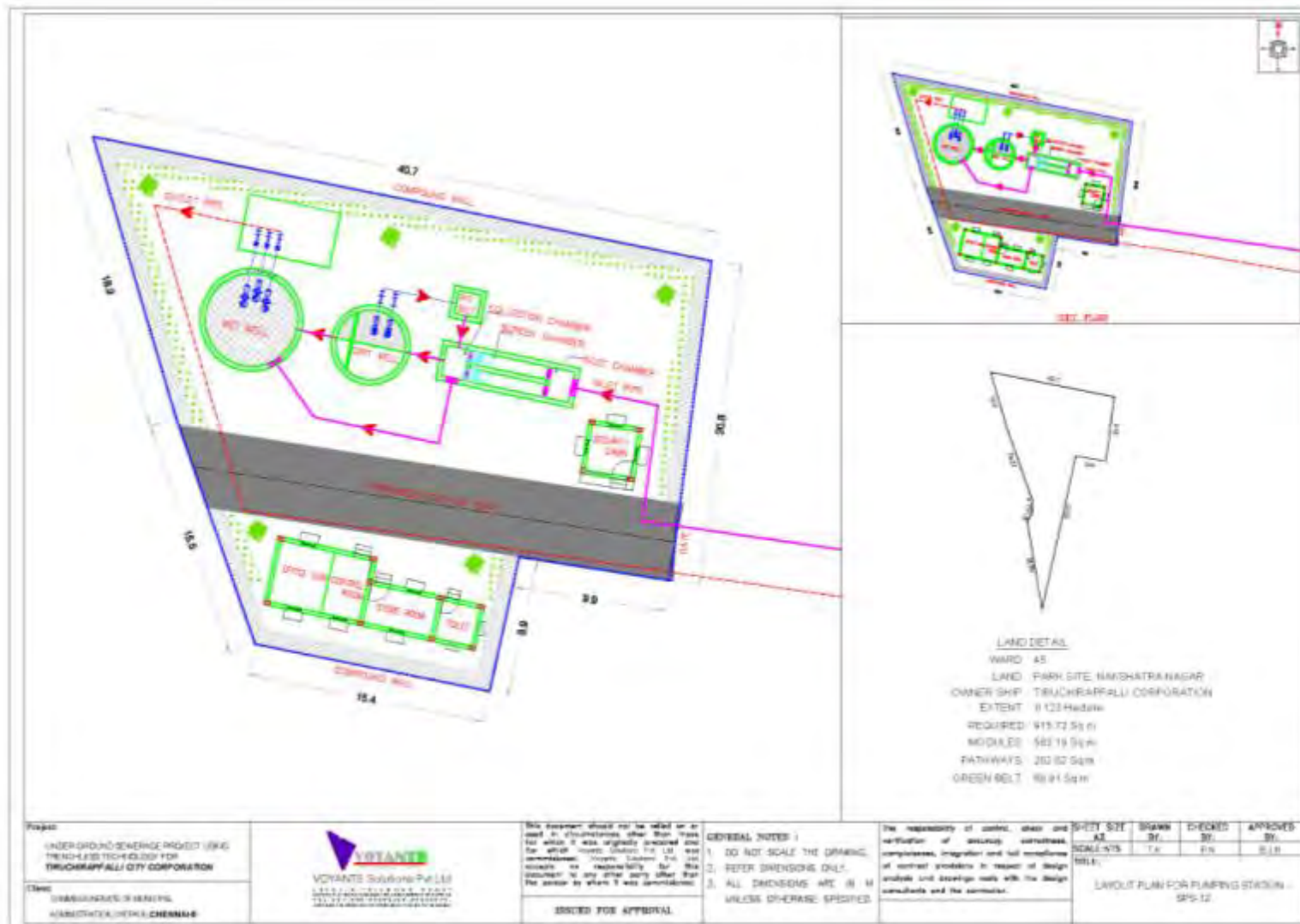
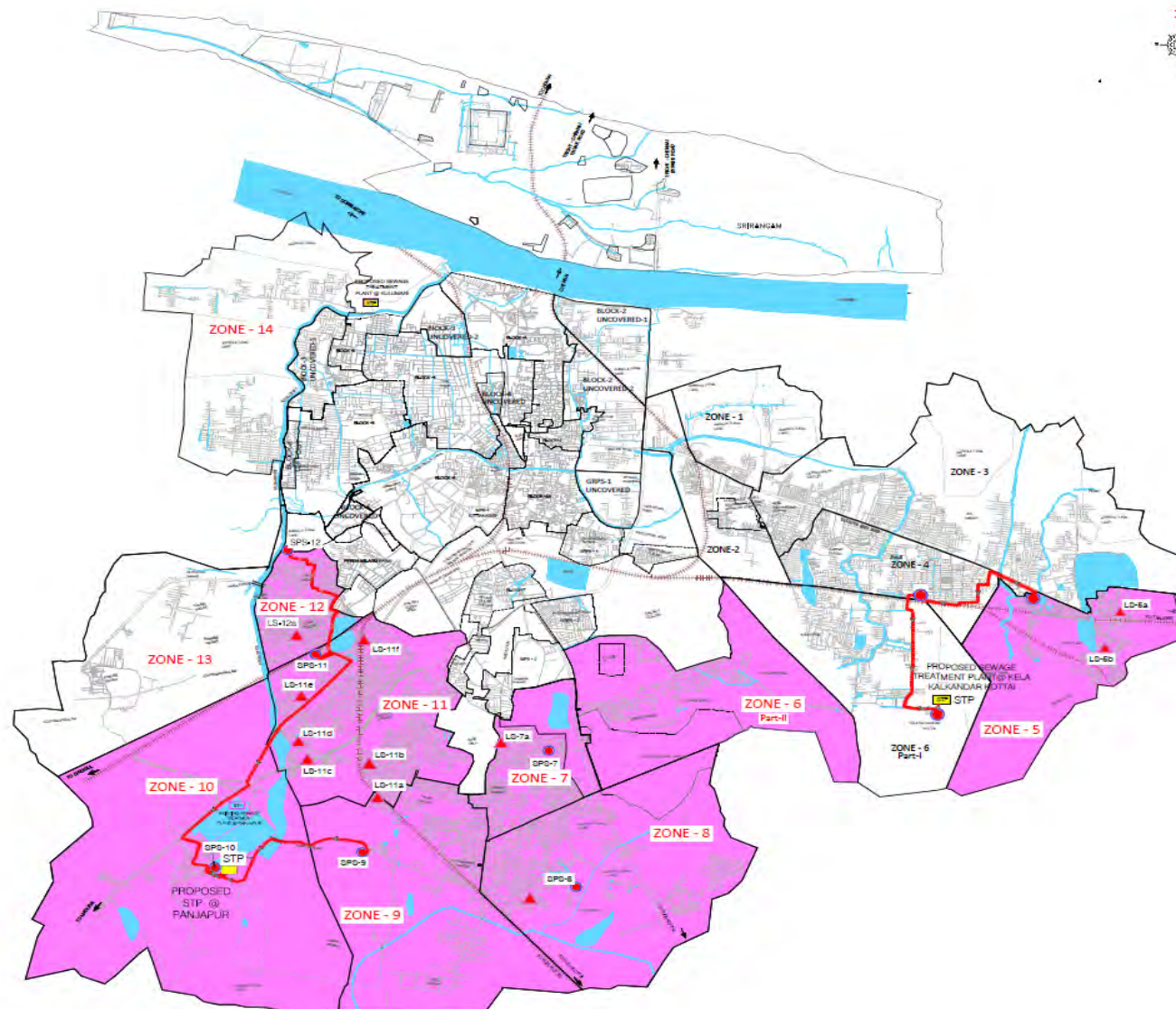


Figure 9: Layout Plan on Revenue Map for Sewage pumping stations 12



[illegible]

III. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. ADB Policy

23. 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.

24. **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.** Projects could have significant adverse environmental impacts. An environmental impact assessment (EIA) is required to address significant impacts.
- (ii) **Category B.** Projects could have some adverse environmental impacts, but of lesser degree or significance than those in category A. An IEE is required to determine whether significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.
- (iii) **Category C.** Projects are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.
- (iv) **Category FI.** Projects involve a credit line through a financial intermediary or an equity investment in a financial intermediary. The financial intermediary must apply an environmental management system, unless all projects will result in insignificant impacts.

25. **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.

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

- (i) for environmental category A projects, draft EIA report at least 120 days before Board consideration;
- (ii) final or updated EIA and/or IEE upon receipt; and
- (iii) environmental monitoring reports submitted by the implementing agency during project implementation upon receipt.

B. National Environmental Laws

27. **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.

28. 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.

29. 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.

30. 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.

31. **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.	Subproject components do not require consent, however the discharge standards will be applicable for disposal of Effluent from the STPs (new and rehabilitation proposed under phase -II).
Environment (Protection) Act, 1986 and 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 for emissions and discharges from the facilities.
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.	<ul style="list-style-type: none"> - 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. 	CTE and CTO from TNPCB is required for hot mix plants, wet mix plants, stone crushers, etc. if installed for construction purposes.

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.
The Ancient Monument and Archaeological Sites and Remains (Amendment and Validation) Act 2010	<p>The Rules designate areas within a radius of 100 m and 300 m from the “protected property/ monument/ area” as “prohibited area” and “regulated area” respectively.</p> <p>Henceforth, no permission for construction of any public projects or any other nature shall be granted in the prohibited areas of the protected monument and protected area</p> <p>In respect of regulated area, the Competent Authority may grant permission for construction, reconstruction, repair and renovation on the basis of recommendation of the National Monument Authority duly taking note of heritage bye-laws, which shall be prepared in respect of each protected monument and protected area</p>	<p>The proposed sewer network in Zone-5 within 300 m of the Erumbeeswarar Temple (an ASI protected monument) is requires permission from ASI.</p> <p>All the works within 300 m of the Erumbeeswarar Temple would be carried out obtaining prior approval from ASI.</p>

Law	Description	Requirement
<p>The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (LARR)</p> <p>The Act shall come into force on 1 January 2014 as notified by the Central Government.</p>	<p>Private land acquisition is guided by the provisions and procedures under this Act. Before the acquisition of any land, the Government is required to consult the concerned Panchayat or Municipal Corporation and carry out a Social Impact Assessment in consultation with them. The Act provides a transparent process for land acquisition for industrialization, development of essential infrastructural facilities and urbanization by giving adequate financial compensation to the affected people.</p>	<p>Land acquisition is not required for this subproject. All the subproject components are proposed in the government land belonging to TCMC (PIU).</p>

ASI = Archeological Survey of India, PIU = program implementation unit, STP = sewage treatment plant, SWM = Solid Waste Management.

32. **Clearances / permissions to be obtained by Contractor.** Following Table shows the list of clearances/permissions required for project construction. This list is 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 3: Clearances and permissions required for Construction

S. No	Construction Activity	Statutory authority	Statute under which Clearance is Required	Implementation	Supervision
1	Tree Cutting	Department of Forest and District Collector	Tamil Nadu Timber Transit Rules, 1968 or latest.	PIU/ CMSC	PIU
2	Hot mix plants, Crushers and Batching plants	TNPCB	Consent to establish and consent to operate under Air Act, 1981	Contractor	PIU
4	Storage, handling and transport of hazardous materials	TNPCB	Hazardous Wastes (Management and Handling) Rules. 1989 Manufacturing, Storage and Import of Hazardous Chemicals Rules, 1989	Contractor	PIU
5	Sand mining, quarries and borrow areas	Department of Geology and mining, GOTN	Tamil Nadu Minor Mineral Concession Rules, 1959 (corrected up to 31 March 2001)	Contractor	PIU
6	New quarries and borrow areas	MOEFCC	Environmental clearance under EIA Notification 2006	Contractor	PIU
7	Groundwater extraction	Public Works Department	Tamil Nadu Groundwater Development and Management Act 2000	Contractor	PIU
8	Disposal of bituminous wastes	Tamil Nadu State Pollution Control Board	Hazardous Wastes (Management and Handling) Rules. 1989	Contractor	PIU

S. No	Construction Activity	Statutory authority	Statute under which Clearance is Required	Implementation	Supervision
9	Temporary traffic diversion measures	-	MORTH 112 SP 55 of IRC codes	Contractor	PIU

CMSC = Construction Management and Supervision Consultant, EIA = environmental impact assessment, GOTN = Government of India, MOEFCC = Ministry of Environment, Forest and Climate Change, MORTH = Ministry of Road Transport and Highways, PIU = program implementation unit, TNPCB = Tamil Nadu Pollution Control Board, WTP = water treatment plant.

33. **ADB SPS Requirements.** During the design, construction, and operation of the project the program management unit (PMU) and program implementation units (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 (www.ifc.org/ehsguidelines). 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, 2009.

Table 4: Applicable Ambient Air Quality Standards for India Projects

Parameter	Location ^a	National Ambient Air Quality Standards ^b	WHO Air Quality Guidelines ($\mu\text{g}/\text{m}^3$)		Applicable Per ADB SPS ^c ($\mu\text{g}/\text{m}^3$)
			Global Update ^d 2005	Second Edition ^e 2000	
Particulate Matter PM ₁₀ ($\mu\text{g}/\text{m}^3$)	Industrial Residential, Rural and Other Areas	60 (Annual) 100 (24-hr)	20 (Annual) 50 (24-hr)	-	20 (Annual) 50 (24-hr)
	Sensitive Area	60 (Annual) 100 (24-hr)	20 (Annual) 50 (24-hr)	-	20 (Annual) 50 (24-hr)
Particulate Matter PM _{2.5} ($\mu\text{g}/\text{m}^3$)	Industrial Residential, Rural and Other Areas	40 (Annual) 60 (24-hr)	10 (Annual) 25 (24-hr)	-	10 (Annual) 25 (24-hr)
	Sensitive Area	40 (Annual) 60 (24-hr)	10 (Annual) 25 (24-hr)		10 (Annual) 25 (24-hr)
Sulfur Dioxide SO ₂ ($\mu\text{g}/\text{m}^3$)	Industrial Residential, Rural and Other Areas	50 (Annual) 80 (24-hr)	20 (24-hr) 500 (10-min)	-	20 (Annual) 800 (24-hr) 500 (10-min)
	Sensitive Area	20 (Annual) 80 (24-hr)	20 (24-hr) 500 (10-min)	-	20 (Annual) 20 (24-hr) 500 (10-min)
Nitrogen Dioxide NO ₂ ($\mu\text{g}/\text{m}^3$)	Industrial Residential, Rural and Other Areas	40 (Annual) 80 (24-hr)	40 (Annual) 200 (1-hr)	-	40 (Annual) 80 (24-hr) 200 (1-hr)
	Sensitive Area	30 (Annual) 80 (24-hr)	40 (Annual) 200 (1-hr)	-	30 (Annual) 80 (24-hr) 200 (1-hr)
Carbon Monoxide CO ($\mu\text{g}/\text{m}^3$)	Industrial Residential, Rural and Other Areas	2,000 (8-hr) 4,000 (1-hr)	-	10,000 (8-hr) 100,000 (15-min)	2,000 (8-hr) 4,000 (1-hr) 100,000 (15-min)

Parameter	Location ^a	National Ambient Air Quality Standards ^b	WHO Air Quality Guidelines ($\mu\text{g}/\text{m}^3$)		Applicable Per ADB SPS ^c ($\mu\text{g}/\text{m}^3$)
			Global Update ^d 2005	Second Edition ^e 2000	
	Sensitive Area	2,000 (8-hr) 4,000 (1-hr)	-	10,000 (8-hr) 100,000 (15-min)	2,000 (8-hr) 4,000 (1-hr) 100,000 (15-min)
Ozone (O_3) ($\mu\text{g}/\text{m}^3$)	Industrial Residential, Rural and Other Areas	100 (8-hr) 180 (1-hr)	100 (8-hr)	-	100 (8-hr) 180 (1-hr)
	Sensitive Area	100 (8-hr) 180 (1-hr)	100 (8-hr)	-	100 (8-hr) 180 (1-hr)
Lead (Pb) ($\mu\text{g}/\text{m}^3$)	Industrial, Residential, Rural and Other Areas	0.5 (Annual) 1.0 (24-hr)	-	0.5 (Annual)	0.5 (Annual) 1.0 (24-hr)
	Sensitive Area	0.5 (Annual) 1.0 (24-hr)	-	0.5 (Annual)	0.5 (Annual) 1.0 (24-hr)
Ammonia (NH_3) ($\mu\text{g}/\text{m}^3$)	Industrial Residential, Rural and Other Areas	100 (Annual) 400 (24-hr)	-		100 (Annual) 400 (24-hr)
	Sensitive Area	100 (Annual) 400 (24-hr)	-	-	100 (Annual) 400 (24-hr)
Benzene (C_6H_6) ($\mu\text{g}/\text{m}^3$)	Industrial Residential, Rural and Other Areas	5 (Annual)	-	-	5 (Annual)
	Sensitive Area	5 (Annual)	-	-	5 (Annual)
Benzo(o) pyrene (BaP) (ng/m^3)	Industrial Residential, Rural and Other Areas	1 (Annual)	-	-	1 (Annual)
	Sensitive Area	1 (Annual)	-	-	1 (Annual)
Arsenic (As) (ng/m^3)	Industrial Residential, Rural and Other Areas	6 (Annual)	-	-	6 (Annual)
	Sensitive Area	6 (Annual)	-	-	6 (Annual)
Nickel (Ni) (ng/m^3)	Industrial Residential, Rural and Other Areas	20 (Annual)	-	-	20 (Annual)
	Sensitive Area	20 (Annual)	-	-	20 (Annual)

^a Sensitive area refers to such areas notified by the India Central Government.

^b http://cpcb.nic.in/uploads/National_Ambient_Air_Quality_Standards.pdf

^c As per ADB SPS, the government shall achieve whichever of the ambient air quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of the government will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

^d WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. *Global update 2005*. WHO. 2006.

^e Air Quality Guidelines for Europe Second Edition. WHO 2000.

Table 5: Applicable Ambient Noise Level Standards for India Projects

Receptor/ Source	Noise Level Standards^a (dBA)		WHO Guidelines Value For Noise Levels Measured Out of Doors^b (One Hour LA_{eq} in dBA)		Applicable Per ADB SPS^c (dBA)	
	Day	Night	07:00 – 22:00	22:00 – 07:00	Day time	Night time
Industrial area	75	70	70	70	70	70
Commercial area	65	55			65	55
Residential Area	55	45	55	45	55	45
Silent Zone	50	40			50	40

^a Noise Pollution (Regulation and Control) Rules, 2002 as amended up to 2010

(<http://cpcb.nic.in/displaypdf.php?id=Tm9pc2UtU3RhbmRhcmRzL25vaXNlX3J1bGVzXzlwMDAucGRm>).

^b Guidelines for Community Noise. WHO. 1999.

^c As per ADB SPS, the Executing Agency shall achieve whichever of the ambient air quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of the government will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS, 2009.

Table 6: Applicable Drinking Water Quality Standards^a for India Projects

Group	National Standards for Drinking Water ^b			WHO Guidelines for Drinking-Water Quality, 4th Edition, 2011 ^c	Applicable Per ADB SPS ^{d,e}
	Parameter	Unit	Max. Concentration Limit		
Physical	Turbidity	NTU	1 (5)	-	1 (5)
	pH		6.5 – 8.5	none	6.5 – 8.5
	Color	Hazen units	5 (15)	none	5 (15)
	Taste and Odor		Agreeable	-	Agreeable
	TDS	mg/l	500 (2,000)	-	500 (2,000)
	Iron	mg/l	0.3	-	0.3
	Manganese	mg/l	0.1 (0.3)	-	0.1 (0.3)
	Arsenic	mg/l	0.01 (0.05)	0.01	0.01
	Cadmium	mg/l	0.003	0.003	0.003
	Chromium	mg/l	0.05	0.05	0.05
	Cyanide	mg/l	0.05	none	0.05
	Fluoride	mg/l	1 (1.5)	1.5	1 (1.5)
	Lead	mg/l	0.01	0.01	0.01
	Ammonia	mg/l	0.5	none established	0.5
Chemical	Chloride	mg/l	250 (1,000)	none established	250 (1,000)
	Barium	mg/l	0.7	none	0.7
	Sulphate	mg/l	200 (400)	none	200 (400)
	Nitrate	mg/l	45	50	45
	Copper	mg/l	0.05 (1.5)	2	0.05 (1.5)
	Total Hardness	mg/l	200 (600)	-	200 (600)
	Calcium	mg/l	75 (200)	-	75 (200)
	Zinc	mg/l	5 (15)	none established	5 (15)
	Mercury	mg/l	0.001	0.006	0.001
	Aluminum	mg/l	0.1 (0.3)	none established	0.1 (0.3)
	Anionic detergents	mg/l	0.2 (1.0)	none	0.2 (1.0)
	Phenolic compounds	mg/l	0.001(0.002)	none	0.001(0.002)
	Residual Chlorine	mg/l	0.2	5	0.2
Microbial indicator	E-coli	MPN/100ml	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample
	Total Coliform	MPN/100ml			

^a <http://cgwb.gov.in/Documents/WQ-standards.pdf>.

^b Bureau of India Standard 10500: 2012 (Indian Standard, Drinking Water — Specification (Second Revision).

^c Health-based guideline values.

^d As per ADB SPS, the government shall achieve whichever of the drinking quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of the government will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS, 2009.

^e Figures in parenthesis are maximum limits allowed in the absence of alternate source.

Table 7: General Standards for Discharge of Environmental Pollutants^a
Part- A: Effluents (SCHEDULE – V)

Sl. no	Parameter	Inland surface water	Public sewers	Land for irrigation	Marine/ coastal areas
1	Suspended solids mg/l, max.	100	600	200	(a) For process waste water (b) For cooling water effluent 10 % above total suspended matter of influent
2	Particle size of suspended solids	shall pass 850 micron IS Sieve	-	-	(a) Floatable solids, solid s max. 3 mm (b) Settleable solids, max 856 microns
3	pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
4	Temperature	shall not exceed 5°C above the receiving water temperature	-	-	shall not exceed 5°C above the receiving water temperature
5	Oil and grease, mg/l max	10	20	10	20
6	Total residual chlorine, mg/l max	1	-	-	1
7	Ammonical nitrogen (N), mg/l, max	50	50	-	50
8	Total kjeldahl nitrogen (N) mg/l, max	100	-	-	100
9	Free ammonia (NH ₃), mg/l, max.	5	-	-	5
10	Biochemical Oxygen Demand (3 days at 27°C), mg/l, max	30	350	100	100
11	Chemical Oxygen Demand, mg/l, max	250	-	-	250
12	Arsenic (As) mg/l, max.	0.2	0.2	0.2	0.2
13	Mercury (Hg), mg/l, max.	0.01	0.01	-	0.01
14	Lead (Pb) mg/l, max	0.1	1	-	2
15	Cadmium (Cd) mg/l, max	2	1	-	2
16	Hexavalent chromium (Cr +6), mg/l, max.	0.1	2	-	1
17	Total Chromium (Cr) mg/l, max.	2	2	-	2
18	Copper (Cu) mg/l, max.	3	3	-	3

Sl. no	Parameter	Inland surface water	Public sewers	Land for irrigation	Marine/ coastal areas
19	Zinc (Zn) mg/l, max	5	15	-	15
20	Selenium (Se) mg/l, max	0.05	0.05	-	0.05
21	Nickel (Ni) mg/l, max.	3	3	-	5
22	Cyanide (CN) mg/l, max	0.2	2	0.2	0.2
23	Fluoride (F) mg/l, max.	2	15	-	15
24	Dissolved phosphates (P), mg/l, max	5	-	-	-
25	Sulphide (S) mg/l, max.	2	-	-	5
26	Phenolic compounds (C ₆ H ₅ OH) mg/l, max.	1	5	-	5
27	Radioactive materials:				
	(a) Alpha emitters micro curie mg/l, max.	10 ⁻⁷	10 ⁻⁷	10 ⁻⁸	10 ⁻⁷
	(b) Beta emitters micro curie mg/l	10 ⁻⁶	10 ⁻⁶	10 ⁻⁷	10 ⁻⁶
28	Bio-assay test	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
29	Manganese	2 mg/l	2 mg/l	-	2 mg/l
30	Iron (Fe)	3mg/l	3mg/l	-	3mg/l
31	Vanadium (V)	0.2mg/l	0.2mg/l	-	0.2mg/l
32	Nitrate Nitrogen	10 mg/l	-	-	20 mg/l

^a <http://cpcb.nic.in/industry-effluent-standards/>

IV. DESCRIPTION OF THE ENVIRONMENT

A. Methodology Used for Baseline Study

34. **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.

35. The literature survey broadly covered the following:

- (i) Project details, reports, maps, and other documents prepared by detailed project report (DPR) technical consultants and TCMC;
- (ii) Discussions with Technical experts of the PPTA team, TNUIFSL, implementing agency and DPR technical consultants 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.

36. **Ocular inspection.** Several visits to the project sites were made during IEE preparation period in 2018 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

socio-economic study was conducted to determine the demographic information, existing service levels, stakeholder needs and priorities.

B. Physical Resources

1. Location, Area and Connectivity

37. Tiruchirappalli is one of the largest city in the state of Tamil Nadu. Geographically, it is situated in the center of the state, on the banks of the Cauvery River. Tiruchirappalli City spreading over an area of 146.90 km² was upgraded from Special Grade Municipality to Corporation in the year 1994. During the year 2011, the adjacent local bodies including Paappakurichi Village Panchayat, Ellakudi Village Panchayat, Aalathur Village Panchayat, Keelkalkandar Kottai Village Panchayat and Thiruverumbur Town Panchayat measuring 20.33 km² were added with the Corporation. Thus the total area of TCMC became 167.23 km² and it is divided into 65 wards with a population of 9.16 lakhs (as per census 2011).

38. Tiruchirappalli is well connected with major cities in Tamil Nadu by road network (connected by 4 National Highways, 2 State Highways and several District Roads with other major towns of the state). By virtue of its location, Tiruchirappalli city serves as an important link from north to south and east to west across the state. Tiruchirappalli town, Srirangam and Golden rock are part of Tiruchirappalli urban agglomeration and also developing as a regional metropolis, extending its influence over the entire Tiruchirappalli and Thanjavur districts. The influence of Tiruchirappalli extends up to Cuddalore, Villupuram, Vellore, Salem, Erode, Dindigul and Pudukottai Districts.

39. Tiruchirappalli is an important Divisional Headquarters of Southern Railways. Tiruchirappalli is well connected by rail to Chennai, Kanyakumari, Madurai, Thanjavur, Rameswaram, Coimbatore and Bangalore. Tiruchirappalli junction is the main station for passengers as well as goods movement. Tiruchirappalli has an International Airport located on the Pudukottai road at a distance of 6 km. City is connected by air with Chennai, Madurai, Thiruvananthapuram, Sri Lanka, Singapore and middle east countries.

40. Tiruchirappalli is bound on the north by Namakkal District, Northeast by Perambalur District, East by Thanjavur District, southeast by Pudukottai District, south by Sivaganga and Madurai Districts, Southwest by Dindigul District and on the West by Karur District. It is a city known for its educational institutions, industries, and temples. Tiruchirappalli, is a commercial and tourist hub of Tamil Nadu. The most prominent landmark is ASI protected Rock Fort Temple, a spectacular monument perched on a massive rocky outcrop which rises abruptly from the plains to tower over the old city.

2. Topography, Soils and Geology

41. Tiruchirappalli lies between 10°10' and 11° 20' of the northern latitude and 78°10' and 79° 0' of eastern latitude. The general slope of the city is towards east. Pachamalai Hill is an important peak rising up to 1,015 m, located at Sengattupatti Reserve Forest. Prominent geomorphic units identified in Tiruchirappalli are alluvial plains, shallow and deep buried sediments, valley fills and structural hills.

42. Geologically, Tiruchirappalli is underlain by formations ranging in age from Achaean to recent formation. Crystalline rocks comprising Charnockites, gneiss occupy a major part of the district. Alluvial deposits are restricted to major drainage courses and foothill zones. The geology

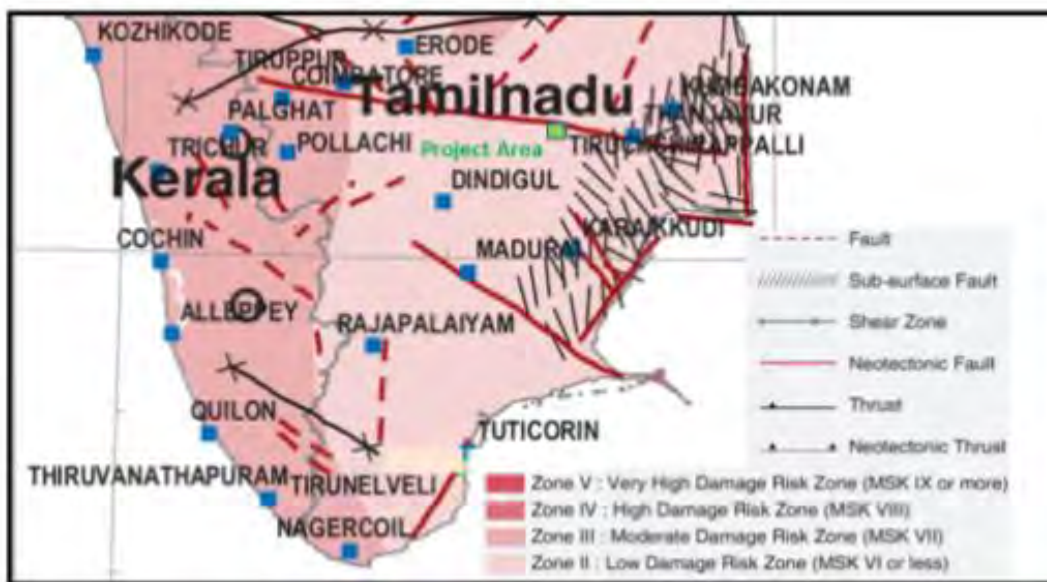
of Tiruchirappalli is mainly hard rock, mostly Charnockites and mixed gneiss with river alluvium. The cretaceous formations consisting of limestone, calcareous shale, clay, argillaceous sandstones etc. occur in parts of Tiruchirappalli. There is no incidence of land subsidence in and around project area. The hydro-geology of the city is represented by hard rock aquifers along the northern and north- western part.

43. The important aquifer systems in Tiruchirappalli are constituted by weathered and fractured crystalline rocks. Groundwater occurs under pre-tertiary conditions in the weathered residuum and under semi-confined to confined conditions in deeper fracture zones. Recent alluvial deposits and semi-consolidated formations are found to form localized, discontinuous aquifers with low to moderate field potentials.

3. Seismology

44. Bureau of Indian Standards, based on the past seismic history, grouped the country into four seismic zones, viz. Zone II, III, IV and V. Of these, Zone V is the most seismically active region, while zone II is the least. As per the Modified Mercalli (MM) intensity scale, which measures the impact of the earthquakes on the surface of the earth, the subproject area comes under Low Damage Risk Zone II.

Figure 11: Seismic Zone of Project Area



Source: BMTPC.

4. Climatic Conditions

45. The district has a tropical climate. The region experiences four main seasons: Winter Season (December to February), Summer Season (March to May), Windy Season (June to August) and, Monsoon (September to November). The period from April to June is generally hot and dry. The weather is pleasant during the period from November to January. Usually mornings are more humid than afternoons. The relative humidity varies between 50% and 85% in the mornings while in the afternoon it varies between 70% and 92%.

46. The normal annual rainfall over the district varies from about 730 mm to about 900 mm. The minimum rainfall was recorded at Musiri (731.9 mm) in the western part of the district. The rainfall intensity gradually increases towards north, east and south and reaches a maximum of 908.5 mm at Manapparai.

Table 8: Annual Rainfall in Tiruchirappalli

Year	2011	2012	2013	2014	2015	Normal Rainfall
Rainfall in mm	806.90	626.90	522.90	535.70	862.0	818.0

Source : IMD Chennai.

5. Surface Water

47. Tiruchirappalli falls under Cauvery River Basin. The Cauvery River is the most important River in the district and the tributaries of Cauvery, i.e., Coleroon River, Koraiyar river, Ariyar, Malattar channel and Uyyakondan canal also drain in Tiruchirappalli. The river splits into two branches, the northern branch being called the Coleroon (Kollidam) and the southern branch called Cauvery River. Ponnaniar, Uppamodai and Siddhayalli reservoirs are mainly used for irrigation purposes in this region. All the channels except Cauvery are ephemeral in nature.

48. Water quality monitoring in Cauvery River is conducted at various locations regularly by Central Pollution Control Board (CPCB) in the upstream and downstream of Tiruchirappalli town. According to the water quality data of 2014 (Table 9), Cauvery River water quality is classified as B; pH of water ranged between 7.4 and 8.4 and biochemical oxygen demand (BOD) ranged between 0.2 and 18 mg/l. The presence of the Coliforms in water quality indicates the contamination due to the inlet of sewage water into the Cauvery River.

49. There are several channels/streams crisscross the city. These include Uyyakondan, Koraiyar and Thirumanjana Cauvery which finally merges into the Cauvery and Coleroon Rivers. With exemption to Uyyakondan channel, the water quality data is not available for rest of the channels/ streams, The water quality information collected for Uyyakondan channel during the IEE assessment is furnished in Table 10. The outcome of the analysis reveals that the surface water is contaminated with higher number of E.coli/ coliforms. The recorded BOD values are also high indicating the strong presence of organic pollution.

Table 9: Water Quality of Cauvery River near Tiruchirappalli

Locations	D.=O (mg/l)			pH			Conductivity (µmhos/cm)			BOD (mg/l)			Nitrate- N+ Nitrite-N (mg/l)			Fecal Coliform (MPN/100ml)			Total Coliform (MPN/100ml)		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Water Quality Criteria	> 4 mg/l			6.5-8.5						< 3 mg/l						< 2500 MPN/100ml			< 5000 MPN/100ml		
Cauvery At Pettaivaithalai, Tiruchirappalli	6.4	10.8	8.6	7.9	8.8	8.3	287	812	575	0.5	3.7	1.3	0	0.5	0.2	260	170000	24822	320	350,000	54,768
Cauvery At Tiruchirappalli U/S	5.9	9.7	8.1	7.9	8.7	8.4	236	686	489	0.2	7.2	1.8	0.03	0.37	0.2	220	170000	23957	330	280,000	57,494
Cauvery At Tiruchirappalli D/S	1.2	8.4	5.5	7.4	8.6	8	279	1438	829	0.7	18	5.5	0	6.14	0.7	320	11000000	975610	390	22,000,000	1,939,974
Cauvery At Tiruchirappalli, Grand Anaicut	3.7	10.2	6.5	7.8	8.8	8.2	274	1323	728	0.8	12	3.7	0.05	0.48	0.2	320	540000	73607	390	920,000	127,304

BOD = Bio-Chemical Oxygen demand, mg/l = milligrams per liter, MPN = most probable number.

Source: cpcbenviis.nic.in

Table 10: Baseline water quality at Uyyakondan Channel

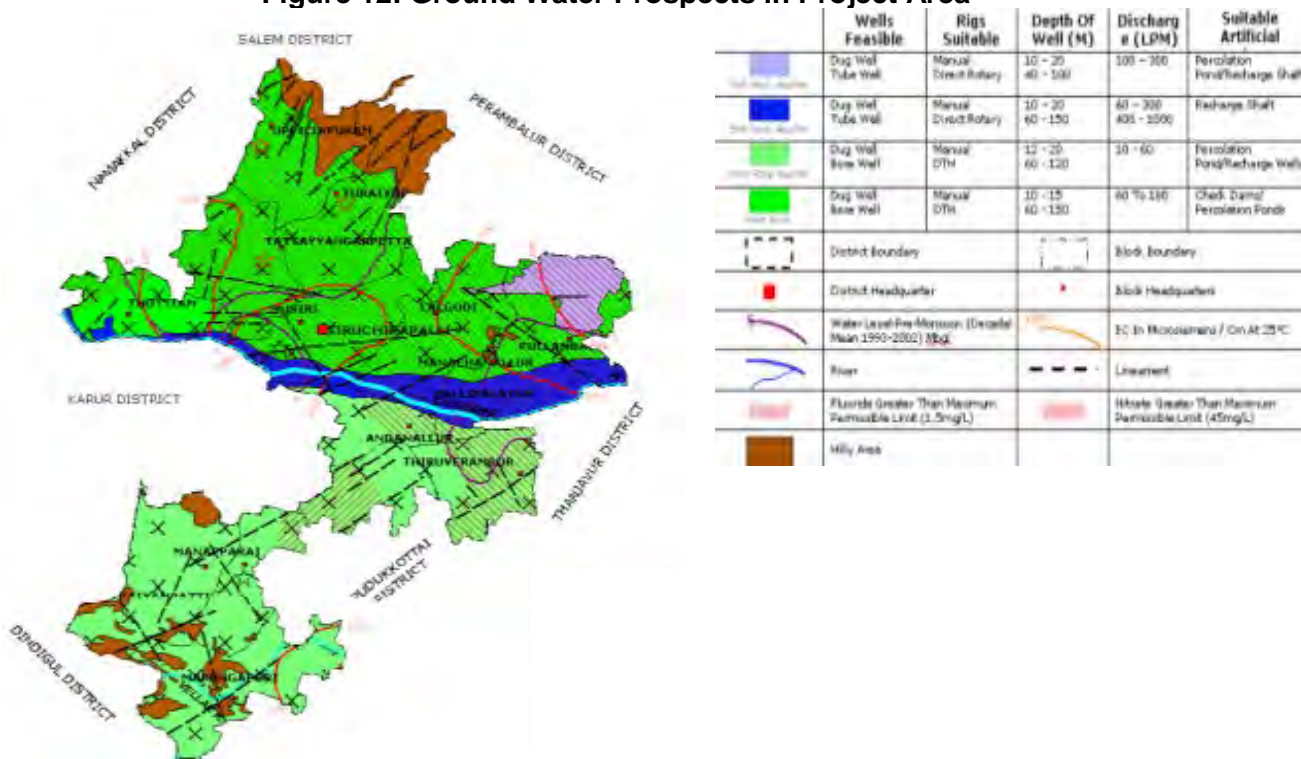
S. No	Parameters	Results River Cauvery's Tributary ,Uyyakondan Channel
1	Color	Slightly Yellowish
2	Odor	Agreeable
3	pH	7.3
4	Electrical conductivity (EC) (Reciprocal mehn ohms Cm ³ at 20°C)	670
5	Turbidity as NTU	10
6	Ammoniacal Nitrogen as N (mg/l)	6.16
7	Nitrite- Nitrogen as NO ₂ (mg/l)	Trace
8	Nitrite Nitrogen as NO ₃ (mg/l)	0.5
9	Dissolved Phosphate as PO ₄ (mg/l)	0.123
10	Oxidisable Organic matter (Tidy' s) (mg/l)	1.84
11	Dissolved Oxygen (D.O) (mg/l)	5.8
12	Bio-Chemical Oxygen demand (BOD) (5th day at 20° c) (mg/l)	3.2
13	Chemical Oxygen Demand (COD) (mg/l)	69.0
14	Sodium as Na (mg/l)	32.0
15	Potassium as K (mg/l)	9.9
16	Calcium as Ca (mg/l)	40.0
17	Magnesium as Mg (mg/l)	22.0
18	Total dissolved Solids (mg/l)	470.00
19	Total Hardness as Ca Co ₃ (mg/l)	192.00
20	Alkanity CaCo ₃ (mg/l)	180.00
21	Phenolphthalein Alkalinity (mg/l)	0
22	HCO ₃ Alkalinity (mg/l)	0
23	Chloride as Cl (mg/l)	85.0
24	Sulphate as SO ₄ (mg/l)	80.0
25	Fluride as F (mg/l)	0.40
26	Total Iron as Fe (mg/l)	0.1
27	Boran as B (mg/l)	Nil
28	Arsenic as As (mg/l)	Nil
29	Cadmium as Cd (mg/l)	Nil
30	Mercury as Mg (mg/l)	Nil
31	Zinc as Zn (mg/l)	Nil
32	Chromium as Cr (total) (mg/l)	Nil
33	Lead as Pb (mg/l)	Nil
34	Nickel as Ni (mg/l)	Nil
35	Phenolic Compound as C ₆ H ₅ OH (mg/l)	Nil
	Bacteriological examination	
36	Total Colonies per ml on agar at 37 °C	60 X 10 ² /ml
37	MPN of coliform bacteria per 100 ml	3450 / 100 ml
38	Fecal coliform bacteria isolated	E-coli
39	Microscopical Examination	Monas,Coleps,Anacystis,Actinophyrus, Pedestrum,Paramecium,scenesmus, Coelastrum,Epiphasres ,Selenastrum

mg/l = milligrams per liter.

6. Groundwater

50. The estimation of groundwater resources for the district has shown that out of 14 blocks, 4 blocks are categorized as over exploited, one block as 'critical' and rest are 'safe'.

Figure 12: Ground Water Prospects in Project Area



Source: CGWB.

51. **Groundwater Quality.** Groundwater in phreatic aquifers in Tiruchchirappalli district, in general, is colorless, odorless and slightly alkaline in nature. The electrical conductivity of ground water in phreatic zone (in microsiemens at 25°C) during May 2006 was in the range of 570 to 4550 $\mu\text{S}/\text{cm}$ and major parts of the district are having the electrical conductivity above 1,700 $\mu\text{S}/\text{cm}$. In general the groundwater is suitable for drinking and domestic uses. However, the concentration of fluoride (in comparison with BIS permissible limit) is observed to be high at Siruganallur (1.85 mg/L).

52. **Ambient Air and Noise Quality.** No regular ambient air or noise quality monitoring is conducted by Tamil Nadu Pollution Control Board (TNPCB) in Tiruchirappalli. However, random monitoring has been conducted for 24 hours by TNCPB/CPCB. The ambient air quality recorded in 2014 shows the concentration of oxides of Sulphur and nitrogen is well below the stipulated ambient air quality standards, however, the concentration of particulate matter is above the standard. Of the 5 monitoring locations, particulate matter recorded in the two locations are well within the limits, one location has slightly above the limits, and at the remaining two locations, particulate matter is much higher than the limits. Dry weather conditions and traffic contributes to the high particulate matter to the ambient air. No data/ information on the ambient noise levels are available.

Table 11: Ambient Air Quality in Tiruchirappalli

Sl. No	Monitoring day	Concentrations of Air Pollutants (24 hours) in $\mu\text{g}/\text{m}^3$		
		SO ₂	NO ₂	RSPM
1	Gandhi Nagar	12	17	92
2	Main guard gate	11	17	68
3	Bishop heber college	9	14	40

Sl. No	Monitoring day	Concentrations of Air Pollutants (24 hours) in $\mu\text{g}/\text{m}^3$		
		SO ₂	NO ₂	RSPM
4	Golden Rock	10	15	48
5	Central bus Stand, Tiruchirappalli	13	19	113
NAAQ standard (24 hrs)		50	40	60

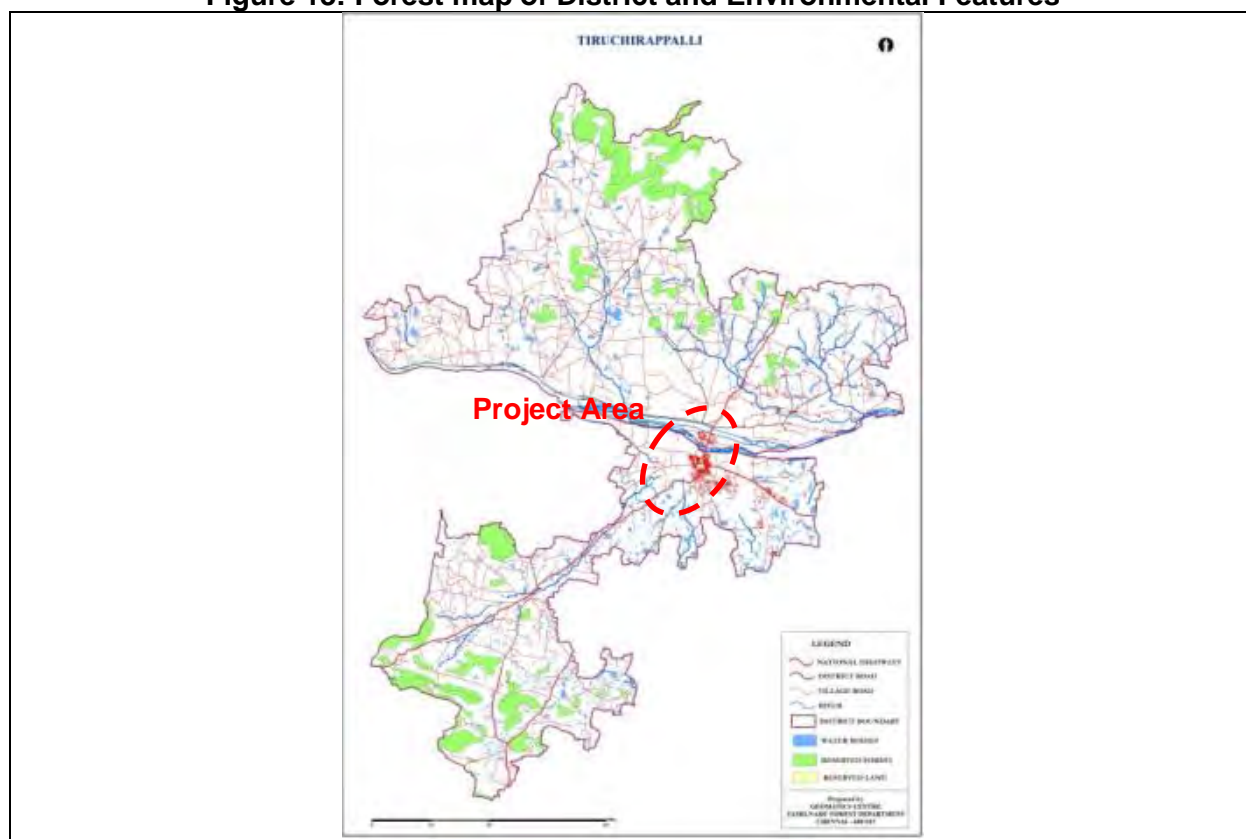
NAAQ = National Ambient Air Quality, RSPM = respirable suspended particulate matter, $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter of air.

Source: Air pollution data base in Tamil Nadu ENVIS Center GOTN-2014.

C. Ecological Resources

53. Project area, Tiruchirappalli town, is an urban area surrounded by land that was converted for agricultural use many years ago. Tiruchirappalli city is surrounded by vast agricultural lands. There is no remaining natural habitat in the town, and the flora is limited to artificially planted trees and shrubs, and the fauna comprises domesticated animals (cows, goats, pigs and chickens), plus other species able to live close to man (urban birds, rodents and some insects). There are no sensitive areas like forest or protected areas in the project area or nearby project area.

Figure 13: Forest map of District and Environmental Features



D. Economic Development

1. Land use

54. The total geographical area of Tiruchirappalli is 33,988 hectares, of which net Land put to non- agriculture occupied 13,059 hectares and this accounted for 38.42% of the total area in the district. Area under net cultivable area accounted for 28.13% of the total land, i.e. 9,560 hectares (Table 12).

Table 12: Land Use Pattern in Tiruchirappalli (Area in Ha)

Land use	2005	
	Area (in ha)	%
Forest	234	0.69
Barron and uncultivated land	1134	3.34
Land put to non- agriculture	13059	38.42
Cultivable waste	1850	5.44
Permanent pasture	54	0.16
Area under not included in cultivate	1174	3.45
Current Fallows	926	2.72
Other Fallows	5997	17.64
Net cultivable area	9560	28.13
Total	33988	100.00

Source: Records of Office of Joint Director of Agriculture, Tiruchirappalli.

2. Industry and Agriculture

55. The Bharath Heavy Electricals Limited (BHEL) established one of its manufacturing units in Tiruchirappalli for producing high pressure boilers in 1961 and envisaged creation of ancillary units in the private sector, in and around Tiruchirappalli to off load items of low and medium Technology. As a result in the last three decades a phenomenal growth of small scale industries numbering as on date to 400 units have been set up by entrepreneurs in Thuvakkudi, Ariyamangalam, Thiruverumbur industrial. Estates. The Industrial units are giving gainful and consistent employment to nearly 18,000 people.

56. Other public sector undertakings and a Railway Workshop at Ponmalai are part of industrial growth of the District. Large numbers of micro, small and medium scale enterprises (MSMEs) have been established in textile and apparels and engineering units. Majority of the investments in this district have taken place in non-electrical machinery. Large part of the investments has also taken place in metals and metal products.

Table 13: Small Industries Development Corporation Industrial Estates in Tiruchirappalli District

Name of Estate	Area (acres)
Ariyamangalam	17.64
Thuvakudi	478.84
Thiruverumbur	74.54
Thuvakudi (WCR)	14.24
Vazhavanthankotti –WIP	86.00
Vazhavanthankotti - P I	56.00

Name of Estate	Area (acres)
Vazhavanthankotti – P II	38.00
Kumbakudi	87.50

SIDCO = Small Industries Development Corporation.

57. **Agriculture.** The Cauvery River irrigates about 51,000 ha in Tiruchirappalli, Lalgudi and Musiri Divisions. Variety of crops are grown in this district and agriculture is the main occupation for most of the people in the district. Rice, millets, cereals, pulses, sugarcane, groundnut, cotton and banana are most common crops cultivated in the district.

58. **Education.** About 33 engineering colleges have come up in and around Tiruchirappalli, that includes the well-known National Institute of Technology, Tiruchirappalli. The city also has a prestigious management institution, the Bharathidasan Institute of Management. Among the many arts and science colleges, St. Joseph's College is the oldest. This city has given great Tamil scholars whose contributions to Tamil literature have been very significant.

3. Infrastructure

59. **Water Supply.** Cauvery River is the major source of water supply in Tiruchirappalli City. The protected water supply scheme to erstwhile Tiruchirappalli Municipality was implemented in 1895 with the head works located on the banks of Cauvery river at Kambarasanpettai, which is 3 km from the city. Under the comprehensive water supply system, the ULB has provided 96,075 individual connections i.e., 76,686 (80%) metered and 19,389 (20%) unmetered. In terms of population, individual service connections cover 46% of the total population. 4,037 public fountains at various locations cover 35% of the city's population. Bore wells with hand pumps cover another 5% and rest 13% are uncovered by the existing system (localized sources).

60. Water supply improvement scheme for TCMC is currently under implementation at a project cost of ₹2,214 million with assistance from JICA (Japan International Cooperation Agency) fund through TNUIFSL. This scheme aims to provide equitable water supply in all parts of the city ensuring 135 lpcd norms.

61. **Sewerage.** TCMC is equipped with a partially implemented UGSS. Sewage generated from the areas having UGSS within the corporation limits are collected through the existing collection system and conveyed by gravity to existing lift stations and sub-pumping stations, and then pumped through the main sewage pump stations to the STPs. Sewage generated from areas not having the UGSS is presently discharged through open drains and channels which ultimately drain into the network of channels such as Uyyakondan, Koraiyar, Thirumanjana Cauvery etc., which finally reaches into the Cauvery and Coleroon Rivers. The existing STPs comprises of oxidation ponds. Wastewater from the Panjappur STP is discharged into Koraiyar River in the south. The existing UGSS in TCMC covers 42,666 residential and 557 commercial assessments (as of 2015 status).

62. **Solid Waste Management.** Solid waste management in the city is handled by TCMC. About 400 tons of solid waste is collected from the city, mostly by door-to-door collection system. From households waste is transferred to transfer stations, and from there to composting and dumping yards located in the city outskirts. A composting and dumping yard is located in Ariyamangalam in the subproject area. TCMC has also procured two plastic shredding

machines and training imparted to the women self-help group members as well as to the sanitary workers. Shredded plastics is in progress and it is being used for road laying works.

63. **Transportation.** Tiruchirappalli is situated at the middle of Tamil Nadu, connected by 4 National Highways, 2 State Highways and several district roads with other major towns of the state. Tiruchirappalli is an important divisional headquarters of Southern Railways. Tiruchirappalli is well connected by rail to Chennai, Kanyakumari, Madurai, Thanjavur, Rameswaram, Coimbatore and Bangalore. Tiruchirappalli junction is the main station for passengers as well as goods movement. Tiruchirappalli has an International Airport located on the Pudukottai road at a distance of 6 km. City is connected by air with Chennai, Madurai, Thiruvananthapuram, Sri Lanka, Singapore and middle east countries.

E. Socio Cultural Resources

1. Demography

64. As per Census 2011, Tiruchirappalli city population was 847,387 of which 418,400 are males while 428,987 are females. Total households are 214,529. Population of children less than 6 year is 79,723 which is 9.41% of total population. Sex ratio is 1,025 against state average of 996. Child sex ratio is 960 compared to Tamil Nadu state average of 943. Literacy rate is 91.38 % higher than state average of 80.09 %; male and female literacy rates are 94.85% and 88.01% respectively.

Table 14: Demographic Characteristics of Tiruchirappalli District (Census)

Description	2011	2001
Actual Population	2,722,290	2,418,366
Male	1,352,284	1,208,534
Female	1,370,006	1,209,832
Population Growth	12.57%	10.10%
Area km ²	4,509	4,509
Density/ km ²	604	536
Proportion to Tamil Nadu Population	3.77%	3.88%
Sex Ratio (Per 1000)	1013	1001
Child Sex Ratio (0-6 Age)	947	955
Average Literacy	83.23	77.90
Male Literacy	89.72	86.55
Female Literacy	76.87	69.31
Total Child Population (0-6 Age)	272,456	270,043

Description	2011	2001
Male Population (0-6 Age)	139,946	138,162
Female Population (0-6 Age)	132,510	131,881
Literates	2,038,981	1,673,478
Male Literates	1,087,765	926,354
Female Literates	951,216	747,124

km² = square kilometer.

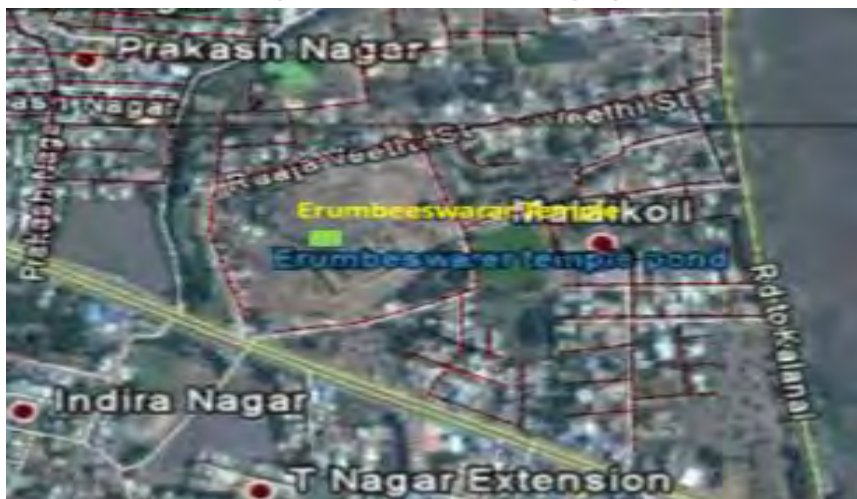
2. History, Culture and Tourism

65. Woraiyur , a part of present day Tiruchirappalli, was the capital city of Cholas from 300 BC onwards. This is supported by archaeological evidences and ancient literatures. There are also literary sources which tell that Woraiyur continued to be under the control of Cholas even during the days of Kalabhra interregnum (A.D. 300 - 575). Later, Woraiyur along with the present day Tiruchirappalli and its neighboring areas came under the control of Mahendra Varma Pallava I, who ascended the throne in AD 590. Till AD 880, according to the inscriptions, this region was under the hegemony of either the Pallvas or the Pandyas. It was in AD880, Aditya Chola brought a downfall to the Pallava dynasty. From that time onwards Tiruchirappalli and its region became a part of Greater Cholas. In AD 1225 the area was occupied by the Hoysalas. Afterwards, it came under the rule of later Pandyas till the advent of Mughal rule.

66. Tiruchirappalli was for some time under the Mughal rule, which was put to an end by the Vijayanagar rulers. The Nayaks, the Governors of Vijayanagar empire, ruled this area till AD 1736. It was Viswanatha Nayaka who built the present day Teppakulam and the Fort. The Nayak dynasty came to an end during the days of Meenakshi.

67. The Muslims ruled this region again with the aid of either the French or the English armies. For some years, Tiruchirappalli was under the rule of Chanda Sahib and Mohamed Ali. Finally the English brought Tiruchirappalli and other areas under their control. Soon after the area was ceded to East India Company as per the agreement at the eve of the Kanatic war, Tiruchirappalli district was formed under the Collectorship of Mr. John (Junior) Wallace in 1801. District was then under the hegemony of British for about 150 years till India's independence.

Figure 14: Google Earth Imagery showing Archeological Survey of India monument (Erumbeeswarar Temple)



68. **Culture and Tourism.** Owing to its rich history and culture, Tiruchirappalli has various archeological and religious places of prominence. Following two monuments are notified as nationally important monuments by ASI, and one monument (Erumbeeshwarar Temple)¹ is located within the subproject area. The subproject sewer network proposed for the surrounding residential areas in sewerage zone -5 in Ponmalai Zone of TCMC falling within 300 m from the boundary of the monument, require prior permission from ASI to conduct works. No works will be allowed in the 300 m ASI regulated zone until (i) ASI permit has been obtained; and (ii) archeological experts have been appointed to assess the impacts and supervise the works.

69. Other prominent places of interest in Tiruchirappalli are:

- (i) **Rock Fort Temple:** Rock Fort Temple (well-known Uchipillayar Temple), the landmark of the city, is on the shores of Cauvery River. It is perched on a massive rocky outcrop at an altitude of 83 m above the mean sea level. The Thayumanaswamy Temple, dedicated to Lord Shiva, is situated halfway to the top. It has a 100-pillar hall and a vimana covered with gold. On the southern face of the rock are several beautifully carved rock-cut cave temples of the Pallava period;
- (ii) **Srirangam:** The Sri Ranganathaswamy Temple at Srirangam, situated 6 km north of the city, is among the most revered shrines dedicated to Lord Vishnu in South India, and is the largest temple complex in the world. Shrouded in a haze of coconut palms away to the north, the temple is built on an island in the middle of Cauvery and covers an area of 2.5 km². Enclosed by seven rectangular walled courtyards, this temple has 21 spires ("gopurams"), the largest of which was completed in 1987 and measures 73 m in height. Srirangam is connected to the mainland by a bridge. The temple is replete with excellent carvings and numerous shrines dedicated to various gods;
- (iii) **Thiruvanaikaval:** The Jambukeswara Temple, dedicated to Lord Shiva, is situated just 2 km east of Srirangam and houses five concentric walls and seven gopurams.

¹ It is a Hindu temple dedicated to the deity Shiva. Built on a 60-foot (18 m) tall hill. The temple's main shrines and its two prakarams (outer courtyards) are on top of the hill, while a hall and the temple tank are located at the foothills. The temple is one in a series built by Aditya Chola (871-907 CE) along the banks of Cauvery river, to commemorate his victory in the Tirupurambiyam Battle. It has several inscriptions from the Chola Empire dating back to the 10th century.

Legend has it that an elephant once worshipped the Lord under the holy Jambu tree, and hence the name Jambukeswara. The principal deity is the Shiva lingam, almost submerged in water, which flows from the subterranean spring in the sanctum sanctorum;


- (iv) Samayapuram: The Samayapuram Mariamman Temple is located 12 km north of the City at the junction of the National Highway connecting Tiruchirappalli and Chennai. The Mariamman Temple is one of the most visited shrines in Tamil Nadu, dedicated to Mariamman, a manifestation of the primeval energy Shakti as the mother Goddess. Samayapuram was a local capital of the Vijayanagar rulers in the vicinity of Tiruchirappalli, and was known as Vikramapuram; and
- (v) Natharvali Dargah: It is an ancient Dargah, which is more than 1,000 years old with marvelous architecture with the dome being made up of shining marbles giving a great look to the Dargah. It is situated in the heart of Tiruchirappalli City.





70. The other temples in and around the city include Thiruvallarai Vishnu Temple, Uraiyur Nachiyaar Temple, Uraiyur Vekkali Amman Temple, Thiruppaigeeli Siva Temple, Brahma temple at Thirupattur and Thirupparaithurai Shiva temple. Kollam pond in Crawford lies along the Tiruchirappalli-Madurai Railway line. This pond is home to different types of bird varieties including common crane, ducks and the kingfisher.




F. Subproject Site Environmental Features

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

Table 15: Site Environmental Features

Infrastructure	Location and Environmental Features	Site Photograph
Proposed Sewage pumping stations - 5	<p>SPS – 5 at Indira Nagar, Ponmalai</p> <p>Proposed SPS -5 site is located in ward no 65 near kilivaikal on vacant land owned by TCMC. The site is surrounded by sparse development . Site is covered with shrubs and bushes, and couple of trees, which needs to removed. There are about 5 houses located at a distance of 10 m from SPS unit. This site will require design based measure for odor control.</p> <p>This site falls within the 300 m regulated boundary of Erumbeswarar Temple which is ASI protected monument and works shall be carried out upon obtaining prior approval from ASI. No works will be allowed in the 300 m ASI regulated zone until (i) ASI permit has been obtained, and (ii) archeological experts have been appointed to assess the impacts and supervise the works.</p>	

Infrastructure	Location and Environmental Features	Site Photograph
Proposed Sewage pumping stations - 7	<p>SPS – 7 at Lurdhu Nagar (JK Nagar Extension)</p> <p>Proposed SPS-7 site is located in JK Nagar Extension . Sufficient vacant land is available to accommodate SPS. The land is owned by TCMC. There are about 5 houses located at a distance of 50 m from SPS boundary. This site will require design based measure for odor control.</p>	
Proposed Sewage pumping stations – 8	<p>SPS – 8 at Vimar Vihar, Kulavaipatty</p> <p>SPS -8 site is located in the outskirts of the city and it is owned by TCMC. Currently, it is identified that there are no residential area in the vicinity.. However there is a school located at a distance of 90 m from the SPS boundary. Hence, this site will require design based measure for odor control.</p>	
Proposed Sewage pumping stations – 9	<p>SPS – 9 at Muthu Kumaraswamy Nagar, K. Sathanur</p> <p>The proposed SPS-9 site is a park located in the outskirts of the city. The ownership of the land belongs to TCMC . There are about 6 houses located at a distance of 15 m from SPS boundary. Hence, this site will require design based measures for odor control.</p>	
Proposed Sewage pumping stations – 10	<p>SPS – 10 at Panjapur</p> <p>The proposed SPS -10 is located in the existing STP campus at Panjapur village. The land is owned by TCMC. There are no residential areas / settlements surrounding the site and hence odor control measures are not required.</p>	

Infrastructure	Location and Environmental Features	Site Photograph
Proposed Sewage pumping stations – 11	<p>SPS – 11 Karumandapam Crematorium Campus, Karumandapam</p> <p>Proposed site for SPS-11 The site identified for SPS-11 is located within the premises of gasifier crematorium in Karumandapam. The land belongs to Trichy Corporation and spread over 0.23 hectares. SPS-11 requires total area of around 1,295 m² and adequate land is available for the construction.</p> <p>There are about 4 houses located at a distance of 20 m from the SPS boundary. This site will require design based measure for odor control.</p>	
Proposed Sewage pumping stations – 12	<p>SPS – 12 at Natchatra nagar (Karumandapam)</p> <p>The proposed SPS - 12 is located in the Natchatra nagar at Karumandapam. The land is owned by TCMC. There are about 4 houses located at a distance of 20 m from SPS unit. This site will require design based measure for odor control.</p>	
Sewage lift stations (LS)	<p>Road Side Lifting station is a small pumping station to lift the sewage to higher level and to discharge into ridge manhole for transporting to the pumping station.</p> <p>Lifting station has a collection well with submersible pumps accommodated inside.</p> <p>Lift stations are essentially proposed as enlarged manholes (either road-side on available land or on road center by enlarging a collection system manhole) fitted with two sewage pumps (small capacity) and a curb or road-side wall mounted Pump Control Panel. Where lifting stations are proposed along the roads, there is no buffer land for trees and high compound available, at such places other design and operation related measures are included in the project</p>	

Infrastructure	Location and Environmental Features	Site Photograph
Sewer network	<p>design.</p> <p>Sewer lines will be laid in the center of road by cutting open the surface. In wider roads, like NH, divided 2-way roads etc., sewers will be laid along the edge of the road, but mostly within the carriageway. In the outskirts where adequate land in the road shoulder is available along the blacktop and is clear of any structures or activities, sewers will be laid in the earthen shoulder.</p> <p>Large diameter sewers will be laid on main roads (300 – 700 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.</p> <p>Trench size to bury the sewer will be of 0.8 m to 1.5 m wide and 1 m to 6 m deep.</p> <p>Most of the roads in central part of the town (old town area) are narrow and congested with traffic, pedestrians and activities.</p> <p>Sewers will also be laid in the road located within 300m of Erumbeswarar Temple (ASI monument) to provide the sewerage system to the areas around the temple. No works will be allowed in the 300 m ASI regulated zone until (i) ASI permit has been obtained, and (ii) archeological experts have been appointed to assess the impacts and supervise the works.</p>	

ASI = Archeological Survey of India, m = meter, NH = national highway, SPS = sewage pumping station, TCMC = Tiruppur City Municipal Corporation.

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

72. 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.

73. 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) **Operation and Maintenance (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.

74. 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).

75. 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.

76. The ADB Rapid Environmental Assessment Checklist in http://www.adb.org/documents/guidelines/environmental_assessment/eaguidelines002.asp has been used to screen the project for environmental impacts and to determine the scope of the IEE.

77. In the case of this project (i) most of the individual elements involve straightforward construction and operation, so impacts will be mainly localized and not 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 (ROW) and existing roads hence, land acquisition and encroachment on private property will not occur.

A. Pre-Construction Impacts – Design and Location

78. **Design of the Proposed Components.** Technical design of the (i) sewage pumping and lifting stations; and (ii) 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.

79. **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, TCMC 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.

80. 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) selection of construction methodology near protected monuments in discussion with the ASI, having the excavation observed by person with archaeological knowledge for chance finds, etc.;
- (ii) Limit the sewer depth where possible;
- (iii) Sewers shall be laid away from water supply lines and drains (at least 1 m, wherever possible);
- (iv) 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);
- (v) In unavoidable cases, where sewers are to be laid close to storm water drains, appropriate pipe material shall be selected (stoneware pipes shall be avoided);
- (vi) For shallower sewers and especially in narrow roads, use small inspection chambers in lieu of manholes;
- (vii) Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize silt/garbage entry; and
- (viii) Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulfide generation

81. **Sewage Pumping stations and lift stations.** It is proposed to construct 11 sewage lift stations, 7 new sewage pumping stations. These 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. 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.

82. 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 will consists of a sewage sump or suction well, 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.

83. **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 the proposed sewage pumping stations include:

- (i) Inlet Chamber;
- (ii) Screen well;
- (iii) Grit well;
- (iv) Collection well;
- (v) DG set platform; and

(vi) Pump room.

84. At the 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.

85. **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 sulfide (H_2S), 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_2S is the most dominant odor causing compound, and therefore can cause nuisance to nearby households. When sewage becomes stagnant, H_2S is generated in the anaerobic conditions. The quantum of H_2S 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_2S 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.

86. 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 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. The 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, however sites which are located close have been selected only in cases where there are no other alternative lands available. There are no standards notified by Government of India or Government of Tamil Nadu for odor. However, Central Pollution Control Board (CPCB) has stipulated Guidelines on Odor Pollution and its Control which deal 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_2S cannot be avoided in the process involving anaerobic decomposition whereas release of H_2S 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.

87. **Measures for pumping stations**

- (i) Maintain buffer distance from nearest residences;
- (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;
- (iv) Proposed wells to be closed using reinforced cement concrete (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;
- (v) 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;
- (vi) Since human intervention is involved and safety shall be primary and critical consideration, additional protection by way of a metaled 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;
- (vii) 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;
- (viii) 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;
- (ix) 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 granular activated carbon (GAC) (including material size) should be selected based on the vent diameter and expelled air flow rate expected;
- (x) 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;
- (xi) 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;
- (xii) 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;
- (xiii) Develop standard operating procedures / operational manual for operation and maintenance of lifting and pump stations; this shall include measures for emerge situations;
- (xiv) Provide training to the staff in SOPs and emergency procedures; and
- (xv) Periodic monitoring of H₂S levels at sewage pumping and lifting stations using handheld H₂S meters.

88. **Lifting stations** are also to be located at technically feasible locations (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 lifting station. Given very limited land availability in urban areas like the project area, that too of government owned lands, locating the lifting stations

away from the houses is not practical in Tiruchirappalli, sites for lifting stations were identified based on the technical suitability and availability of government owned land parcels to avoid land acquisition. Odor nuisance from lifting stations is very limited compared to pumping stations. Lift stations are essentially proposed as enlarged manholes (either road-side on available land or on road center by enlarging a collection system manhole) fitted with two sewage pumps (small capacity) and a curb or road-side wall mounted Pump Control Panel. Following odor control and mitigation measures are considered:

- (i) Provide closed wells fitted with necessary ventilation wherever required;
- (ii) Provide greenbelt (tree cover) around the lift stations, wherever possible; and
- (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 lifting stations.

89. Noise from pumping operations. Operation of pumps and motors and diesel generators is a major source of noise. Six of the seven pumping stations (i.e., except Panjapur) are located very close to the houses/ residential plots Hence noise generated from lifting/pump stations can have continuous negative impacts on the surrounding population. 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. Internal noise level in a room measured at a distance of 1m from these pump sources typically will be in the range from 70 dB(A) to 100 dB(A).

- (i) Procure good quality latest technology high pressure pumps that guarantee controlled noise at a level of around 80 dB(A) at a distance of 1 m;²
- (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 generators³ with low emission and low noise fitted with acoustic enclosures;
- (v) Provide sound mufflers for ventilators in the plant rooms; and sound proof doors
- (vi) Provide ear plugs to workers;
- (vii) Consult the ASI and 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; and
- (viii) Excavation and construction methodology to be used near the monuments (within the regulated area of 300 m of any monument) shall be finalized in

² Indian Standards require to maintain the noise level of 70 dBA or less during night time. However, in case of STPs/WTPs/Water Supply Headworks, 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.

³ CPCB has published Genset notifications, which includes specification for emission limits for new Diesel Engines (up to 800 kW) and Noise limits for Generator sets which run with Diesel as Fuel type

Emission limits for DG's

POWER RANGE	HC+ NO _x	CO	PM	SMOKE
	g/kWh			m ⁻¹
Up to 19 kW	7.5	3.5	0.3	0.7
>19 kW	4.7	3.5	0.3	0.7
Up to 75 kW				
>75 kW	4.0	3.5	0.2	0.7
Up to 800 kW				

Noise limit shall not exceed 75 dB(A) at 1 m distance.

The generators that are in line with the specifications shall be procured. The requirement for the same is specified in the BoQ that are to be monitored to ensure that generation of noise and potential deterioration of ambient air quality will be avoided.

consultation with ASI; no equipment causing vibration and heavy noise should be used.

90. **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 station. 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.

91. 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:

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

92. **Tree cutting at selected project sites.** Detailed engineering design including final alignments will be determined prior to start of works. Tree survey and assessment will be conducted and to be reported in the Updated/Final IEEs. ULBs, having the overall responsibility as determined by statutory clearances, will determine the locations for replantation/afforestation and maintenance of the trees prior to any cutting and during implementation of replantation program.

93. **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 Tiruchirappalli City Municipal 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.

94. **Site selection of construction work camps, stockpile areas, storage areas, and disposal areas.** Priority is to locate these near the project location. 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.

95. **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, to the maximum extent possible, procure material from existing quarries, and creation of new quarry areas should be avoid as far as possible. If new quarries are required then the contractor will be responsible for obtaining all permissions and clearances, including environmental clearance for mining. Contractor should factor in the time required for obtaining clearances including conduct of EIA if required under the law. It will be the construction contractor's responsibility to verify the suitability and legal status of all material sources and to obtain the approval of Department of Geology and Mining and local revenue administration, as required.

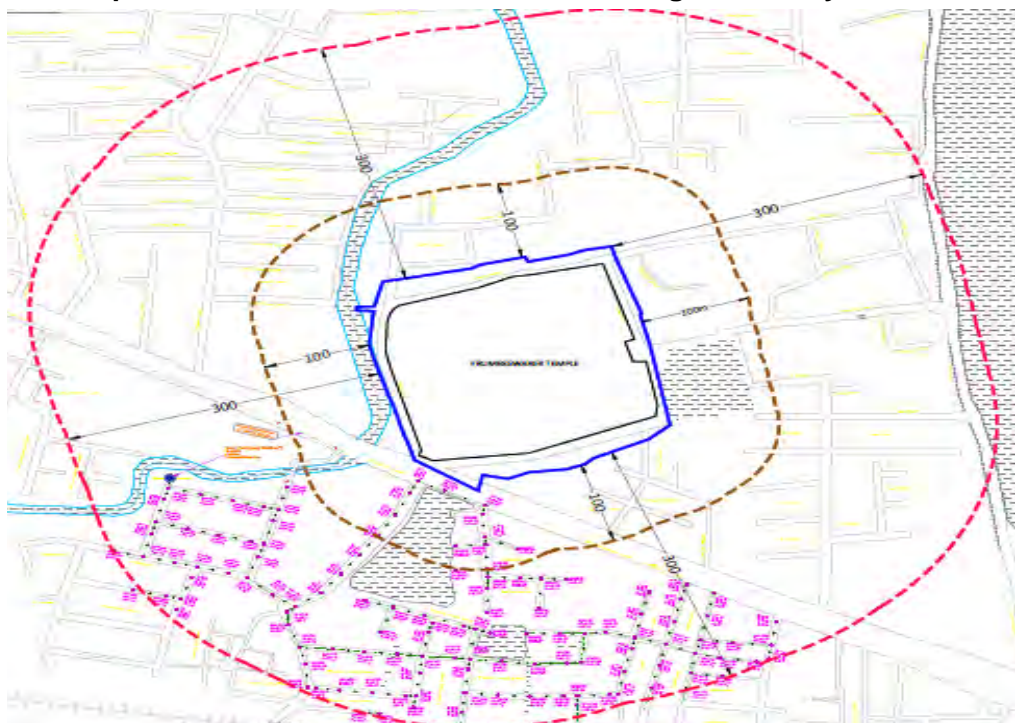
96. **Social and Cultural Resources – Chance Finds.** No works are proposed within the protected monument (Erumbeswarar Temple, see figure) located in the subproject area. However, as this monument is located inside the city surrounded by residential areas, some works (sewer lines) are required to be laid within the regulated area (i.e., up to 300 m from the monument boundary). No direct interference with the monuments anticipated. Moreover, all works within 300 m distance of monument will be conducted with the prior permission of ASI.

97. Necessary precautionary measures, as listed below, including if any measures suggested by ASI, to be followed. Any work involving ground disturbance can uncover and damage archaeological and historical remains. For this subproject, excavation will occur, laying pipelines, and for construction of a pumping station.

98. Details of network within 300 m of the regulated boundary of Erumbeswarar temple:

- Location: Ponmalai Zone of TCMC – Sewerage Zone -5
 - a) Subproject components: Collection network, pumping main, 1 no. of sub Pumping station (SPS-5 at Indira Nagar).

Figure 15: Proposed UGSS network near the Archeological Survey of India Monument



99. Measures for works in the regulated zone (300 m) of the ASI monument:
- (i) Obtain prior permission from ASI for the works to be conducted within the regulated zone of monument; submit detailed construction drawings clearly indicating the details of proposed works, use of equipment and machinery, etc., to ASI for their review; incorporate any suggestions/recommendations of ASI in project design and implementation;
 - (ii) Consult ASI and 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;
 - (iii) Excavation and construction methodology to be used within the regulated area of 300 m of any monument shall be in line with the ASI recommendations;
 - (iv) No equipment causing vibration (e.g., pneumatic drills, excavators etc.), and heavy noise should be used; works shall be conducted manually;
 - (v) Dust control measures shall be put in place; all work areas to be barricaded and enclosed with dust screens;
 - (vi) Conduct air quality and noise monitoring weekly throughout construction phase in the 300 m regulated area; and
 - (vii) Appoint an archaeological expert to assess impacts and supervise works.

100. **Measures for Chance finds.**⁴ Construction contractors to follow these measures in conducting any excavation work:

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

101. **Sewage treatment Plant.** The new STP at Keela Kalkandhar Kottai and rehabilitation of 30 MLD plant at Panjappur are implemented under Phase II of TNUFIP Tranche 1. The sewage discharged this current subproject will be linked to these two STPs for treatment. The flow of zone 5 and part of zone 6 (9.12 MLD) will be treated in 37 MLD STP at Keelakalkandhar kottai and the flow of zone 7 to zone -12 will be treated in 88 MLD (2 WSP modules of 58 MLD and 30 MLD capacity) STP at Panjapur.

102. Sustainability of new sewer infrastructure and realization of intended purpose (removing the human waste from those areas served by the network rapidly and treated to an acceptable standard) and benefits (improved environmental conditions, public health, etc.) would accrue only with a proper functioning of the existing STP. Therefore, the existing STP is an associated facility as per the ADB SPS, 2009. Associated facilities need to be in compliance with safeguard policy, and ADB SPS requires conduct of environmental audit of associated facilities. Environmental audit of the existing STPs being improved under TNUFIP has been included as Appendix 3. This audit identifies the improvements required for the STP, which are to be carried out as part of TNUFIP Tranche 1 and will be revisited prior to the start of operation of subproject. Corrective action plan based on the environmental audit is provided in Table 16.

⁴ <http://asichennai.gov.in/downloads/indian-treasure-trove-act-1878.pdf> (amended 1st September 1949).

Table 16: Corrective Action Plan for Environmental Compliance of Existing Sewage Treatment Plant at Panjappur

Item	Compliance	Action Required / Proposed for compliance	Timeline	Responsible Agency and funding source
Compliance with Applicable National and State Laws, Rules, and Regulations	Non-compliance: CTO is to be obtained for STP	Obtain CTO from TNPCB	31 September 2019	TCMC with own funds
Treated wastewater (STP) effluent quality to meet following disposal standards stipulated by Proceeding No. Ministry of Environment, Forest and Climate Change Notification New Delhi, the 13 October, 2017 and CPCB file No : A-19014/43/06-Mon t:21.4.2015. pH – 6.5- 9.0 BOD – 30 mg/l COD- 50 mg/l TSS -100 mg/l Ammoniacal Nitrogen - 5 mg/l Total Nitrogen -10 mg/l	Current effluent quality is not meeting the parameters stipulated by TNPCB. However, revised standards have recently been notified.	The existing STP performance will be monitored closely by TCMC and any improvement if required will be taken up prior to commissioning of this subproject. (The sewage flow from areas covered under UGSS phase III is about 28 MLD will come to Rehabilitation STP at Panjapur)	Prior to commissioning of this subproject.	TCMC with own funds
Sludge disposal	No sludge handling, drying or storing facilities	Prepare and implement sludge management plan for safe collection, treatment and disposal of sludge, including periodic monitoring and safe reuse application	Prior to commissioning of this subproject.	TCMC with own funds

CTO = Consent to Operate, MLD = million liters per day, STP = sewage treatment plant, TCMC = Tiruppur City Municipal Corporation.

B. Construction Impacts

103. Main civil works in the subproject include laying of sewer lines and construction of sewage pumping and lifting stations at the identified sites.

104. Sewage pumping and lifting stations 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 (RC), 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.

105. In works confined to the boundary of identified sites like pumping stations, 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, labor camps etc., will have negative impacts, which needs to be avoided or mitigated properly.

106. Subproject also include linear works (laying of 327 km of tertiary sewers, and 20.93 km of pumping mains along the roads). This covers entire area (including areas not covered under UGSS and newly extended/ added area) of Tiruchirappalli City. 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 will be laid mostly on wider main roads. Sewers will be laid by open cut method and Pipe Jacking method will be used for NH, Rail and Canal Crossing.

107. 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 uPVC pipes and trunk sewers and conveying mains (pumping mains) are of cast iron (CI). The diameter of gravity sewer ranges from 200 mm to 700 mm, of which nearly 92% of the sewers are of size between 200 mm and 250 mm. The size of pumping main ranges from 150 mm to 500 mm. According to the design the sewers will be laid at a depth of 1 to 6.5 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 6.5 m. Nearly 92% length of sewers will be laid in trench of depth 3 m or less, and only about 3% of sewers will be laid deeper between 5 m and 6.5 m. 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 17.

Table 17: Sewer Construction

Proposed depth of sewers	Total length of sewers to be laid (in m)	% of length
Up to 2 m	225,468	69%
2 m – 4 m	78,424	24%
4 m – 6.5 m	22,874	7%

m = meter.

108. Earthwork 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 6.5 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 nearly 523,495 m³, of which nearly 98% will be reused, and the remaining 10,472 m³ of excess soil needs to be disposed safely.

109. 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.

110. Comprising old town area of Tiruchirappalli, project area is mostly characterized by high density residential areas and very narrow streets and roads. Outer areas are comparatively less dense, however, erstwhile village areas which are added to corporation, and which are part of subproject area, are also having dense habitations in the core village areas. Outer areas are mainly a mix of old village habitations with narrow streets, and few 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.

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

112. **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 government approved licensed quarries only, to ensure these controls are in place. In Tiruchirappalli, construction sand is obtained from Public works department, GOTN's authorized mining areas, gravel and aggregate is available Kuttimalai locally in Tiruchirappalli district (about 10 km from the city). Contractor should avoid new borrow pits / quarries as far as possible, if necessary, all the permissions, including conduct of environmental assessment, and environmental clearance as necessary shall be obtained prior to start of quarrying activity. 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); and

- (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.

113. **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. Nearly 523,495 m³ of earthwork is anticipated from the subproject, and 98% 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 lifting and 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. While pumping and lifting stations are located within residential neighborhoods, 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:

1. For all construction works

- (i) Provide a dust screen around the construction sites of pumping and lifting stations;
- (ii) Damp down the soil and any stockpiled material on site by water sprinkling;
- (iii) Stabilize 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;
- (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;
- (ix) Clean wheels and undercarriage of haul trucks prior to leaving construction site; and
- (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.

2. 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; and
- (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.

114. **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 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.

115. 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.

116. **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. Periyakulam (a big lake) and Vathiyar kulam lake are located within the project area, and Koraiyar river flows in the west of the project area, The Uyyakondan canal also flows through the project area besides, there are canals and other small water bodies in and around the project area. Project area mostly drains into these water bodies. 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;

- (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 or sedimentation basins along the drainage leading to the water bodies;
- (v) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;
- (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 EMP.

117. Construction of pipe carrying bridges across canals/streams to cross over sewers will have negative impact on water quality of canals/streams. Following measures to be implemented:

- (i) Conduct works in the water body (especially foundation work) only during no-flow season;
- (ii) Select a construction method which is less disruptive (e.g., precast type);
- (iii) Do not spill construction chemicals, fuels, lubricants in the water body; and
- (iv) Clean up the site immediately after construction is complete; construction debris, materials, etc., shall be cleared and pre project condition restored or improved.

118. **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 of only clarified water into drainage channels/streams after sedimentation in the temporary ponds; and
- (iii) Consider safety aspects related to pit collapse due to accumulation of water.

119. **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 nearly 523,495 m³, of which nearly 98% will be reused, and the remaining 10,472 m³ 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 4);
- (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 of to approved designated areas immediately;

- (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;
- (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 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 waste and hazardous waste will be managed by Tiruchirappalli City Municipal Corporation (TCMC), who is a pioneer in handling SWM and hazardous waste management in Tamil Nadu;
- (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; and
- (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.

120. **Noise and Vibration Levels.** Except a new pumping station site located near Panjapur STP, all other subproject components including pumping stations, lifting stations and sewers are located within the Tiruchirappalli city. Sewer lines are spread over entire project area. All these sites are located within habitations, 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. Trenches deeper than 2-3 m require removal of rocks (soft to hard), will generate heavy noise and vibration. 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;
- (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;
- (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;
- (v) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach; and
- (vi) 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.

121. Besides the above, works in the regulated buffer zone of protected monuments requires special precautions to avoid any potential disturbance / damage to the monuments. Noise, dust and vibration emanating from the works, if not properly planned or executed may disturb / damage the monument. Following measures are to be implemented:

- (i) Obtain prior permission from ASI for the works to be conducted within the regulated zone of monument; submit detailed construction drawings clearly indicating the details of proposed excavations and works, use of equipment and machinery, etc., to ASI for their review; incorporate any suggestions/recommendations of ASI in project design and implementation;
- (ii) Excavation and construction methodology to be used within the regulated area of 300 m of any monument shall be in line with the ASI recommendations;
- (iii) No equipment causing vibration (e.g. pneumatic drills, excavators etc.), and heavy noise should be used; works shall be conducted manually;
- (iv) Dust control measures shall be put in place; all work areas to be barricaded and enclosed with dust screens;
- (v) Conduct air quality and noise monitoring weekly throughout construction phase in the 300 m regulated area; and
- (vi) Appoint an archaeological expert to assess impacts and supervise works.

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 several roads (National and State Highways, and other major roads providing regional connectivity) in the project area that carry considerable traffic. These roads also centers of commercial activities. Internal roads in the project area are narrow, except in the newly developing residential layout which comparatively have wide roads. In old city area, roads are very narrow and congested with activities, traffic and pedestrians. 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.

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

124. 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:

1. **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 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 over the open trenches at each house to maintain the access.
- (ix) Inform the affected local population 1-week in advance about the work schedule;
- (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 TV services; and
- (xiii) At work site, public information/caution boards shall be provided including contact for public complaints.

2. 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;
- (iii) Locate entry and exit points in areas where there is low potential for traffic congestion;
- (iv) Drive vehicles in a considerate manner; and
- (v) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.

125. **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, no notable 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.

126. **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 shall require to Employ local labor force as far as possible

127. **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 labor laws (indicative list is in Appendix 2);
- (ii) Develop and implement site-specific occupational health and safety (OH&S) Plan 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) OHS Training⁵ 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;⁶
- (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;

⁵ 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.

⁶ <http://www.ifc.org/wps/wcm/connect/a99ab8804365b27aa60fb6d3e9bda932/EHS-Guidelines+101-Webinar.pdf?MOD=AJPERES>

- (v) Provide Health and Safety (H&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;
- (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 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 and be well known to, and easily understood by workers, visitors, and the general public as appropriate;
- (x) Disallow worker exposure to noise level greater than 85dBA 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; and
- (xii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances.

128. **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; and

- (xiii) Maintain regularly the construction equipment and vehicles; use manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.

129. **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 100 m buffer shall be maintained) or locate the camp site within the existing facilities of Tiruchirappalli 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;
- (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;
- (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

130. Operation and maintenance of the sewerage system will be carried out by TCMC. Operation will involve collection and conveyance of wastewater from houses to nearest lifting / pumping stations and operation of lifting/pumping stations to pump accumulated sewage.

131. **Quality of Raw Sewage.** The subproject does not involve construction of STP, however the sewage collected from the proposed collection network will be treated in the STPs (i.e., constructed / rehabilitated under Phase II of the Trichy UGSS). 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. Tiruchirappalli houses various small and medium scale units; food, cotton, textiles, wood, paper, plastic, chemical, engineering, electrical units are established.. Although proposed sewer network will not cater to industrial wastewater, It is important to ensure that no wastewater from industries enters the sewer network with strict monitoring and enforcement. Following measures are to be implemented:

- (i) No wastewater from industrial premises (including domestic wastewater) shall be allowed to dispose into municipal sewers; and
- (ii) Monitor regularly and ensure that there is no illegal discharge through manholes or inspection chambers; conduct public awareness programs; in coordination with TNPCB.

132. **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 a vis its relation with operational practices;
- (iii) Ensure that pumping cycles are properly followed; and there is no buildup of sewage beyond design volume in the wells; and
- (iv) Conduct periodic H₂S monitoring at pumping and lifting stations using handheld H₂S meters.

133. **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.

134. 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:
 - 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;
 - 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;
 - Monitoring of sewer flow to identify potential inflows and outflows;
 - 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; and
- (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 sulfide, methane, etc.); provide for adequate equipment (including oxygen masks) for emergency use.

VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Overview

135. 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.

136. 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 and pumping/lifting stations), 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, TNUIFSL, Government of Tamil Nadu and the ADB.

B. Public Consultation

137. 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

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

139. Focus-group discussions with affected persons and other stakeholders were conducted 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 including women along the project activity areas were also consulted. A project area level consultation workshop is conducted in Tiruchirappalli with the public representatives and prominent citizens, NGOs etc. A formal consultations were held on 21 January 2018 (details are provided in Appendix 10). Subsequently, another consultation with nearby residents was conducted on 08 January 2019 for the SPS-11, Arasu colony during which residents objected to the proposed site. Hence alternate site for locating SPS-11 was identified in Karumandapam (Vacant area in Crematorium belonging to TCMC).

140. 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. Construction on narrow roads is seen as biggest hindrance. 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

141. 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. 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 10). At the work sites, public information boards will also be provided to disseminate project related information.

C. Information Disclosure

142. Executive summary of the IEE will be translated in Tamil and made available at the office of TCMC 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 TCMC after approval of the IEE by ADB. Stakeholders will also be made aware of grievance register and redress mechanism.

143. 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.

144. 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

145. 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 program management unit (PMU) and concerned program implementation unit (PIU) will ensure that their grievances are addressed.

146. 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 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.

147. 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 Cell (GRC) will be established in PIUs; Safeguards officer, supported by the social, gender and environmental safeguards specialist of 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.

148. 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).

149. 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 ULB level. In the event that certain grievances cannot be resolved even at ULB 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.

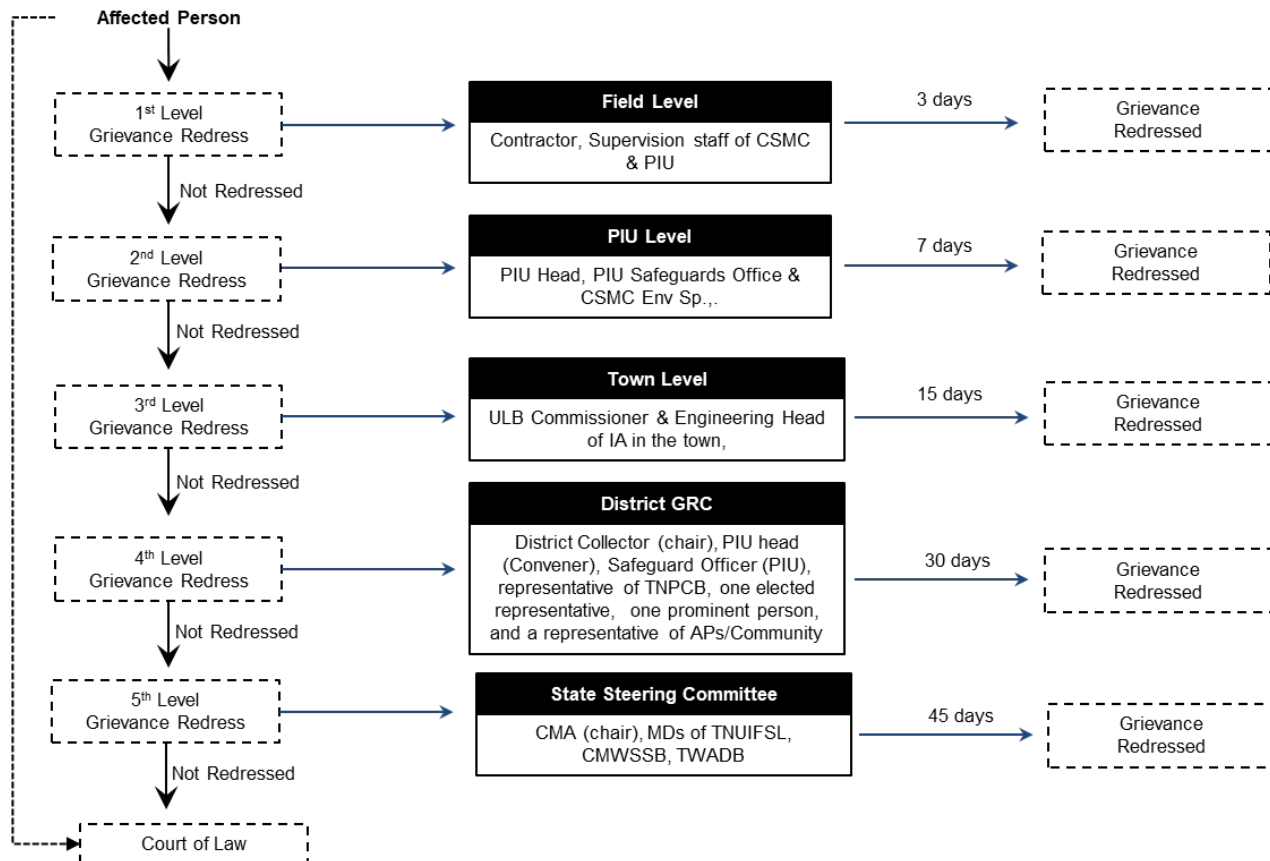
150. GRC will meet every month (if there are pending, registered grievances), determine the merit of each grievance, and resolve grievances within specified time upon receiving the complaint-filing which the grievance will be addressed by the state-level steering committee. The steering committee will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

151. **Composition of GRC.** 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.

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

153. **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).

154. The multi-tier GRM for the project is outlined below (Figure 16), 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 16: Proposed TNUFIP Grievance Redress Mechanism

AP = affected person, CMSC = Construction Management and Supervision Consultant, IA = implementing agency, PIU = program implementation unit; ULB = urban local body; TNPCB = Tamil Nadu Pollution Control Board.

155. 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 CMSC) and submitted to PMU.

156. Information dissemination methods of the GRM. The PIU, assisted by CMSC 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.

157. **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.

158. **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.

159. **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.

160. **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

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

162. The EMP will guide the environmentally-sound construction of the subproject and ensure efficient lines of communication between TNUIFSL, PMU, Implementing agency, PIU, consultants and contractors. The EMP will (i) ensure that the activities are undertaken in a responsible non-detrimental manner; (i) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (ii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iii) detail specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (iv) 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.

163. 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 SEP. No works are allowed to commence prior to approval of SEMP.

164. 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.

165. For civil works, the contractor will be required to (i) carry out all of the mitigation and monitoring measures set forth in the approved SEP; 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.

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

Table 18: Design Stage Environmental Impacts and Mitigation Measures (included in DPR)

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
Sewer network	Nuisance due to leaks, overflows, contamination of water supplies, occupation health and safety of workers, etc.	<ul style="list-style-type: none"> (i) Limit the sewer depth where possible (ii) Sewers shall be laid away from water supply lines and drains (at least 1 m, wherever possible); (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 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 	PIU/TCMC	Project Costs
Construction works in the regulated buffer zone of ASI monument (Erumbeeswarar Temple)	Disturbance / damage to monument	<ul style="list-style-type: none"> (i) Obtain prior permission from ASI for the works to be conducted within the regulated zone of monument; submit detailed construction drawings clearly indicating the details of proposed excavations and works, use of equipment and machinery, etc., to ASI for their review; incorporate any suggestions/recommendations of ASI in project design and implementation (ii) Consult ASI and 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. (iii) Excavation and construction methodology to be used within the regulated area of 300 m of any monument shall be in line with the ASI recommendations and have the excavation observed by person with archaeological knowledge for chance finds (iv) No equipment causing vibration (e.g., pneumatic drills, excavators etc.) and heavy noise should be used; works shall be conducted manually 	PIU/TCMC	Project Costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(v) Dust control measures shall be put in place; all work areas to be barricaded and enclosed with dust screens (vi) Conduct periodical air quality and noise monitoring throughout construction phase in the 300 m regulated area (vii) Appoint a archaeological expert to assess impacts and supervise works		
Sewage stations pumping	Odor nuisance	Measures specific (additional) to New Pumping Station near household area (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 Design measures for all pumping stations (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 metaled 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.	PIU/TCMC	Project Costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		<p>(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.</p> <p>(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.</p> <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) Conduct periodic H₂S monitoring</p>		
Sewage lifting stations	Odor nuisance	<p>(i) Provide closed wells fitted with necessary ventilation and odor abatement systems such as GAC air filters fitted to the ventilation shaft outlet(s).</p> <p>(ii) Provide greenbelt (tree cover) around the lift stations, wherever possible</p>	PIU/TCMC	Project costs
Sewage pumping and lifting stations	Noise	<p>(i) Procure good quality latest technology high pressure pumps that guarantee controlled noise at a level of around 80 dB(A) at a distance of 1 m</p>	PIU/TCMC	Project costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		<ul style="list-style-type: none"> (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 with low emission and low noise fitted with acoustic enclosures (v) Provide sound mufflers for ventilators in the plant rooms; and sound proof doors (vi) Provide ear plugs to workers. (vii) Consult the ASI and the 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. (vii) Excavation and construction methodology to be used near the monuments (within the regulated area of 300 m of any monument) shall be finalized in consultation with ASI; have the excavation observed by person with archaeological knowledge for chance finds; no equipment causing vibration and heavy noise should be used 		
Sewage pumping and lifting stations	Energy consumption	<ul style="list-style-type: none"> (i) Using low-noise and energy efficient pumping systems (ii) Efficient Pumping system operation (iii) Installation of Variable Frequency Drives (VFDs) 	PIU/TCMC	Project Costs

ASI = Archeological Survey of India, CPCB = Central Pollution Control Board, O&M = operation and maintenance, PIU = program implementation unit, SOP = Standard operating procedure, TCMC = Tiruppur City Municipal Corporation.

Table 19: Pre Construction Stage Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Cost and Source of Funds
Submission of updated EMP / SEMP; EMP implementation and reporting	Unsatisfactory compliance to EMP	(i) Appoint EHS Supervisor to ensure EMP implementation (ii) Submission of updated EMP/ SEMP (iii) Timely submission monthly of monitoring reports including documentary evidence on EMP implementation such as photographs	Contractor and CMSC	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 CMSC/PIU	Contractor 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 with CMSC/PIU	Contractor 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 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 (EC) prior to approval by PIU	Contractor to prepare list of approved quarry sites and sources of materials with the approval of PIU	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Cost and Source of Funds
Consents, permits, clearances, 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. (ii) Ensure that all necessary approvals for construction to be obtained by contractor are in place before start of construction (iii) Acknowledge in writing and provide report on compliance all obtained consents, permits, clearance, NOCs, etc.	Contractor ,CMSC and PIU	Cost of obtaining all consents, permits, clearance, NOCs, etc. prior to start of civil works is the responsibility of PIU.
Chance finds	Damage / disturbance to 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.	Contractor, CMSC and PIU	Contractor cost

CMSC = Construction Management and Supervision Consultant, EMP = environmental management plan, m = meter, NOC = no objection certificate, PIU= Program Implementation Unit, SEMP = site environmental management plan.

Table 20: 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	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 (OHS), core labor laws, applicable environmental laws, etc.	Contractor and CMSC	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,	For all construction works (i) Provide a dust screen around the construction sites of pumping and lifting stations (ii) Damp down the soil and any stockpiled material on site by water sprinkling; (iii) Stabilize 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	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
	sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons.	<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</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>For sewer works</p> <p>(i) Barricade the construction area using hard barricades (of 2 m height) on both sides</p> <p>(ii) Initiate site clearance and excavation work only after barricading of the site is done</p> <p>(iii) Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes etc.), to the barricaded area</p> <p>(iv) Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area</p> <p>(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</p> <p>(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.</p> <p>(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.</p> <p>(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.</p> <p>(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</p>		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		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.		
Surface water quality	<p>Mobilization of settled silt materials, and chemical contamination from fuels and lubricants during construction can contaminate nearby surface water quality.</p> <p>Ponding of water in the pits / foundation excavations</p>	<p>(i) All earthworks be conducted during the dry season to prevent the problem of soil/silt run-off during rains</p> <p>(ii) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;</p> <p>(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;</p> <p>(iv) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;</p> <p>(v) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;</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>	Contractor	Contractor cost
Pipe bridge construction across streams and canals	Degradation of water quality / silting of water body	<p>(i) Conduct works in the water body (especially foundation work) only during no-flow season</p> <p>(ii) Select a construction method which is less disruptive (eg, precast type)</p> <p>(iii) Do no spill construction chemicals, fuels, lubricants in the water body</p> <p>(iv) Clean up the site immediately after construction is complete; construction debris, materials, etc., shall be cleared and pre project condition restored or improved</p>	Contractor	Contractor cost
	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 of only clarified water into drainage channels/streams after sedimentation in the temporary ponds</p> <p>(iii) Consider safety aspects related to pit collapse due to accumulation of water</p>	Contractor	Contractor cost
Noise and vibration Levels	Increase in noise level due to earth-moving and excavation equipment, and the	(i) Plan activities in consultation with CMSC/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	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
	transportation of equipment, materials, and people	<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 70 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> <p>(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.</p> <p>Works near the ASI monument</p> <p>(i) Excavation and construction methodology to be used near the monuments (within the regulated area of 300 m of any monument) shall be in line with the ASI recommendations</p> <p>(ii) No equipment causing vibration (e.g., pneumatic drills, excavators etc.,) and heavy noise should be used; works shall be conducted manually</p> <p>(iii) Dust control measures shall be put in place; all work areas to be barricaded and enclosed with dust screens</p> <p>(vi) Conduct periodical air quality and noise monitoring throughout construction phase in the 300 m regulated area</p>		
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 4)</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 of 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>	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<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 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 in disposal sites managed by the TCMC, who is a pioneer in handling SWM and hazardous waste in Tamil Nadu;</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.</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>		
Accessibility and traffic disruptions	Traffic problems and conflicts near project locations and haul road	<p>Sewer works</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 7)</p> <p>(ii) Plan the sewer work in coordination with the traffic police; provide temporary diversions, where necessary 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</p>	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<p>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 over the open trenches at each house to maintain the access.</p> <p>(ix) Inform the affected local population 1-week in advance about the work schedule</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> <p>Hauling (material, waste/debris and equipment) activities</p> <p>(i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites</p> <p>(ii) Schedule transport and hauling activities during non-peak hours;</p> <p>(iii) Locate entry and exit points in areas where there is low potential for traffic congestion;</p> <p>(iv) Drive vehicles in a considerate manner</p> <p>(v) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.</p>		
Socio-Economic Loss of access to houses and business	Loss of income	<p>(i) Inform all businesses and residents about the nature and duration of any work well in advance so that they can make necessary preparations;</p> <p>(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</p> <p>(iii) Barricade the construction area and regulate movement of people and vehicles in the vicinity, and maintain the surroundings safely with</p>	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<p>proper direction boards, lighting and security personnel – people should feel safe to move around</p> <p>(iv) Control dust generation</p> <p>(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.</p> <p>(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;</p> <p>(vii) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and</p> <p>(viii) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.</p>		
Socio-Economic – Employment	Generation of temporary employment and increase in local revenue	<p>(i) Employ local labor force as far as possible</p> <p>(ii) Comply with labor laws</p>	Contractor	Contractor cost
Occupational Health and Safety	Occupational hazards which can arise during work	<p>(i) Follow all national, state and local labor laws (indicative list is in Appendix 2);</p> <p>(ii) Develop and implement site-specific occupational health and safety (OHS) Plan 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) OHS Training^a 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.^b</p> <p>(iii) Ensure that qualified first-aid is provided at all times. Equipped first-aid stations shall be easily accessible throughout the sites;</p> <p>(iv) Secure all installations from unauthorized intrusion and accident risks</p> <p>(v) Provide H&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;</p> <p>(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;</p>	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<ul style="list-style-type: none"> (vii) Ensure the visibility of workers through their use of high visibility vests 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 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 70 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 		
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians during material and waste transportation	<ul style="list-style-type: none"> (i) Consult PIU before locating project offices, sheds, and construction plants; (ii) Select a camp site away from residential areas (at least 100 m 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 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 (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 (x) Prohibit employees from cutting of trees for firewood; contractor should provide cooking fuel (cooking gas); fire wood not allowed 	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(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 (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.		
Work Camps and worksites	Temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants Unsanitary and poor living conditions for workers	(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) (ii) Avoid tree cutting for setting up camp facilities (iii) Ensure that a proper compound wall is provided, and erect a wind/dust screen around (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 (v) Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit (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; (vii) Consult PIU before locating project offices, sheds, and construction plants; (viii) Minimize removal of vegetation and disallow cutting of trees (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	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<ul style="list-style-type: none"> (x) Camp shall be provided with proper drainage, there shall not be any water accumulation (xi) Provide drinking water, water for other uses, and sanitation facilities for employees (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) (xiii) Train employees in the storage and handling of materials which can potentially cause soil contamination (xiv) Recover used oil and lubricants and reuse or remove from the site (xv) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; provide a compost pit for biodegradable waste, and non-biodegradable / recyclable waste shall be collected and sold in local market (xvi) Remove all wreckage, rubbish, or temporary structures which are no longer required (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. 		
Post-construction clean-up	Damage due to debris, spoils, excess construction materials	<ul style="list-style-type: none"> (i) Remove all spoils wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (ii) All excavated roads shall be reinstated to original condition. (iii) All disrupted utilities restored (iv) All affected structures rehabilitated/compensated (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. (vi) All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be top soiled and regrassed using the guidelines set out in the revegetation specification that forms part of this document. (vii) The contractor must arrange the cancellation of all temporary services. (viii) Request PIU to report in writing that worksites and camps have been vacated and restored to pre-project conditions before acceptance of work. 	Contractor	Contractor cost

ASI = Archeological Survey of India, CMSC = Construction Management and Supervision Consultant, EMP = environmental management plan, PIU = program implementation unit, SWM = Solid Waste Management.

^a 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.

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

Table 21: Operation Stage Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
Operation of sewage lifting and pumping stations	Odor nuisance	(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 a vis its relation 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 H ₂ S monitoring periodically	PIU and TCMC	Operating costs
Operation and maintenance of sewerage system	Blocks, overflows, system malfunction, occupational health and safety	(i) Establish regular maintenance program, including: <ul style="list-style-type: none"> 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 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 Monitoring of sewer flow to identify potential inflows and outflows 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	PIU and TCMC	Operating costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(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 sulfide, methane, etc.); provide for adequate equipment (including oxygen masks) for emergency use		

PIU= Program Implementation Unit, TCMC = Tiruppur City Municipal Corporation.

Table 22: Pre-construction & Construction Stage Environmental Monitoring Plan

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
Construction phase					
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 8	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 (locations 50 m downwind direction near sewer and pumping / lifting station work sites in the city);	<ul style="list-style-type: none"> PM₁₀, PM_{2.5}, NO₂, SO₂, CO 	Once before start of construction Quarterly (yearly 4-times) during construction (3 year period considered)	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (65 samples x 5000 per sample = 325,000)
Ambient noise	5 locations (locations near sewer and pumping / lifting station work sites in the city);	<ul style="list-style-type: none"> Day time and night time noise levels 	Once before start of construction Quarterly (yearly 4-times) during construction (3 year period considered)	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (65 samples x 1500 per sample = 97,500)
Surface water quality	3 locations (2 points in River Koraiyar and 1 point in Uyyakondan	<ul style="list-style-type: none"> pH, Oil and grease, Cl, F, NO₃, TC, FC, Hardness, Turbidity BOD, COD, DO, E- 	Once before start of construction Half yearly during construction (3 year	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
	canal near pipe carrying bridge)	coli, Total Alkalinity ,heavy metals and pesticides.	construction period considered)		(21 samples x 4000 per sample = 84,000)

CMSC = Construction Management and Supervision Consultant.

Table 23: Operation Stage Environmental Monitoring Plan

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
Odor monitoring at pumping stations	7 points (downwind direction) at all pumping stations: near suction well; outside the pumping station and at nearest house	Hydrogen sulfide (H ₂ S)	Periodical (throughout the operation phase)	TCMC	Handheld H ₂ S meters to be procured as part of the project and operated by operating staff
Odor monitoring at lifting stations	6 points (downwind direction) at all lifting stations: near suction well and at nearest house	Hydrogen sulfide (H ₂ S)	Periodical (throughout the operation phase)	TCMC	Handheld H ₂ S meters to be procured as part of the project and operated by operating staff

TCMC = Tiruppur City Municipal Corporation.

B. Implementation Arrangements

167. The Municipal Administration and Water Supply Department (MAWS) of GOTN acting through the Tamil Nadu Urban Infrastructure Financial Services Ltd. (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. A Project Steering Committee, headed by Principal Secretary, MA and WS, and members include managing directors of TNUIFSL, CMA, and Chennai Metro Water Supply and Sewerage Board (CMWSSB) will be established.

168. The implementing agency for this subproject is TCMC. A Project Implementation Unit (PIU) will be established in TCMC headed by full-time a Project Manager (a senior official of TCMC) and comprising dedicated full-time staff from engineering and other departments of TCMC. PIU under the TCMC 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.

169. **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 Head, project division. At PIU level, a safeguards officer will be appointed, who will coordinate monitoring and implementation of safeguards on behalf of TCMC. Experts available at CMSC will monitor implementation of safeguards.

170. **PMU Safeguard Responsibilities.** Key tasks and responsibilities of the ESS Manager (Environment), for this subproject include the following:

1. 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; and
- (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.

2. Construction stage:

- (i) Prior to start of construction:
 - Ensure that all necessary clearances/permissions/licences, including that of contractor's are in place prior to start of construction;
 - 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; and
- (v) Oversee site closures to ensure that all work / facility sites are restored properly prior to issuing work completion certificate to the contractor.

3. Operation stage: Ensure that all clearances as required for operation of project are in place prior to operation, such as consent to operate (CTO) from TNPCB for STPs which will treat the sewage contributed from this subproject

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

1. 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 EMP 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) Labor 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; and
- (vi) Obtain all clearance/permissions as required for implementation of subproject, prior to invitation of bids and/or prior to award of contract as appropriate.

2. 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, labor welfare and safety etc.;
- (ii) Obtain CTE from TNPCB and NMA permission for works within 300 m regulated boundary of ASI monument as applicable prior to construction;
- (iii) 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;
- (iv) Ensure contractor compliance with staff resources as per the IEE/EMP/Bid Document;
- (v) Guide contractor on updating EMP / preparing Site Specific Environmental Plan at the start of the project;
- (vi) Update IEE and EMP; ensure that IEE reflects the final design being implemented by contractor;
- (vii) Conduct public consultation and information disclosure as necessary;
- (viii) Take necessary action for obtaining rights of way;
- (ix) Supervise day-to-day EMP implementation on site by contractor, including the environmental monitoring plan;
- (x) Supervise ambient environmental monitoring by contractors;
- (xi) Take corrective actions when necessary to ensure no environmental impacts;
- (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 / TNUISL; and
- (xx) Provide any assistance in environmental safeguard related tasks as required by PMU to ensure compliance and reporting to ADB.

2. Operation stage:

- (i) Ensure that all clearances as required for operation of project are in place prior to operation, such as consent to operate (CTO) from TNPCB for STPs which will treat the sewage contributed from this subproject; and
- (ii) Conduct environmental management and monitoring activities as per the EMP.

172. Contractor's Responsibilities:

1. Bidding stage:

- (i) Understand the EMP requirements and allocate necessary resources (budget, staff, etc.);

- (ii) Understand the regulatory compliance requirements related to labor welfare, safety, environment, etc.

2. 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 4);
 - (b) Traffic management plan (TMP) (sample is Appendix 7);
- (vi) Implement the mitigation measures as per the EMP including CWM and TMPs;
- (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; and
- (xiii) Comply with applicable government rules and regulations.

C. Training Needs

173. Table 24 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 24: Outline Capacity Building Program on environmental management plan Implementation

Description	Target Participants and Venue	Cost and Source of Funds
1. Introduction and Sensitization to Environmental Issues (1 day) <ul style="list-style-type: none"> - ADB Safeguards Policy Statement - Government of India and Tamil Nadu applicable safeguard laws, regulations and policies including but not limited to core labor standards, OHS, etc. - Incorporation of EMP into the project design and 	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	Cost and Source of Funds
contracts - Monitoring, reporting and corrective action planning		
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 - Work near ASI monuments - 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 CMSC 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) Awareness & on-site training for workers and staff on sludge handling and disposal in existing STP repair work	Contractors' EHS officer to conduct program, with guidance of CMSC

ADB = Asian Development Bank, CMSC = Construction Management and Supervision Consultant, EHS = environmental Health and Safety, EMP = environmental management plan, OHS = occupational health and safety, PMU = program management unit, PIU = program implementation unit, SOP = standard operating procedures.

D. Monitoring and Reporting

174. 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. Baseline Environmental monitoring as indicated in the construction stage environmental monitoring plan should be conducted and the analysis outcome should be shared in the compliance report. 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.

175. 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 Environmental Monitoring 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 9). During operation, PIU will conduct management and monitoring actions as per the operation stage EMP, and submit to PMU an annual report.

176. Based on PIU Quarterly Environmental 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 TCMC websites.

177. ADB will review project performance against the TNUIFIP 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

178. 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 25: Cost Estimates to Implement the Environmental Management Plan

	Particulars	Stages	Unit	Total Number	Rate (₹)	Cost (₹)	Costs Covered By
A.	Mitigation Measures						
1	Providing odor control system sewage pumping & lifting stations (gas capturing & treatment at required stations) and handheld H ₂ S meters for monitoring	Design	per Number	-	-	4,000,000	Civil work contract
2	Provision for tree cutting and compensatory plantation measures (1:10 ratio replantation)	Construction	Per tree	90	1,000	90,000	Project costs (PIU)
3	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	-	-	300,000	Civil works contract
4	Safety barricading	Construction	Lump sum	Lump sum	-	20,000,000	Civil works contract
	Subtotal (B)					243,90,000	
B.	Monitoring Measures						
1	Air quality monitoring	Construction	per sample	60	5,000	300,000	Civil works contract
2	Noise levels monitoring	Construction	Per sample	60	1,500	90,000	Civil work contract
3	Surface water monitoring	Construction	Per sample	25	4,000	100,000	Civil work contract
	Subtotal (C)					490,000	
D.	Capacity Building						
1.	Training on EMP implementation	Pre-construction				-	Part of PIU and PMU , consultant tasks

	Particulars	Stages	Unit	Total Number	Rate (₹)	Cost (₹)	Costs Covered By
2.	Contractors Orientation to Workers on EMP implementation	Prior to dispatch to worksite				-	Civil works contractor cost
	Subtotal (D)						
	Total (A+B+C+D)				₹	2,84,80,000	
	Contractor Cost					- 24,390,000	
	PIU Cost					- 4,090,000	
	Total					- 2,8480,000	

EMP = environmental management plan, PMU = program management unit, PIU = program implementation unit.

IX. CONCLUSION AND RECOMMENDATIONS

179. The process described in this document has assessed the environmental impacts of all elements of the proposed underground sewerage subproject covering municipal area (Ponmalai, K. Abishekapuram Zones and part of Ariyamangalam) of Tiruchirappalli. 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 odor control at pumping stations, uninterrupted power supply provision; standard operating procedures for operation and maintenance; and imparting necessary training for TCMC staff; providing necessary safety, no manual cleaning of sewers, and personal protection equipment for workers (protection against oxygen deficiency, harmful gaseous emissions)

180. 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 household. New sewage pumping stations (6 nos.) are located within or close to residential areas. The distance between SPS units and residents / receptors are mentioned in Table.13. 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. Erumbeeswarar temple, a protected monument, is located within the subproject areas surrounded by residential areas. Proposed provision of sewer network in this area also falls under the 300 m regulated buffer zone of monument. No impacts are envisaged as the works are not located within the monument, and also that works within 300 m area of the monument will be conducted with the prior permission of competent authority.

181. proposed 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.

182. 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.

183. 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 Operation and Maintenance manual and standard operating procedures to be developed for all the activities.

184. 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.

185. 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, TCMC and ADB websites. The consultation process will be continued during project implementation to ensure that stakeholders are engaged in the project and have the opportunity to participate in its development and implementation.

186. 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.

187. 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/ SEMP 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.

188. The citizens of the Tiruchirappalli 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.

189. Therefore, as per ADB SPS, this subproject is classified as environmental category B and does not require further environmental impact assessment. For the project components located within the regulated zone of protected monument, prior permission of ASI shall be obtained prior to construction. Further, TCMC has to carry out the Corrective Action plan as suggested in the IEE based on the environmental audit of the existing STP, which is an associated facility for the subproject. This IEE is prepared based on the Detailed Project Report , and shall be updated by PIU during implementation phase to reflect final project design and will be reviewed and approved by PMU. The updated IEE will be submitted to ADB for concurrence and disclosure.

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 Sustainable Development and Climate Change 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 – Supplying, laying, testing and commissioning of sewer network in the extended area and erstwhile area of Tiruchirappalli including lifting station, pumping station and pumping main

Sector Division: Urban Development

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area...			
➤ Densely populated?	✓		Subproject activities are located in Tiruchirappalli City, a rapidly developing urban area in the state of Tamil Nadu. Subproject area includes old town area of Tiruchirappalli, which is very densely populated.
➤ Heavy with development activities?	✓		It is a developing area; urban expansion is considerable.
➤ Adjacent to or within any environmentally sensitive areas?		✓	-
➤ Cultural heritage site	✓		The proposed sewer alignment (Collection network 3.3km, pumping main 549m and a pumping station (SPS 5) at Indira nagar) will pass through regulated areas of the protected monument (Erumbeshwarar Temple) of the Archaeological Society of India (ASI). Potential impacts from civil works will be avoided by (i) consulting with and obtaining permission from ASI, and (ii) appointing an archaeological expert to assess the impacts and supervise construction. During operation phase, environmental impacts are not envisaged.
➤ Protected Area		✓	In Tamil Nadu State, there are 5 national parks, 15 wildlife sanctuaries (including four tiger reserves), 15 bird sanctuaries, and two conservation reserves. The ADB Mission team confirmed during pre- and fact-finding missions that Tranche 2 locations are not in these protected areas.
➤ Wetland		✓	
➤ Mangrove		✓	

Screening Questions	Yes	No	Remarks
➤ Estuarine		✓	
➤ Buffer zone of protected area		✓	There are 3 biosphere reserves in Tamil Nadu. Biosphere reserves have vast areas and may cover urban and developing areas. The ADB Mission team confirmed during pre- and fact-finding missions that Tranche 2 locations are components are/will be in the biosphere core zones.
➤ Special area for protecting biodiversity		✓	
➤ Bay		✓	
B. Potential Environmental Impacts Will the Project cause...			
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?	✓		The proposed sewer network (including collection network 3.3km, pumping main 549m and a pumping station (SPS 5) at Indira nagar) falls within the regulatory zone of the ASI monument (Erumbeshwarar Temple). However, suitable mitigation measures has been suggested in the EMP in order to mitigate the anticipated impacts. Moreover, an ASI/ Archeological expert shall be appointed to look after/ supervise the construction works proposed in the regulatory zone areas. Hence the proposed sewer network shall not have any damage to the ASI site.
▪ interference with other utilities and blocking of access to buildings; nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.?	✓		Anticipated during operations but can be avoided and mitigated. STP, sewage lifting, and pump stations are in urban areas and odor may create nuisance to communities. Appropriate odor standards will be applied, and necessary odor control measures are included in the designs and EMPs.
▪ dislocation or involuntary resettlement of people?	✓		Anticipated but can be managed. Any involuntary resettlement impact is addressed in the resettlement plan prepared per ADB SPS.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		✓	Not anticipated. The contractor will be encouraged to hire workers from the local labor force.
▪ impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?		✓	Not anticipated. Sewage will be treated in the proposed STPs. The designs and operation of the STPs will consider on assimilative capacity of receiving body of water and effluents will comply with discharge standards.
▪ overflows and flooding of neighboring properties with raw sewage?		✓	Not anticipated. Risks, climate change factors, and 30 years population projects have been considered in identifying the capacity and design of the sewerage systems. The design engineers confirmed no risk of overflow.
▪ environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally		✓	Not anticipated. STP designs will include sludge collection, treatment and disposal process. The sewerage collection systems will

Screening Questions	Yes	No	Remarks
disposed in sewers?			only allow flow domestic sewage by direct connections to households. The designs ensure no industrial effluent will be allowed into the sewer network.
▪ noise and vibration due to blasting and other civil works?	✓		Anticipated but temporary, site-specific and can be mitigated. No blasting activities envisaged. Nuisance/disturbance due to elevated noise may be experienced by sensitive receptors during construction. Noise will be minimized with mitigation measures specified in the EMPs. During operations, noise may be experienced by sensitive receptors due to STP operations. This will be avoided by including noise barriers and enclosure of noise-producing components to meet IFC EHS' WHO guideline values and/or national standards, whichever is more stringent.
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, and biological hazards during project construction and operation?	✓		Anticipated but temporary, site-specific and can be mitigated. EMPs and contract provisions include requirement for contractors' Health and Safety (H&S) plan. The contractors' H&S plans will be reviewed and cleared by PIUs prior to commencement of works.
▪ discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?		✓	Not anticipated. The sewerage collection systems are designed to only allow flow of domestic sewage by direct connections to households. The designs ensure no industrial effluent will be allowed into the sewer network.
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?		✓	Note anticipated. STP, pump and lifting stations will include buffer zones as required and condition in the Consent to Establish by the Tamil Nadu State Pollution Control Board.
▪ road blocking and temporary flooding due to land excavation during the rainy season?	✓		Anticipated during construction but temporary, site-specific and can be mitigated. Complete road blocks are not envisaged. In narrow roads, traffic may be diverted but access will be ensured for pedestrians. Works will be conducted during dry season. Contractors are required to submit traffic management plan as part of site-specific EMP.
▪ noise and dust from construction activities?	✓		Anticipated during construction but temporary, site-specific and can be mitigated. No major noise-generating activities like rock blasting is anticipated. As the sewers will be laid on the road surface, cutting open of road surface using pneumatic drills will produce noise and dust. Temporary nuisance/disturbance due to noise and dust may be experienced by sensitive receptors. These impacts will be minimized with mitigation measures specified in the EMPs. During operations, noise may be experienced by sensitive receptors due to STP operations. This impact will be avoided by including noise barriers and enclosure of noise-

Screening Questions	Yes	No	Remarks
			producing components.
▪ traffic disturbances due to construction material transport and wastes?	✓		Anticipated during construction but temporary, site-specific and can be mitigated. EMPs and contract provisions include requirement for contractors' Traffic Management Plan which will be reviewed and cleared by PIUs prior to commencement of works.
▪ temporary silt runoff due to construction?	✓		Anticipated during construction but temporary, site-specific and can be mitigated. EMPs and contract provisions include requirement for contractors to provide silt control measures.
▪ hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?		✓	Not anticipated. O&M Manuals will be developed as part of the contracts. Necessary equipment and training to workers will be provided under TNUIFP. The ULBs will be trained on standard operating procedures and maintenance to ensure facilities are functioning according to the designs.
▪ deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?		✓	Not anticipated. The STP designs include sludge handling and treatment facilities. Necessary equipment and training to ULBs/workers on sludge handling and effluent monitoring will be provided under TNUIFP.
▪ contamination of surface and ground waters due to sludge disposal on land?		✓	Not anticipated. The STP designs include sludge handling and treatment facilities. O&M Manual will include testing procedures, parameters and restriction on re-use of treated sludge. Only if it meets the Government of India standards for soil conditioner and fertilizer then will be allowed for re-use and strictly for non-food crops only.
▪ Health and safety hazards to workers from toxic gases and hazardous materials which may be contained in confined areas, sewage flow and exposure to pathogens in untreated sewage and unstabilized sludge?	✓		Anticipated during operation but temporary, site-specific and can be mitigated. Workers may be exposed during cleaning of blockages in sewerage network. However, O&M Manuals will include standard operating procedures. All necessary health and safety training and personal protection equipment will be given to workers and staff during operation of sewerage system. Implementation of contractors' H&S will be strictly enforced by the PIUs.
▪ Large population increase during project construction and operation that causes increased burden on social infrastructure (such as sanitation system)?		✓	Not anticipated.
▪ Social conflicts between construction workers from other areas and community workers?		✓	Not anticipated. The contractor will be encouraged to hire workers from the local labor force.
▪ Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel	✓		Anticipated but can be mitigated. Construction will not involve use of explosives and chemicals. During operations, chemicals such as pH adjusters, flocculants, or coagulants may be

Screening Questions	Yes	No	Remarks
and other chemicals during construction and operation?			used. The complete list of chemicals, quantities, and requirements for safe use and storage will be included in the Updated/Final IEE for the STPs (these are design-build-operate packages). The EMPs in the current IEEs already include measures and monitoring requirements conforming with IFC EHS Guidelines. O&M Manuals will include health and safety requirements for managing chemicals.
<ul style="list-style-type: none"> 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? 		✓	Not anticipated. Work area will be clearly demarcated. STPs will have compound walls and security personnel. Pump houses and lifting stations will be secured and locked. Only workers and project-concerned members will be allowed to enter the sites. PIUs, in coordination with water and sanitation committees, will disseminate information on community health and safety.

CHECKLIST FOR PRELIMINARY CLIMATE RISK SCREENING

Screening Questions		Score	Remarks ^a
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather-related events such as floods, droughts, storms, landslides?	1	Some project locations may experience flooding during heavy rains. No components will be sited in river flood plains, drainage channels, etc. Locations may however be in low-lying areas. Adequate measures will be included in the designs to safeguard facilities from extreme events.
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc.)?	1	Intakes and other structures (e.g., pumping stations, STPs) located in or close to rivers/water bodies, low lying flat lands, etc., to be designed with proper hydro-meteorological parameters
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	No significant effect
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance	0	No significant effect

	(scheduling and cost) of project output(s)?		
Performance of project outputs	Would weather/climate conditions and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	No significant effect

If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High): Medium Risk

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 at 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 (Amendment) Act 2017- 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 Rs. 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.

ENVIRONMENTAL AUDIT OF EXISTING SEWAGE TREATMENT PLANT IN TIRUCHIRAPPALLI

I. Introduction

1. Under the ADB funded Tamil Nadu Urban Flagship Investment Program (TNUFIP), it is proposed to develop sewer system (sewer collection and conveyance infrastructure) in Tiruchirappalli City.

2. The subproject under Phase III shall provide sewerage system in south zone , southwest (Phase III) which covers all areas in Ponmalai and K.Abishekapuram Zone and Thiruverumbur area in city area of TCMC. The components are: (i) sewage collection system (327 km length of sewers); (ii) 11 sewage lift stations; (iii) 7 new sewage pumping station; (iv) pumping main sewers 20.93 km length); (v) 12,389 manholes; (vi) 32,000 house service connections; and (vii) Connecting to STPs: The flow of zone 5 and part of zone 6 (9 MLD) will reach 37 MLD Keelakal kandar kottai STP (these two zones flows already considered in STP at Keelakalkandar Kottai) and the sewage flow of zone 7 to zone 12 (28 MLD) will flow to 88 MLD Panjapur.

3. Sustainability of new sewer infrastructure and realization of intended purpose (removing the human waste from those areas served by the network rapidly and treated to an acceptable standard) and benefits (improved environmental conditions, public health etc.,) would accrue only with a properly functioning treatment facility. Therefore the existing STP is an associated facility as per the ADB Safeguard Policy Statement, 2009. Compliance with the environmental safeguards will ensure the subproject sustainability, and therefore, ADB SPS, 2009 requires conduct of environmental audit of associated facilities.

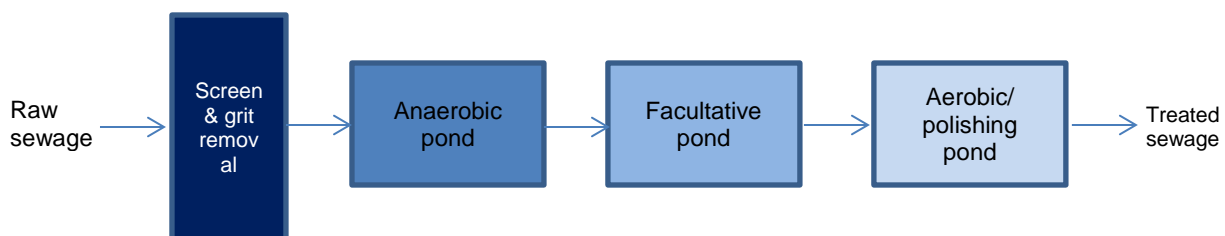
4. The objectives of this environmental audit are to (i) assess the compliance of the existing sewage treatment plant (STP) with country's environmental regulatory framework; (ii) improve environmental performance, as required, through monitoring the effectiveness of the management system; and (iii) increase the TCMC's knowledge of its activities, thus increasing its ability to continually improve and minimize future potential liabilities.

5. The methodology adopted for this audit was to initially review existing plans and technical information and list various activities being carried out in the STP. Due diligence was carried out to physically check whether environmental performance, health and safety, etc., were in compliance with national and state prescribed standards and guidelines. The audit process involved visit to the STP to observed operations, Meetings and discussions with key personnel and review of various documentations regarding the operational aspects.

II. Description of the STP

Location	Panjapur ,Tiruchirappalli City
Start of operation (year)	1987
Owned by	Tiruchirappalli City Corporation (TCMC)
Contact person and designation	City Engineer, TCMC
Capacity	88 million liters per day (MLD)
Sewage treatment process	Waste stabilization pond based sewage treatment plant. Facility has the following components: (i) Manual screening, (ii) Manual grit removal, (iii) Flow division system to different treatment units, (iv) Anaerobic ponds, (v) Facultative ponds, and (vi) Maturation ponds. Technical details of STP units are as follows:

	<table><tr><th>Treatment Technology</th><th>Waste Stabilization Pond</th><th></th></tr><tr><td>Anaerobic Ponds</td><td>2</td><td>nos.</td></tr><tr><td>Facultative Ponds</td><td>2</td><td>nos.</td></tr><tr><td>Polishing (Maturation) Ponds</td><td>2</td><td>nos.</td></tr><tr><td>Area of STP (new)</td><td>160.00</td><td>acres</td></tr><tr><td>Area of STP (Old – Facultative Ponds only)</td><td>75.00</td><td>acres</td></tr><tr><td>Area of AL (additional provided through NRAP)</td><td>12.50</td><td>acres</td></tr><tr><td>Total Area of Sewage Treatment Plant(s)</td><td>247.50</td><td>acres</td></tr><tr><td>Treated Wastewater Disposal</td><td>Koraiyar River</td><td></td></tr><tr><td>Treatment Quality/ Level</td><td>Effluent BOD of 20 mg/l</td><td></td></tr></table>	Treatment Technology	Waste Stabilization Pond		Anaerobic Ponds	2	nos.	Facultative Ponds	2	nos.	Polishing (Maturation) Ponds	2	nos.	Area of STP (new)	160.00	acres	Area of STP (Old – Facultative Ponds only)	75.00	acres	Area of AL (additional provided through NRAP)	12.50	acres	Total Area of Sewage Treatment Plant(s)	247.50	acres	Treated Wastewater Disposal	Koraiyar River		Treatment Quality/ Level	Effluent BOD of 20 mg/l	
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	<p>Treatment Process at STP: Waste stabilization pond (WSP) based treatment process, which treats the sewage/domestic wastewater in are large man-made water bodies by natural occurring processes and the influence of solar light, wind, microorganisms and algae, has been adopted in the existing STP at Tiruchirappalli. WSP based treatment process consists of large basins in which sewage / domestic wastewater is treated and treated water is normally used for irrigation or land disposal. For effective treatment, Tiruchirappalli WSP based STP is developed with a series of ponds comprising first of anaerobic ponds, then facultative ponds, and finally the aerobic ponds (polishing ponds).</p> <p>Raw sewage after passing through a manual screen and grid chamber enters the anaerobic ponds, where primary treatment occurs and reduces organic load in the wastewater. The depth of this basin is 3 m, and in entire depth it acts as anaerobic pond. Due to sedimentation, sludge accumulates in the bottom, that aids removal of solid and BOD through anaerobic digestion. Retention time in anaerobic pond if 1 day.</p> <p>From anaerobic ponds, the effluent enters facultative pond of 1.5 m deep. The top layer of the pond receives oxygen naturally, while the lower layer becomes anaerobic in the absence of oxygen. Settle solid accumulate in the bottom and are digested. Both the aerobic and anaerobic process reduces the BOD further. Retention time in facultative pond is 4 days.</p> <p>Finally from the facultative ponds, the effluent enters aerobic/polishing ponds that primarily aid removal of pathogens and is the last step in WSP treatment process. Depth of pond is 1.5 m, and retention time is 5 days. Due to shallow depth, sunlight penetrates into full depth and aids photosynthesis. Photosynthetic algae release oxygen into the water and at the same time consume carbon dioxide produced by the respiration of bacteria.</p>																														

Process at Existing STP**View of Existing STP**

Treatment efficiency	Normally about 60% treatment efficiency (BOD removal) is expected in anaerobic ponds, while it is about 75% in facultative ponds. So the overall efficiency of treatment can be expected from WSP process at a minimum of 90%. However, in Tiruchirappalli, the inlet and outlet effluent quality data from the STP indicate that treatment process is efficiency reducing the value of BOD and TSS to satisfactory level but the COD is above the prescribed level of TNPCB.
Sludge management	At the WSP based STP, sewage sludge settled at the bottom of the ponds will need to be removed periodically (as per the design, which normally range from three to five years). Ponds are allowed to dry out naturally and the solid sludge is removed by manual digging. 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. No records available on the removal of sludge. No laboratory tests were conducted on the sludge to check its quality prior to its disposal.
Treated wastewater (effluent disposal)	No reuse plan for treated water was available for review . In the current situation, wastewater from the polishing pond is let into a natural stream.

III. Compliance with Applicable National and State Laws, Rules, and Regulations

Law, Rules, and Regulations	Description and Requirement	STP at Tiruchirappalli
		<i>Y = compliant (if applicable, specify expiration date of permit/clearance)</i> <i>N = non-compliant^a</i> <i>N/A = not applicable (state justification)</i>
EIA Notification	The EIA Notification of 2006 states that environmental clearance is required for certain defined activities/projects.	N/A Environmental clearance is not required as STPs are not listed in the EIA Notification's "Schedule of Projects Requiring Prior Environmental Clearance"
Manufacture, Storage, and Import of Hazardous Chemical Rules, 1989	Storage of chlorine (threshold quantity greater than 10 tons but less than 25 tons) in STP s will require clearance from Tamil Nadu Pollution Control Board (TNPCB).	N/A No chlorine used or stored in the STP
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Consent to operate from TNPCB	Consent to establish was obtained in 2005 for construction of STP. Subsequent to construction and prior to start of operation consent to operate (CTO) under process . CTO is to be obtained (renewal) annual from the CTO.
Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	Consent to operate from TNPCB	Record for DG Set (available on site) was not maintained.
Environment (Protection) Act, 1986 and CPCB Environmental Standards	Emissions and discharges from the facilities to be created, refurbished, or augmented shall comply with the notified standards. a. Wastewater disposal standards	As per the CTO issued by TNCPB, STP effluent shall meet the following disposal standards: BOD: <20 mg/l and TSS: < 30 mg/l. Available laboratory reports indicate that STP effluent is meeting the stipulated disposal standards for BOD but not for other parameters.
Noise Pollution (Regulation and Control) Rules, 2002 amended up to 2010	Applicable ambient noise standards with respect to noise for different areas/zones	Record for DG Set (available on site) was not maintained.
National Institute of Occupational Safety and Health (NIOSH) Publication No. 2002-149	Compliance with NIOSH Guidance for Controlling Potential Risks to Workers Exposed to Class B Biosolids	Training and proper PPEs are required
Forest (Conservation) Act, 1980 and Forest Conservation Rules, 2003 as amended	As per Rule 6, every user agency, who wants to use any forest land for non-forest purposes shall seek approval of the central government.	N/A
Ancient Monuments and Archaeological Sites and Remains Rules of 1959	No development activity is permitted in the "protected area," and all development activities likely to damage the protected property are not permitted in the "controlled area" without prior permission of the Archaeological Survey of India (ASI). Protected property includes the site, remains, and monuments protected by ASI or the State Department of Archaeology.	N/A
The Child Labor (Prohibition and Regulation) Act, 1986	No child below 14 years of age will be employed or permitted to work in any of the occupations set forth in the Act's Part A of the Schedule or in any	<u>STP is operated by TCMC staff and proper PPEs are required. No children are engaged.</u>

Law, Rules, and Regulations	Description and Requirement	STP at Tiruchirappalli
		Y = compliant (if applicable, specify expiration date of permit/clearance) N = non-compliant ^a N/A = not applicable (state justification)
	workshop wherein any of the processes set forth in Part B of the Schedule are present.	

^a Compliant = There is sufficient and appropriate evidence to demonstrate that the particular regulatory requirement has been complied with; non-compliant = clear evidence has been collected to demonstrate the particular regulatory requirement has not been complied with.

IV. Institutional Arrangement

Parameter	STP
Operations	Continuous operation; involves no mechanical or electrical operation; Except manual operation for removal of debris from the screen, and removal of collected grit from grit chamber, no interference is required in operation of STP.
Manager per shift	Personnel at STP are available in one shift (day shift 9 AM to 6 PM)
Sewerage/public health engineer on-site	
Estimated number of technical employees on-site per shift	Assistant Executive Engineer (AEE), Ponmalai Zone, Tiruchirappalli City Corporation, is in-charge of STP operation. There are total 8 persons engaged in STP operation include a chemist in lab
Estimated number of laborers on-site per shift	
Estimated number of employees in charge of environmental management and monitoring	Nil
Frequency of waste water quality monitoring (raw)	Monthly
Frequency of wastewater quality monitoring (treated)	Monthly
Frequency of sludge quality monitoring	not conducted
In-house laboratory for water quality analyses (Yes/None). If none, provide name of third-party laboratory.	In-house laboratory is available at the STP; apparatus to conduct pH, BOD, COD and TSS available Laboratories of Tamil Nadu Water and Drainage Board and TNPCB, both located in Tiruchirappalli.

V. Rehabilitation of existing STP at Panjapur

6. TCMC has proposed to rehabilitate the 30 MLD STP for improving the performance towards achieving the prescribed standards for disposal of treated sewage effluent. This is being taken under Phase –II of UGSS which is under procurement stage.

7. To improve effluent standards quality of the existing 30 MLD plant, the following works has considered under Phase II.

- (i) In pretreatment units, the inlet chamber sluice gate -2, Manual Screens – 2, and Grit Chamber in let Sluice gates – 3.

- (ii) 600 mm CI pipeline from Primary Units to Anaerobic pond
 - (iii) The bunds of 2 numbers of facultative ponds shall be reconstructed (338 m x 223 m).
 - (iv) The bunds of polishing ponds shall be reconstructed (338 m x 223 m)
 - (v) The connection pipe (600 mm) between 4 ponds
 - (vi) The effluent channel from the polishing pond to be reconstructed up to the disposing point into the Koraiyar River.
8. Scraping of sludge , removing of old clay bed and disposing off and relaying of clay up to depth of 30 cm for providing impervious bed to Anaerobic ponds (2) , facultative ponds (2) and Polishing pond (1).
9. Increasing the bund width at top from 1 to 2.25 m to arrest seepage from ponds.

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.

Public Information Notice Template**Public Announcement
Providing Underground Sewerage System Tiruchirappalli City
Tiruchirappalli City Municipal Corporation**

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

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.

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:	

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 A7.1** 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 A7.1: Policy Steps for the TMP

Review	<ul style="list-style-type: none"> •Review construction schedule and methods
Traffic Re-Circulation	<ul style="list-style-type: none"> •Identify initial traffic recirculation and control policy
Traffic Diversions	<ul style="list-style-type: none"> •Identify routes for traffic diversions •Analyse adverse impact and mitigation at the detours
Full Road Closures	<ul style="list-style-type: none"> •Begin community consultation for consensus •Finalise or determine alternate detours
Temporary parking	<ul style="list-style-type: none"> •Identify temporary parking (on and off -street) •Discuss with CMC, owner, community for use
Police Coordination	<ul style="list-style-type: none"> •Coordinate with the Traffic Police to enforce traffic and diversions
Install control devices	<ul style="list-style-type: none"> •Install traffic control devices (traffic cones, signs, lightings, etc)
Awareness	<ul style="list-style-type: none"> •Conduct campaigns, publicity, and notify public about street closure
Public Redress	<ul style="list-style-type: none"> • Develop a mechanism to address public grievances regarding disruptions (traffic, utilities, and diversions)

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.

7. 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.

8. 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.

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

10. 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

11. 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:

- Signs
- Pavement Markings
- Channelizing Devices
- Arrow Panels
- Warning Lights

12. 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”).

13. **Figure A 7.2 to Figure A 7.6** 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

14. 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.

15. 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 A7.2 and A7.3: Work on shoulder or parking lane and Shoulder or parking lane closed on divided road

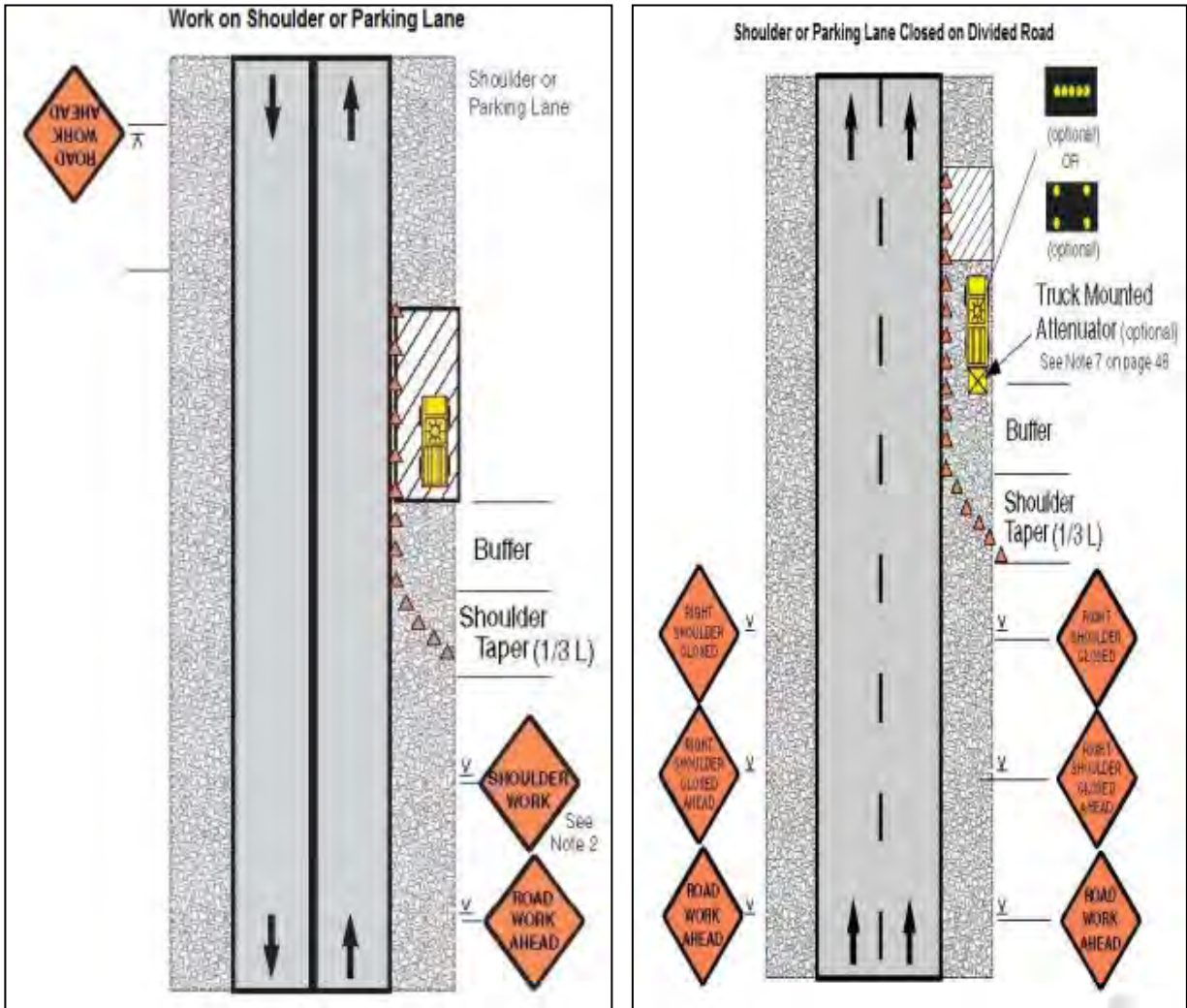


Figure A 7.4 and A 7.5: Work in Travel lane and Lane closure on road with low volume

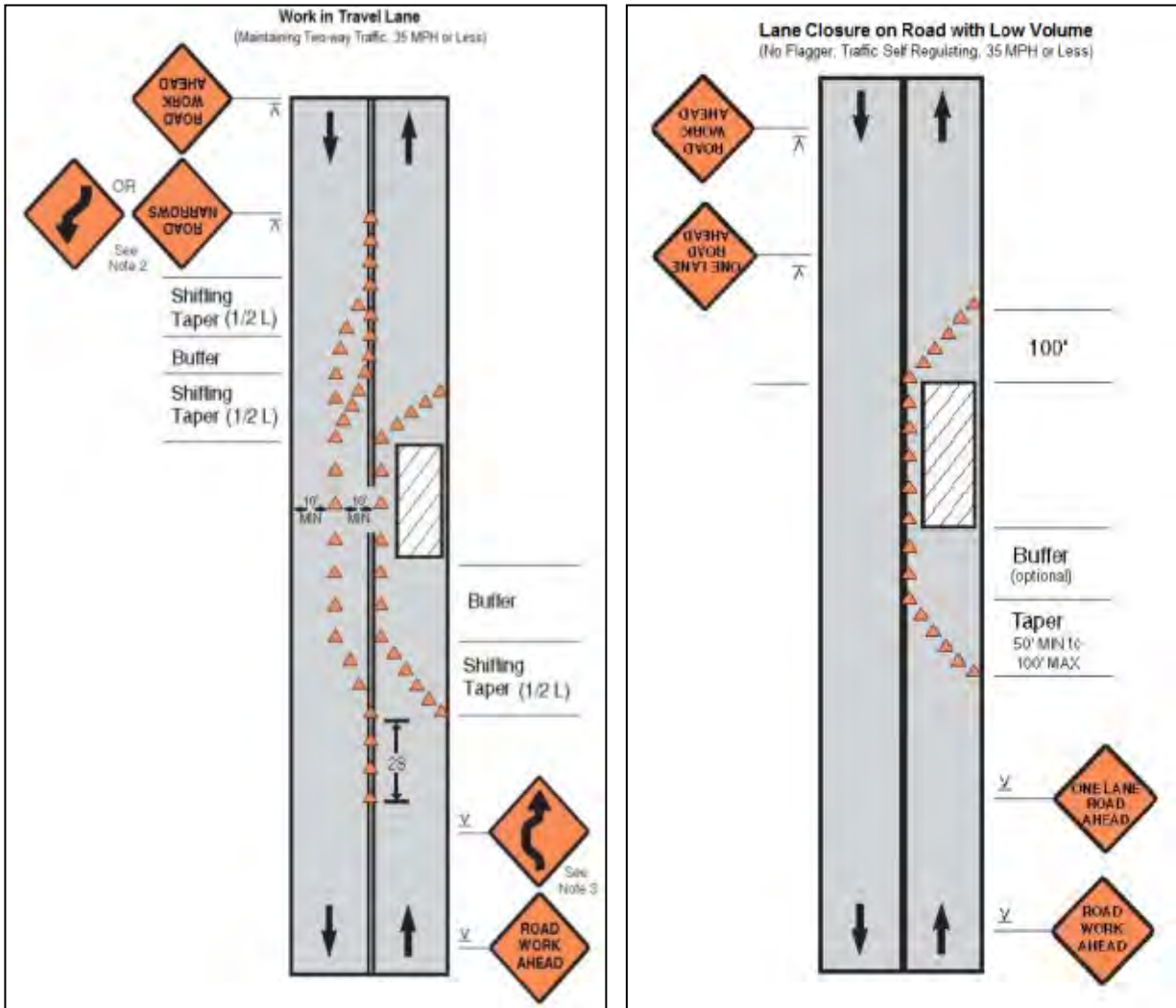
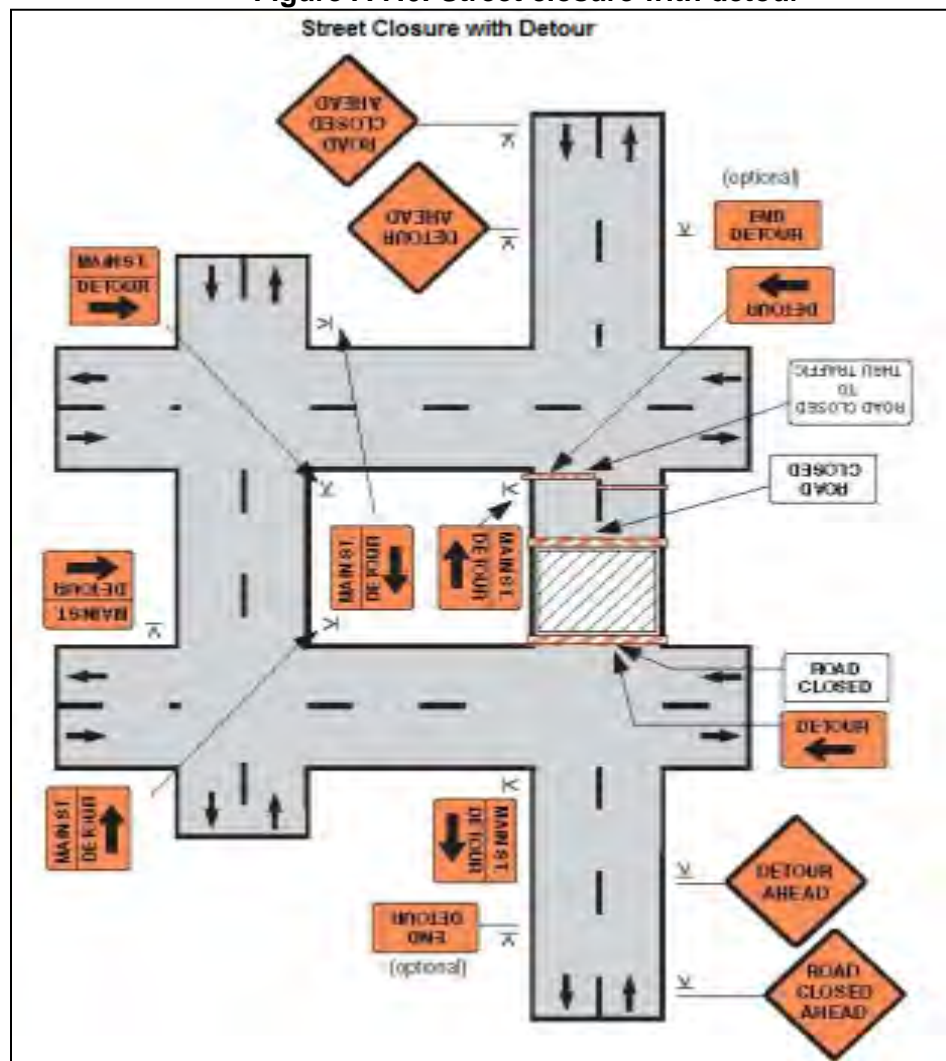


Figure A 7.6: Street closure with detour



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
Compliance marked as Yes / No / Not applicable (NA) / Partially Implemented (PI)	
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	

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

Sign off

Name
Position

Name
Position

SEMI ANNUAL ENVIRONMENTAL MONITORING PLAN TEMPLATE

I. 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 subproject 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/Detailed Design/On-going Construction/Completed/O&M) ^a	Contract Status (specify if under bidding or contract awarded)	If On-going Construction	
				%Physical Progress	Expected Completion Date

^a If on-going construction, include %physical progress and expected date of completion.

II. Compliance status with national/state/local statutory environmental requirements^a

Package No.	Subproject Name	Statutory Environmental Requirements ^b	Status of Compliance ^c	Validity if obtained	Action Required	Specific Conditions that will require environmental monitoring as per Environment Clearance, Consent/Permit to Establish ^d

^aAll 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" column.

^bSpecify (environmental clearance? Permit/consent to establish? Forest clearance? Etc.)

^cSpecify if obtained, submitted and awaiting approval, application not yet submitted

^dExample: *Environmental Clearance requires ambient air quality monitoring, Forest Clearance/Tree-cutting Permit requires 2 trees for every tree, etc.*

III. Compliance status with environmental loan covenants

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

IV. 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.
- 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)^a

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

^a Attach Laboratory Results and Sampling Map/Locations.

Overall Compliance with CEMP/ EMP

No.	Subproject Name	EMP/ CEMP Part of Contract Documents (Y/N)	CEMP/ EMP Being Implemented (Y/N)	Status of Implementation (Excellent/ Satisfactory/ Partially Satisfactory/ Below Satisfactory)	Action Proposed and Additional Measures Required

V. Approach and methodology for environmental monitoring of the project

- Brief description on the approach and methodology used for environmental monitoring of each subproject

VI. Monitoring of environmental IMPACTS on PROJECT SURROUNDINGS (ambient air, water quality and noise levels)

- Brief discussion on the basis for monitoring
- Indicate type and location of environmental parameters to be monitored
- Indicate the method of monitoring and equipment to be used
- Provide monitoring results and an analysis of results in relation to baseline data and statutory requirements

As a minimum the results should be presented as per the tables below.

Air Quality Results

Site No.	Date of Testing	Site Location	Parameters (Government Standards)		
			PM10 µg/m3	SO2 µg/m3	NO2 µg/m3

Site No.	Date of Testing	Site Location	Parameters (Monitoring Results)		
			PM10 µg/m3	SO2 µg/m3	NO2 µg/m3

Water Quality Results

Site No.	Date of Sampling	Site Location	Parameters (Government Standards)					
			pH	Conductivity µS/cm	BOD mg/L	TSS mg/L	TN mg/L	TP mg/L

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 _{eq} (dBA) (Government Standard)	
			Day Time	Night Time

Site No.	Date of Testing	Site Location	LA _{eq} (dBA) (Monitoring Results)	
			Day Time	Night Time

VII. SUMMARY OF KEY ISSUES AND REMEDIAL ACTIONS

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

VIII. APPENDIXES

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

SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name
Contract Number

NAME: _____ DATE: _____
TITLE: _____ DMA: _____
LOCATION: _____ GROUP: _____

WEATHER CONDITION:

INITIAL SITE CONDITION: _____

CONCLUDING SITE CONDITION:

Satisfactory _____ Unsatisfactory _____ Incident _____ Resolved _____ Unresolved _____

INCIDENT:

Nature of incident:

Intervention Steps:

Incident Issues

Resolution

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

Inspection

Emissions	Waste Minimization			
Air Quality	Reuse and Recycling			
Noise pollution	Dust and Litter Control			
Hazardous Substances	Trees and Vegetation			
Site Restored to Original Condition	Yes		No	

Signature

Sign off

Name
Position

Name
Position

DETAILS OF PUBLIC CONSULTATIONS

Details of stakeholder consultations was held on 21 January, 2018
Venue : Kajamalai community hall, Kajamalai OHT, Trichy

Question raised and answers provided during consultations

1. Jeya Raj.N,Teacher ,KK.Nagar

S.No	Questions	Answers
1	scheme to has to be finished within stipulated time	Corporation will institute a Project Management Consultancy for this Phase –III scheme. So Corporation and PMC will closely monitor the works and will complete the works within stipulated period. (3 Years).

2. J.Pathmavadhi,Arasu Colony.

S.No	Questions	Answers
1	Awaiting for this sewerage scheme for the long periods and kindly finish the works at the earliest and reduce disturbance of local residents while executing the works.	While execution of works , the traffic diversion and safety measures (i.e) keeping Barricading system will be considered to minimize the disturbance to local residents.

3. A.Abdul Mohamed, Rajiv Gandhi Nagar, Edamalai Patty pudur,

S.No	Questions	Answers
1	During construction period, kindly consider the water supply line. Without disturbing the utility like water supply, telephone cable , execute the works.	Before starting the works , the contractor will do trial pits to assess the existing utilities (i.e.,) water supply line, telephone cables etc., Accordingly contractor will shift the utilities.

4. P.Andhoni samy,Vasanth Nagar , Karumandapam,Trichy

S.No	Questions	Answers
1	Kindly restore the road, once execution of works gets over.	After hydraulic test of the laid pipe line, the excavated trench will be closed immediately by contractor.
2	During construction period, kindly consider the water supply line. Without disturbing the utility like water supply, telephone cable , execute the works.	Before starting the works , the contractor will do trial pits to assess the existing utilities (i.e.,) water supply line, telephone cables etc. Accordingly contractor will shift the utilities.

5. Dr.G.Gurumoorthy , President ,Anbu Nagar, Crawford

S.No	Questions	Answers
1	New roads have to be laid after the drainage scheme.	After hydraulic test of the laid pipe line, the excavated trench will be closed immediately by contractor. And the cutting portion of the road will be restored by CC road.

6. Ku.Kannan, Associate professor, KK Nagar

S.No	Questions	Answers
1	scheme to has to be finished within stipulated time	Corporation will institute a Project Management Consultancy for this Phase –III scheme. So Corporation and PMC will closely monitor the works and will complete the works within stipulated period. (3 Years).

7. A.Thangavelu,Anbu Nagar, Kirapatti

S.No	Questions	Answers
1	Please confirm whether Anbu nagar has included under UGSS phase -III scheme.	Yes . Anbu nagar area is included in this scheme.
2	Our area is low lying area, so rainy season the sewage water and rain will be stagnated. So kindly resolve the problems.	Once scheme executed the works, the sewage will be diverted into pumping station at Arasu Colony and will pump to STP by rely pumping station. In other scheme, the road side drain will be constructed by the corporation to divert the rain water to the existing channel or water bodies.

8. PV. Dhanraj, United welfare association, Karumandapam

S.No	Questions	Answers
1	Please confirm whether Vasanth Nagar,Jeya nagar extension has included under UGSS phase -III scheme.	Yes it is included in this scheme.

9. M. Anbazgan,JK nagar

S.No	Questions	Answers
1	scheme to has to be finished within stipulated time	Corporation will institute a Project Management Consultancy for this Phase –III scheme. So Corporation and PMC will closely monitor the works and will complete the works within stipulated period. (3 Years).
2	Sewage Treatment Plant has to locate faraway from resident areas.	The STP is located away from the local resident area and which is already considered in Phase -II.

10. K . Vijayakumar , sakthi Nagar, Karumandapam

S.No	Questions	Answers
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1	the pipe line connection , from outlet of building to Compound wall (inside premises) has to consider under contract.	In Phase –III scheme also, inside premises pipe line (HSC) will be laid by the contractor .
2	Future expansion area also has to be considered in this Phase –III.	The overall sewerage master plan including detail design is kept ready . When-ever the population density criteria will match will local population (100 Nos/hectare), the sewage line will be laid

11 P. Pudhiyanayagam, Renga Nagar

S.No	Questions	Answers
1	The scheme board has to keep in the street . In Board , the contractor Name , phone number and respective wards official number from TCMC has to mention.	Will do necessary action in this regard.
2	Sewage pumping station has to locate faraway from resident area.	Most of the cases , the SPS is proposed at remote areas only. Due to land constraint, SPS -11 and 12 only located in the Resident area, the odor control device will be installed to control odor issues .

12 S. Chin ayan, Stalin Nagar, E. Pudur

S.No	Questions	Answers
1	Without disturbing the local resident , works has to be done	While execution , the traffic diversion and safety measures like keeping Barricading system will consider to minimize the disturbance of local residents.
2	Once pipe line works has over, the excavated trench in the road has to be closed.	After hydraulic test of the laid pipe line, the excavated trench will be closed immediately by contractor.
3	scheme to has to be finished within stipulated time	Corporation arranging Project Management Consultancy for this Phase –III scheme. So Corporation and PMC will closely monitor the works and will complete within period (3 Years).
4	The road restoration has to finish once works has finished and the manhole cover has to be leveled with road surface level.	Contractor will do similar way and PMC and Corporation will monitor road restoration works also.

14. Hari hararaju.S , TSN avenue , KK Nagar

S.No	Questions	Answers
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1	What is the execution period and operation and maintenance period	The execution period is 3 years.
2	The scheme board has to keep in the street. In Board, the contractor Name, phone number and respective wards official number from TCMC has to mention.	Will do necessary action in this regard.
3	While road restoration, the road level should not increase with existing road level.	While doing road restoration works , the road level will be leveled with existing road level. Corporation and PMC will monitor the works

15 Jeyabalan, Renga Nagar

S.No	Questions	Answers
1	After construction of manholes, the top of the cover to be leveled with existing road level.	Noted . Always manhole cover top level will be leveled with existing road level .

16 G. Meenachi sundram, Viswas Nagar ,Karumandapam

S.No	Questions	Answers
1	Our area is low lying area, so rainy season the sewage water and rain used to stagnate. So kindly resolve the problems.	If it is low lying area, the lifting station is proposed to pump the collected sewage into ridge manhole or pumping station by pumping main . so sewage stagnation will not be there in the low-lying areas.

17 S.Kalimuthu, JK nagar, Kajamalai

S.No	Questions	Answers
1	Please confirm whether JK nagar, - I and II ,Thirumurugan, Lurdhu Nagar, Mohamed Nagar has included under UGSS phase -III scheme.	Yes it is included in this scheme.

18 A. Kalainesan, JK nagar, Kajamalai

S.No	Questions	Answers
1	Wherever the SPSs are located near to residential areas, . the odor should not come-out from the sewage pumping station.	Odor control device has proposed to control the odor
2	Kindly select qualified contractor. The contractor should not give sub-contract.	Both experience-wise and financial-wise qualified contractor only will consider for this works.

News Paper clippings of 22 January 2018 about public consultations

திருச்சி. 22.1.2018

16 வார்டுகளில் 32 ஆயிரம் வீடுகளுக்கு புதை சாக்கடை குழாய் இணைப்புகள்

திருச்சி, ஜன. 21: திருச்சி மாநகராட்சிக்கு உள்பட்ட 16 வார்டுகளில் ரூ.264.12 கோடி மதிப்பில் செயல்படுத்தப்படும் புதை சாக்கடைத் திட்டம் பகுதி-3 இன் கீழ், 32 ஆயிரம் வீடுகளுக்கு புதை சாக்கடை குழாய் இணைப்புகள் வழங்கப்படும் என மாநகராட்சி ஆணையர் ந.ரவிச்சந்திரன் தெரிவித்தார்.

மாநகராட்சியின் 16 வார்டுகளில் விடுபட்ட பகுதிகளுக்கு புதை சாக்கடைத் திட்டம் (பகுதி-3) கற்றுச்சுழல் தாக்க மதிப்பீடு தொடர்பான பொதுமக்கள் மற்றும் குடிமருப்பு நலச்சங்கத்தினருடனான கலந்தாய்வுக் கூட்டம், காஜாமலை சமுதாயக் கூடத்தில் நூற்றுக்கணக்கான நடைபெற்றது. இக்கூட்டத்துக்கு தலைமை வகித்து, மாநகராட்சி ஆணையர் மேலும் பேசியது:

திருச்சி மாநகராட்சி வார்டு எண்கள் 31,32,35,36, 38,42,43,45, 52,53,60,63 ஆகியவற்றில் பகுதியாகவும், வார்டு எண்கள் 37,39, 40,41-இல் முழுமையாகவும் புதை வடிகால் திட்டம் அமைக்கப்படவுள்ளது.

மத்திய பொது சுகாதார மற்றும் சுற்றுச்சூழல் பொறியியல் நிறுவன விதிமுறைகளின்படி புதைவடிகால் திட்டம் ரூ.264.12 கோடியில் தயா

திருச்சி மாநகராட்சி ஆணையர் தகவல்



பொதுமக்களுடனான கலந்தாய்வுக் கூட்டத்தில் பேசிய திருச்சி மாநகராட்சி ஆணையர் ந.ரவிச்சந்திரன்.

ரிக்கப்பட்டு, தமிழ்நாடு நகர்ப்புற நிதி மற்றும் உள் சுட்டமைப்புமேம்பாட்டுக் கழகம், தமிழ்நாடு நகர்ப்புற உள்சுட்டமைப்பு நிதி சேவைகள் லிமிடெட், ஆசிய வளர்ச்சி வங்கி ஆகியவற்றின் நிதியுதவி மற்றும் மாநகராட்சி பங்களிப்புடன் அம்ருத் திட்டத்தில் இத்திட்டம் செயல்படுத்தப்பட உள்ளது.

கழிவுநீர்க் குழாயின் நீளம் 331 கி.மீ. இதில் 7 இடங்களில் நீர் உந்தும் நிலையங்கள் அமைக்கப்படும்.

11 இடங்களில் லிப்டிங் நிலையம் அமைக்கப்படும். 32,000 வீடுகளுக்கு புதை சாக்கடைக் குழாய் இணைப்புகள் வழங்கப்படும் என்றார்.

இக்கூட்டத்தில், செயற்பொறியாளர்கள் எஸ்.கண்ணன், பி.செல்வம், உதவி ஆணையர்கள் தயாநிதி, பிரபாகரன், உதவிச் செயற்பொறியாளர்கள், குடிமருப்பு நலச்சங்க நிர்வாகிகள் உள்பட பலர் கலந்து கொண்டனர்.

Summary of Translation: Information on UGSS subproject and announcement for public consultations

THE TIMES OF INDIA - 22.1.2018

Corporation gets nod for phase-3 UGD works

HURDLES CLEARED Administrative sanction is expected in 15 days

UGD Phase-2 | Phase-3

- > Wards covered in full | 5 | 4
- > Wards covered partially | 20 | 12
- > Length of UGD pipes | 319 km | 331 km
- > Pumping stations | 7 | 7
- > Houses covered | 43,417 | 32,000
- > Project cost | 344 crore | 265 crore
- > Work to begin by | June | July



Estimated deposit fee for households/commercial establishments in Phase-3 | 6,000- 10,000

TIMES NEWS NETWORK

Trichy: All preliminary hurdles to implement phase-3 of the underground drainage system (UGD) covering 16 wards of the civic body mostly remote wards, have been cleared by the Trichy Corporation. This phase is considered to be the longest among the three phases of in terms of area covered.

Addressing a public hearing meeting on Sunday at Khajamalai, held ahead of commencing works, Trichy Corporation officials informed residents that administrative sanction for commencing phase-3 is expected to be obtained in 15 days, following which the ground works have been scheduled to commence by July 2018.

Evacuating drainage and sewage has been a chronic trouble for the city despite being coveted as the cleanest city in the state. Pollution in the delta's lifeline Cauvery river and its distributaries have been going on with or without the knowledge of the district administration for which absence of UGD was cited as reason.

As part of addressing the issue, in 2013, parts of Srirangam was provided with UGD in phase-1 as part of a pan city project covering the entire city with efficient drainage system in a phased manner. Subsequently in November 2017, in phase-2, 25 wards including

20 wards will be partially covered, for which work is expected to commence by June 2018.

Even before the commencement of works for phase-2, at an estimated cost of ₹344 crore, phase-3 has been given approval by the Commissionerate of Municipal Administration at an estimated outlay of ₹265 crore. Ahead of implementing the project, the corporation conducted a public meeting with residents of the 16 wards covering Khajamalai, Sundarraj Nagar, K Pudur and Panchapur.

Welcoming the phase-3, S. Ganapathy, a resident of ward 39, said, "We were assured that the UGD works in our area would commence by early 2017, but the assurance was not kept. We expect the underground drainage works to commence without delay this time."

The 331km-long pipeline for phase-3 would cover 32,000 households with seven pumping stations pushing the drainage to the Panchapur waste water treatment plant. "Within a short span, Trichy Corporation has managed to get approval for implementing phase-2 and phase-3 of UGD. Households have been selected based on population density."

The Corporation sought public cooperation to implement the project by paying the deposit for UGD which will be announced shortly.

சுவிட்சர்லாந்து - 22.1.2018

மாநகராட்சியில் விடுபட்ட 16 வார்டுகளில்

ரூ.264.12 கோடியில் பாதாள சாக்கடை திட்டம்

32,000 வீடுகள் பயன்பெறும்

திருச்சி, ஜன.22: மாநகராட்சியில் ரூ.264.12 கோடி மதிப்பீட்டில் 16 வார்டுகளில் புதிய பாதாள சாக்கடை திட்டம் செயல்படுத்துவது தொடர்பாக பொதுமக்களுடன் கலந்தாய்வு கூட்டம் நடந்தது.

திருச்சி மாநகராட்சிக்குட்பட்ட பகுதிகளில் ரூ.264.12 கோடி மதிப்பீட்டில் 16 வார்டுகளில் விடுபட்ட பகுதிகளுக்கு புதிதாக பாதாள சாக்கடை (பகுதி 3) திட்டத்தின் சுற்றுச்சூழல் தாக்க மதிப்பீடு தொடர்பான பொதுமக்கள் மற்றும் நலச்சங்கத்தினர்களுடன் கலந்தாய்வு கூட்டம் காஜாமலை சமுதாய கூடத்தில் நேற்று நடந்தது. மாநகராட்சி ஆணையர் ரவிச்சந்திரன் தலைமை வகித்து தெரிவித்தாவது:

திருச்சி மாநகராட்சிக்குட்பட்ட பகுதிகளில் பாதாள சாக்கடை பகுதி-3 திட்டம் விடுபட்ட பகுதிகளான வார்டு எண்.31, 32, 35, 36, 38, 42, 43, 45, 52, 53, 60, 63, 37, 39, 40, 41 ஆகிய 16 வார்டு பகுதிகளுக்கு புதைவடிகால் அமைக்க வழிவகை செய்யப்பட்டுள்ளது. மத்திய பொதுக்கார மற்றும் சுற்றுச்சூழல் பொறியியல் நிறுவன விதிமுறைகளின்படி புதைவடிகால் திட்டம் ரூ. 264.12 கோடி மதிப்பீட்டில் திட்டம் தயாரிக்கப்பட்டு தமிழ்நாடு நகர்புற நிதி மற்றும் உட்கட்டமைப்பு மேம்பாட்டு கழகம், தமிழ்நாடு நகர்புற உட்கட்டமைப்பு நிதி சேவைகள் லிமிடெட், ஆசிய வளர்ச்சி நிதி வங்கி ஆகிய நிறுவனங்களின் நிதி

உதவியின்றி மாநகராட்சி பங்களிப்புடன் அம்மூத்திட்டத்தில் நடைமுறைப்படுத்தப்படவுள்ளது. அதன் படி பாதாள சாக்கடை திட்டத்தில் கழிவுநீர் குழாயின் நீளம் 331 கி.மீ, பிரதான கழிவு நீர் உந்துக்குழாய் நீளம் 21.50 கி.மீ, பம்பிங் ஸ்டேஷன் 7, லிப்டிங் ஸ்டேஷன் 11, இணைப்புகள் வழங்கப்படும் வீடுகளின் எண்ணிக்கை 32,000 ஆகும். இந்த திட்டத்திற்கு பஞ்சப்பூர் கழிவுநீர் சுத்திகரிப்பு நிலையத்தை மேம்படுத்தி பயன்படுத்தும் வகையில் வழிவகை செய்யப்பட்டுள்ளது. இவ்வாறு அவர் பேசினார்.

மாநகராட்சி உதவி ஆணையர் தயாநிதி, குடியிருப்பு நலசங்கம் உறுப்பினர்கள் மற்றும் பொதுமக்கள் கலந்து கொண்டனர்.

Summary of Translation: Information on UGSS Subproject and announcement for public consultations

சூன லைன், 22.11.2018

32 ஆயிரம் வீடுகளுக்கு பாதாள சாக்கடை இணைப்பு

புதிதாக தருகிறது மாநகராட்சி

திருச்சி, ஜூன். 22-

திருச்சி மாநகராட்சிப் பகுதிகளில் 32 ஆயிரம் வீடுகளுக்கு ரூ.264.12 கோடி மதிப்பில் பாதாள சாக்கடை இணைப்புகள் வழங்கப்பட உள்ளன.

திருச்சி மாநகராட்சியில் 16 வார்டுகளில் விடுபட்ட பகுதிகளுக்கு பாதாள சாக்

கடை திட்டம் கற்றுச்சுமல் தாக்கம்மிப்பிடுதொடர்பான பொதுமக்கள் மற்றும் நல சங்கத்தினருடன் கலந்தாய்வு கூட்டம் காஜாமலை சமுதாய கூட்டத்தில் நேற்று நடந்தது.

கூட்டத்தில் கமிஷனர் ரவிச்சந்திரன் கலந்து கொண்டு பேசியதாவது:

"திருச்சி மாநகராட்சியில்

விடுபட்ட பகுதிகளில் பாதாள சாக்கடை திட்டம் செயல்படுத்தமுடிவுசெய்யப் பட்டு 16 வார்டுகளில் பணிகள் துவக்கப்பட உள்ளது. மத்திய பொது காகதாரமற்றும்சுற்றுச்சுமல் பொறியியல் நிறுவன விதி களின்படி பாதாள சாக்கடை திட்டம் ரூ.264.12 கோடி மதிப்பீட்டில் தயாரிக்கப் பட்டு தமிழ்நாடு நகர்ப்புற உட்கட்டமைப்பு நிதி சேவைகள்லிமிடெட்,ஆசிய

நிதி வளர்ச்சி வங்கி,ஆசிய நிறுவனங்களின் உதவியின் கீழ் மாநகராட்சி பங்களிப்புடன் அம்மூத் திட்டத்தில் செயல்படுத்தப்பட உள்ளது. இத்திட்டத்தில் கழிவுநீர் குழாயின் நீளம் 331 கி.மீ., பிரதான கழிவுநீர் உந்து குழாயின் நீளம் 21.50 கி.மீ. பம்பிங்ஸ்டேஷன், லிப்டிங் ஸ்டேஷன்-11, 32 ஆயிரம் வீடுகளுக்கு இணைப்புகள் வழங்கப்பட உள்ளது. இந்த திட்டத்துக்காக பஞ்சாயத்து

கழிவுநீர் சுத்திகரிப்பு நிலையத்தை மேம்படுத்தி பயன் படுத்தும் வகையில் ஏற்பாடு செய்யப்பட்டுள்ளது'' என்றார். கூட்டத்தில் குடியிருப்போர் சங்க நிர்வாகிகள், பொதுமக்கள்கருத்துக்களை தெரிவித்தனர். செயற்பொறு யாளர்கள் கண்ணன், செல்வம், உதவி கமிஷனர்கள் தயாநிதி, பிரபாகரன் மற்றும் பலர் கலந்து கொண்டனர்.

Summary of Translation: Information on UGSS subproject and announcement for public consultations

THE HINDU - 22.1.2018

Work on third phase of UG drainage project to begin by July

C. JAISANKAR
TIRUCHI

The administrative sanction for the third phase of the underground drainage system to extend to areas in 16 wards here is expected within 15 days, according to N. Ravichandran, Special Officer-cum-Commissioner, Tiruchi Corporation.

The project, sanctioned at a cost of ₹264.12 crore under the Atal Mission for Rejuvenation and Urban Transformation (AMRUT), will be extended to four wards fully and uncovered areas in 12 wards.

Participating in a public hearing to assess the environmental impact of the phase-III of the project held at Khajamalai here on Sunday, Mr. Ravichandran said that share of the Central and State governments for the



Residents airing their opinion at a public hearing in Tiruchi on Sunday. • PHOTO: S. VELANKANNI RAJ

project would be ₹153 crore and ₹52 crore respectively.

The scheme would be implemented with the financial assistance of Tamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL), Tamil Nadu Urban Financial Infrastructure Development Corporation (TUFIDCO) and the Asian Development Bank

(ADB).

The State government was expected to issue administrative order shortly. Tenders for executing the project would be floated within a few

weeks. Execution of the project would begin in July.

He said that tender for executing the second phase of the underground drainage system had already been

floated. The project aimed at providing underground sewer lines to five wards fully and omitted areas in 20 other wards in the city would begin in June. Both the phases would be implemented simultaneously.

Formation of sewage line for 331 km and construction of pumping mains for 21.50 km were part of the phase-III of the project.

The project would have seven pumping stations at Indira Nagar, Lurdu Nagar, Kulavaipatti, Muthukumarasamy Nagar, Panjapur, Arasu Colony and Natchathira Nagar. There would be seven lifting stations.

Four wards - 37, 39, 40 and 41 - would be fully covered in phase-III. Twelve wards - 31, 32, 35, 36, 38, 42, 43, 45, 52, 53, 60 and 63 would be partially covered.

CIVIC SCENE

List of Participant

TIRUCHIRAPPALLI CITY CORPORATION				
PROVIDING UNDER GROUND SEWERAGE SCHEME UNDER				
AMRUT (PHASE III)				
ENVIRONMENTAL IMPACT ASSESSMENT WITH STAKE HOLDER'S				
DATE: 21.01.2018		VENUE: KAJAMALAI COMMUNITY HALL,		
DAY: SUNDAY		KAJAMALAI, TRICHY		
S.No.	NAME OF THE PARTICIPANT	ADDRESS	PHONE NO.	SIGNATURE
1	Dr. S. S. Rangan	6, P. S. Rangan, P. S. Rangan, 5625-21	0431-2459118	Dr. S. S. Rangan
2	M. Thiruganapathy	Plot 10, North Avenue, K. K. Nagar, Ward 41	9443185283	M. Thiruganapathy
3	M. Anand	No. 91, Melakallur Street, K. K. Nagar, Trichy-23	9443733070	M. Anand
4	R. JAYARAJAN	22, Third Main Road, Benjapur, Trichy-620021	9443188007	R. Jayarajan
5	M. Mohan	14P, K. K. Nagar, North Avenue, K. K. Nagar, Trichy-21	9994047100	M. Mohan
6	M. Ganapathy	Secretary, Bhacatai, Main Road, Ward 39	9787049137	M. Ganapathy
7	A. Mohd. Mazhar	No. 76, Basanthi, Main Road, P. S. Rangan, Ward 39	9443502569	A. Mohd. Mazhar
8	C. Panniyar	Plot no. 90, K. K. Nagar, P. S. Rangan, Main Road, K. K. Nagar	9498157005	C. Panniyar
9	Dr. M. V. S. S. S. S. S.	Plot no. 3, K. K. Nagar, P. S. Rangan, Main Road, K. K. Nagar, Trichy-21	9443188007	Dr. M. V. S. S. S. S.
10	K. Dharmadharan	14, Reddy Nagar, K. K. Nagar, Trichy-21	9362606172	K. Dharmadharan

56 திருச்சிராப்பள்ளி மாநகராட்சி



S.No.	NAME OF THE PARTICIPANT	ADDRESS	PHONE NO.	SIGNATURE
22.	S Syed Riaz Basha	No. 22, J MESC Colony, North Ext. 2nd Street, Trichy-21	9944457912	
23	M. ABDULLA-SAN	No. 64 E.B. Colony Vark Pagan ngol. Ar. 1977	9443672744	M. A. San
24.	P. MARIAPILLAI	Plot No. 101, J.K. Phase 3 K. Waser (BSW)	9486060220	
25	M. Sheikh Afroz Khan	No. 215 J. Nagar, Trichy-23	9865216451	
26.	M. சத்யசூரி	5K moor	9345110488	M. சத்யசூரி
27.	T. MANI	No. 4, Sri Ram Nagar, 23/10A School, Airport	9842836869	
28	J. GNANASEKAR	No. 20b, Karunyanagar, Ponnalai, Trichy-6 Ward - 31	9442785757	
29	G. RAJASEKARAN	2. Srinagar, Main Road, Gurnash Nagar	9788979910	
30	J. John Victor	208, Karunyanagar, Ponnalai	9463072882	
31	G. PARAMESWARAN	121, Karunyanagar, Ponnalai, Trichy-31	809883140	G. Parameswaran

திருச்சிராப்பள்ளி



மாநகராட்சி

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S.No.	NAME OF THE PARTICIPANT	ADDRESS	PHONE NO.	SIGNATURE
32.	N. JEYARAJ	13, A. PERIYAR GANDHI NAGAR K. L. NAGAR T. R. CITY -	94441 04777	<i>[Signature]</i>
33	B. Balas.	Plot No. 51, Thiruvallur T. K. Nagar	9487456503	<i>[Signature]</i>
34.	D. RENGARAO	Plot No. 124, VAIGAI ST, J. K. NAGAR, ERM.	9994797559	<i>[Signature]</i>
35	Ku. Kannan	7a Amman Nagar K. K. Nagar T. R. 21	9443952460	<i>[Signature]</i>
36	D. Adhimoolam	1, Bharathi St, Amman Nagar T. R. - 21.	9443578106	<i>[Signature]</i>
37.	D. Madhavan	No. 60. S. R. M. Avenue West Erum K. K. Kottai, Thiruvallur	9688552223	<i>[Signature]</i>
38.	C. Balakrishnan Advocate/Secy	11/1 Stalin Nagar Welfare Assn.	9442549926	<i>[Signature]</i>
39.	S. Chinnayyan Yoga Guru No. Stalin Nagar	St. -	8903424733	<i>[Signature]</i>

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திருச்சிராப்பள்ளி



மாநகராட்சி

S.No.	NAME OF THE PARTICIPANT	ADDRESS	PHONE NO.	SIGNATURE
40	R. PRABHAKARAN	107, J.K. Nagar, TRY	9444651370	<i>R. Prabakaran</i>
41	A.P. Rajendran	105, J.K. Nagar II	9443765817	<i>A.P. Rajendran</i>
42	M. SATHYASEELAN	106, J.K. Nagar II	9578522806	<i>M. Sathya</i>
43	P. Anbarasan	No. 103 J.K. Nagar	9894553042	<i>P. Anbarasan</i>
44	T.S. Suresh Kumar	No 148 Anna Nagar	759872520	<i>T.S. Suresh Kumar</i>
45	N. Chinnadurai	No. 19 Anna Nagar	94866 92931	<i>N. Chinnadurai</i>
46	K. Adam	No. 34 Anna Nagar	9965108766	<i>Adam</i>
47	S. BHAVUDIN	9/21-3rd Range Nagar	9443834131	<i>S. Bhavudin</i>
48	M. AHAMAD IBRAHIM	9/21-3rd Range Nagar	9443531133	<i>M. Ahmadi</i>
49	S. Kalimuthu	120, J.K. Nagar I	8220002152	<i>S. Kalimuthu</i>
50	R. Victor	241, Venkateswara Nagar	9786514832	<i>R. Victor</i>
51	K. Ponnusamy	159, Indira Nagar	-	<i>for Smt. K. Ponnusamy</i>
52	G. JAYAKIRAN	President United Welfare Socy 5 Sri Ram Nagar Kannur Nagar Tamil Nadu	9894716235	<i>G. Jayakiran</i>
53	P. V. Dharmaraj	General Secretary United Welfare Socy, Kannur Nagar	9442248138	<i>P. V. Dharmaraj</i>
54	K. VIJAYA KUMAR	72/1, SAKTHANAR Nagar WARD 45 TRY 1	978749657	<i>K. Vijaya Kumar</i>

திருச்சிராப்பள்ளி



மாநகராட்சி

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S.No.	NAME OF THE PARTICIPANT	ADDRESS	PHONE NO.	SIGNATURE.
55	Dr. G. Gurusamy	President, Ananthanagar Mun. Council, TRICHY-12	98946 80368	
56	A. R. Srinivasan	சுமந்திராபுரம் சுமந்திராபுரம் கிராம பஞ்சாயத்	979439067	A. R. S.
57	B. Sasidharan	Francena colony Welfare Sangam E. Puduk	9790747566	B. Sa
58	சுமந்திராபுரம் கிராம பஞ்சாயத்	D-12, Ananthanagar Mun. Council, Ananthanagar	9486265335	
59	T. சிவசுந்தரன்	D-13, Ananthanagar Mun. Council, Ananthanagar	9788788526	
60	A. CELESTINE	9 RAJA RAJAN NAGAR TRICHY-21	9042915390	A. Celestine
61	A. D. DAYALAN	10, T. CROSS Sunder Nagar	9894 9894 22	
62	T. பஞ்சவர்ணம்	சுமந்திராபுரம் பஞ்சவர்ணம் பஞ்சாயத்	9994797797	T. Panjavarman
63	A. THANGAVELU	Ananthanagar.	9443463262	
64	M. TANTUJEE	Ananthanagar Corpal	9412772222	
65	M. Anny Stephen	Rani meiammai ry.	9486425831	M. Anny Stephen
66	R. J. Rajagani	T. h. n. Nagar, Ananthanagar	98656 06000	
67	D. Ambudor	Dersaleya Nagar R. G. NAGAR	9486752082	
68	G. Majali		9786526731	
69	A. RASHAD HUSSAIN	Rajivancha	9443038544	
70	A. Abdulmalik	Rajivancha	9842668344	

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திருச்சிராப்பள்ளி



மாநகராட்சி

Sl. No	NAME OF THE PARTICIPANT	ADDRESS	PHONE NO	Signature
72	HARI HARARAJUS	Plot no 54, TSN Avenue, W. 35	91345100104	S. H.
73	I. MAHALINGAM	13A - Mullaiveli Kshatriya Nagar, Kannur	9443124822	Devi
	R Chandrasekaran	14, Gopichandran Colony 23, Karamana Trichy	9840097996	Dr. S. S.
74	சி. ச. மூர்த்தி	5/9 கோமுகம் காலனி R. P. F. 2906 தென்-23	9865642674	Dr. S.
75	S. சத்திரசென்	10, பி. சி. சி. 2906 கந்திரசென்-6 வட்டம் தென்-21	9345120706	R. K.
76	M. சென்	10, கோமுகம் காலனி 1, தென், சி. சி. சி. 2906 தென்-21	95635513	M.
77	S. சந்திரசென்	6/1, தென், சி. சி. சி. 2906 தென்-21	954407111	Dr. S.
78	P. RAMASAMI	5, Sakthi Nagar K. K. Nagar, Tiruch-21.	9677847224	P. M.
80	R. PUSHPARAJ.	Nehru Nagar Kannur Tiruch-21	9944009715	P. M.
81	C. Shanmugavel	2, Sakthi Nagar Kannur Tiruch-21	944562583	M.
82	M. Prabhakaran	13, Suresh Colony E. Pothu	9994318899	M. P.

திருச்சிராப்பள்ளி



மாநகராட்சி

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Sr.	Name of the Participant	Address	Phone. no.	Signature.
82	B. Gurusubrah.	19. Achak nagar Sethi Rm. colony Kumbalur.	9842465239	B. Gurusubrah.
83	C. Kesavaadas	15. 3 rd St- Ashok Nagar South Coimbatore	9443427941	C. Kesavaadas
84	G. Meenakshisundaram	9, Viswasnagar Kattumundapam Tiruv. I. W. 40	9443421600	G. Meenakshisundaram
85	K. Gurusaravanan	201, Venkateswara Nagar, Coimbatore.	9445413744	K. Gurusaravanan
86	V. முருகுதாஸ் I. கருணாநிதி கருணாநிதி V. MURUGUDASS	KMG நகர் சுலட்சுமி பட்டினம், 42 nd	6672828494 9080960208	V. Murugudass
87	P. Subramaniam	சுலட்சுமி நகர்	9865739686	P. Subramaniam
88	A. பஞ்சவர்ணம்	சுலட்சுமி நகர் K.K. நகர்.	9345117393	A. Panchavarnam
89	P. P. Srinivasan	சுலட்சுமி நகர் சுலட்சுமி நகர், 2.2.5.5.5.5. சுலட்சுமி நகர், J.B. நகர். சுலட்சுமி நகர், சாலை சுலட்சுமி நகர் (45)	9629870651	P. P. Srinivasan
90	சுலட்சுமி நகர், சுலட்சுமி சுலட்சுமி நகர் K.K. Nager	:	9897766970	Sulakshmi Nagar
91	R.V. Kannan 23 IB Colony TRICHY-21	:	9443999554	R.V. Kannan
92	P. Anand 69 சாலை சுலட்சுமி	சுலட்சுமி	9395185114	P. Anand

Photographs of Stakeholder consultations held on 21 January 2018



Details of Public consultations

Details of stakeholder consultations was held on 08 January, 2019
Venue : Edaimalaipatti Pudur Government higher secondary school,
Edaimalaipatti Pudur Trichy

Question raised and answers provided during consultations

1. Mr.Soundararajan, Arasu Colony

S.No	Questions	Answers
1	This area is completely residential area, hence do not construct the sewage pumping stations at this location.	While constructing the pumping station, the environmental remediation measures i.e odor control , planting greeneries all-around compound wall etc will be considered.

2. Mr. Santhana packiam, Arasu Colony

S.No	Questions	Answers
1	Parks has to construct at this location.	After detailed study of design and site visits ,the technical consultants and corporation engineering officials has decided and concluded that locating pumping station at this location is appropriate and collecting more areas coverage sewage into this pumping station.

3. Mr. Saveri Muthu , Arasu Colony

S.No	Questions	Answers
1	DTCP has approved this plot for constructing /developing park . Hence, change the location of pumping station from this location.	Due to technical reasons, this location has selected for locating pumping stations . moreover the land was handed over to Corporation .

4. Johnson, Arasu Colony

S.No	Questions	Answers
1	The width of road is very narrow in this locations, hence construction vehicles movement is not easy to move inside streets.	construction purpose, heavy vehicle may not required to come at this site. Light weight vehicles can easily enter into this areas streets roads.

5. Mr. Martin , Arasu Colony

S.No	Questions	Answers
1	Kindy change the location of pumping station from this location.	Alternative site is under feasible studies. But that land also coming near to pond , hence searching other land.

6. Mrs. Padmavathi, Arasu colony

S.No	Questions	Answers
1	Kindy change the location of pumping station from this location.	Alternative site is under feasible study. But that land also coming near to pond , hence searching other land.

7. Mr. Muthu Selvam , Ex. Councilor, Arasu colony

S.No	Questions	Answers
1	Local residents of Arasu colony are objecting to locate sewage pumping station at this plot. Hence kindly change location.	Noted and will look into alternative site

List of Participant

ԶԵՅՅԱՆՍԻՄԼ ԼՈՏՔՈՒՆԻ ՉԱՌՆՈՒՄԻ ԿՕ
 ԵՅ ԶԻՆՈՒ ՆԱԳՅԱՆ ԶԻՆ ԼՅԱՅՈՒՆՆ ԼՅԱՆ
 ՏՆՔՈՒ ԲՅՈՅՆՅ ԲՅՈՒՆՈՒ ԶՈՒՆԻ ԵՄՈՒՆԻՔԻ
 ԼՈՏՔՈՒՆԻ ԴԻՆՆՈՒ 8.1.2019 ԺԱՄԱՆԱԿՆ
 ԶՈՒՆ (ԼՈՒԼՈՒՆՈՒ ՄԼՈՒՆԵՐՈՒԹՅԱՆ ԼՈՏՔՈՒՆԻ
 ԲՅՈՒՆՍԻՄԻՆՈՒ ԶԵՅՆ ԵՄՈՒՆ ԶԻՅՅՈՒՆ
 ՄԻՅՈՒՆ ԺԱՄՆ ԵՅՆՆՈՒ ԵՅ ԴՅՆՆՈՒ
 ՄԼՈՒՆԵՐՈՒԹՅԱՆ ԶՈՒՆԻՔԻՆԻ ՄՈՒՆԻՔԻ
 ԶՈՒՆԻՔԻ ԵՄՈՒՆԻՔԻ ԲՅՈՒՆՈՒՆԻ ԶՈՒՆԻՔԻ
 ՄՈՒՆԻՔԻ ԵՄՈՒՆԻՔԻ ՄՈՒՆԻՔԻ ԵՄՈՒՆԻՔԻ
 ԵՅՆՆՈՒ ԼՅԱՆՈՒՆՈՒ ԵՄՈՒՆԻՔԻ ԵՅՆՆՈՒ
 ԲՅՈՒՆՈՒՆ ԶՈՒՆԻՔԻ ԴՅՆՆՈՒ ԶՈՒՆՈՒՆ
 ՄԻՅՈՒՆՈՒ ՄԻՅՈՒՆՈՒ ԶՈՒՆՈՒՆ ԶՈՒՆՈՒՆ
 39.40 ՆՆՈՒ ԵՄՈՒՆ ԶՈՒՆՈՒ ԶՈՒՆՈՒ ՄՈՒՆԻՔԻ
 ԵՄՈՒՆ ԵՄՈՒՆՈՒ ԼՈՏՔՈՒՆԻ ԴԻՆՆՈՒ
 ԶՈՒՆԻՔԻ ԵՄՈՒՆՈՒ ՄԻՅՈՒՆ ԵՄՈՒՆՈՒՆ

I. [Signature] 978820204

[Signature] 9345998084

V. Elumadani

R. P. [Signature] 8110013339
 (R. P. [Signature])

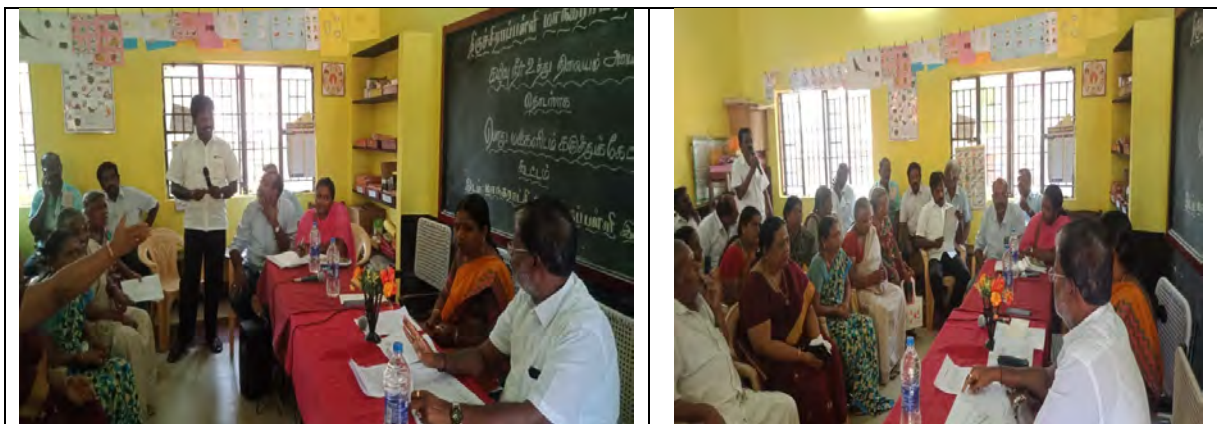
B. Baidharan
 9720747561

[Signature] 9442184291

D. Palaniyandi 9655944527

S no	Name & Address with Mobile no.	Signature
21	S. Jeyaraj 98466-	S. Jeyaraj
22	J. C. P. Jeyaraj	J. C. P. Jeyaraj
23	M. Neelgagan	M. Neelgagan
24	M. Siddharthan	M. Siddharthan
25	K. Nanthakumar	K. Nanthakumar
26	B. Dharmalingam Neerthi	B. Dharmalingam Neerthi
27	S. Jeyaraj	S. Jeyaraj
28	A. Uthayakumar	A. Uthayakumar
29	A. Kalimuthu	A. Kalimuthu
30	A. V. Vasan	A. V. Vasan
31	A. E. L. ANGO	A. E. L. ANGO
32	M. Ganesapathy	M. Ganesapathy
33	J. Banumathi	J. Banumathi
34	LA. KANNAN BJP 9443143197	LA. KANNAN
35	S. Devendran 1378 9895697337	S. Devendran
36	K. Padanilam 9789182164	K. Padanilam
37	A. J. Fernando	A. J. Fernando
38	Z. Nandhan 944374088	Z. Nandhan
39	G. M. C. S. S. S. S. 9444722608	G. M. C. S. S. S. S.
40	M. Vairappan 9443733497	M. Vairappan
41	M. MOHAMMED FAROOK - Congress - 98426-56184	M. MOHAMMED FAROOK
42	J. S. S. S. S. S. S. 944284991	J. S. S. S. S. S. S.

Photographs of Stakeholder consultations held on 8 January 2019



Pending English translation (c/o PMU)

AGENDA

புதைவடிக்கால் திட்டம் AMRUT (Phase III) திட்டத்தின் கீழ் ரூ.312.14.00 கோடி மதிப்பீட்டில் செயல்படுத்த அரசு ஆணை எண். 05 நகராட்சி நிர்வாக மற்றும் குடிநீர் வழங்கல் துறை (MC 2) நாள். 22.01.2018 ல் நிர்வாக அனுமதி ஒப்புதல் அளிக்கப்பட்டது. மேற்படி திட்டத்திற்கு அரசாணையில் நிதி ஆதாரம் விவரம் கீழ்வருமாறு

Rs in Crores					
Sanctioned Project Cost	GOI Share	GTN Share	ULB Share	ADB / TNUFISL Loan	O & M Cost
312.14	132.06	52.82	31.21	96.05	-

அடல் நகரிய சீர்திருத்தம் மற்றும் வளர்ச்சி இயக்கம் திட்டத்தின் திருச்சிராப்பள்ளி மாநகராட்சியின் பகுதி 3 புதைவடிக்கால் திட்டத்திற்காக மேற்படி நிதி ஆதாரப்படி நிர்வாக அனுமதி பெறப்பட்டு பணிகள் மேற்கொள்ளப்பட்ட உள்ளது. இத்திட்டத்தில் அடங்கும் அரசு காலனி பகுதியில் கழிவுநீர் உந்து நிலையம் அமைப்பது தொடர்பாக பொதுமக்களிடையே கருத்து கேட்பு கூட்டம் இன்று 08.01.2019 முற்பகல் 11.00 மணி அளவில் எடமலைப்பட்டி புதூர் அரசு உயர்நிலைப் பள்ளி வளாகத்தில் நகரப்பொறியாளர், உதவி செயற்பொறியாளர், உதவி பொறியாளர் மற்றும் இளநிலைப் பொறியாளர் ஆகியோர் முன்னிலையில் நடைபெற்றது.

அரசு காலனி குடியிருப்போர் நலச்சங்கம் பிரதிநிதிகள் மற்றும் அந்த பகுதியில் வாடும் மக்கள், பிரான்சிணா காலனி பொதுமக்கள், காளியம்மன் கோவில் தெரு, பிள்ளையார் கோவில் தெரு, வடக்கு மற்றும் தெற்கு மேட்டு தெரு, கொல்லான்குளம் ஆகிய பகுதிகளில் வசிக்கும் மக்கள் பிரதிநிதிகள் மற்றும் அரசியல் சார்ந்த முன்னாள் மாமன்ற உறுப்பினர்கள் என பொத்தம் 42 நபர்கள் கலந்து கொண்டனர்.

I	1	புதைவடிக்கால் திட்டம் (AMRUT) கேள்விகளுக்கு திருச்சிராப்பள்ளி மாநகராட்சியிலிருந்து திட்ட விளக்கம் வழங்கியவர்
	1	S.Amudavalli.,BE, City Engineer(i/c),~ Tiruchirappalli City Corporation.
II		புதைவடிக்கால் திட்டப் பகுதிகளில் உள்ள ஆக்கிரமிப்பு பற்றிய கேள்விக்கு பதில் வழங்கியவர்கள்
	1	S.Amudavalli.,BE, City Engineer(i/c),~ Tiruchirappalli City Corporation.
	2	K.S.Balasubramanian Assistant Executive Engineer, K-abishekapuram Zone

!!!	வருகை தந்த மக்கள் நல முக்கிய பிரமுகர்கள்
1	Thiru. Santhanapakkiam, Arasu Colony Mobile No. 9655167751
2	Thiru.B.Harhara Sudhan, Arasu Colony, Mobile No. 9944151002
3	Tmt.R.Usha, Arasu Colony, 7358952974
4	Tmt.T.Renuka, Arasu Colony, 994277080
5	Thiru.M.Jeeva Arasu Colony 9364113503
6	Thiru.Kannan, Arasu Colony, 94431 43197
7	Thri.Devandhran, ARasu Colony, 98946 97337
8	Thiru.K.Palanisamy Arasu Colony, 9789182164
9	Thiru.Jeasu Raj, Arasu Colony, 94447 22603
10	Thiru.Vaiyapuri, Arasu Colony, 94436 33497
11	Thiru.Mohamed Farrok, ARasu Colony, 98426 56184
12	Thiru.J.Iruthiyaraj ARasu Colony, 94421 84291
13	Thiru.R.Palaniyandi, ARasu colony, 81100 13339
14	Thiru.D.Palaniyandi, Arasu Colony 9655949527

ஆலோசனை விளக்கம் விபரம் :

1. திரு. செளந்திராஜன், அரசு காலனி

S.No	Questions	Answers
1	சூடியிருப்பு பகுதி அதிகமாக இருப்பதால் அப்பகுதியில் கழிவுநீர் உந்துநிலையம் அமைக்க வேண்டாம்.	அப்பகுதியில் வசிக்கும் மக்களுக்கு எந்தவிதமான கற்றுப்புற சூழ்நிலை பாதிப்பு ஏற்படமாலும், பொதுமக்களுக்கு பாதிப்பு ஏற்படாத வகையில் கழிவுநீர் உந்துநிலையம் செயல்படுத்தப்படும்.

2. திரு. சந்தாண பாக்கியம் அரசு காலனி

S.No	Questions	Answers
1	இந்த பகுதியில் பூங்காவாக அமைத்து தர வேண்டும்.	கலந்தறிதற்குரியர் மற்றும் மாநகராட்சி பொறியாளர்களால் தளஆய்வு செய்ததில், இந்த பகுதியில் கழிவுநீர் உந்து நிலையம் அமைத்தால் கழிவு நீர் Gravity மூலமாக வந்து சேரும்.

3. திரு. சவரிமுத்து அரசு காலனி.

S.No	Questions	Answers
1	DTCP lay out பார்க் அமைப்பதற்காக ஒதுக்கப்பட்ட இடம், எனவே, இப்பகுதியில் கழிவு நீர் உந்துநிலையம் அமைக்க வேண்டாம்.	தொழில் நுட்ப ரீதியாக, பாதாள சாக்கடை திட்ட சேகரிப்பு கிணறு அமைக்க இவ்விடம் ஏதுவாக இருந்ததால் இடம் தேர்வு செய்யப்பட்டது. மாநகராட்சிக்கு ஒப்படைக்கப்பட்ட இடமாகும்.

4. திரு. ஜான்சன், அரசு காலனி

S.No	Questions	Answers
1	இப்பகுதியில் சாலை அகலம் மிகவும் குறைவாக இருப்பதால், போக்குவரத்துக்கு மிகவும் இடைஞ்சலாக இருக்கும்.	கனரக வாகனங்கள் செல்லும் அவசியம் இல்லை.

5. திரு. மார்டின், அரசு காலனி

S.No	Questions	Answers
1	கழிவுநீர் உந்துநிலையம் மாற்று பகுதியில் அமைத்ததல் தொடர்பாக.	மாற்று இடம் ஆலோசிக்கப்பட்டு வருகிறது. அருகாமையில் குளம் பகுதியாக இருப்பதால் தேர்வு செய்ய இயலவில்லை.

6. திருமதி. பத்மாவதி, அரசு காலனி

S.No	Questions	Answers
1	கழிவுநீர் உந்துநிலையம் மாற்று பகுதியில் அமைத்ததல் தொடர்பாக.	

7. திரு. முத்துச்செல்வம், முன்னாள் மாமன்ற உறுப்பினர்

S.No	Questions	Answers
1	பொதுமக்கள் அனைவரும் இந்த பகுதியில் கழிவுநீர் உந்து நிலையம் வருவதை விரும்பாத காரணத்தால், வேறு இடத்தில் மாற்றி அமைக்கும்படி கேட்டுக்கொள்கிறேன்.	மாற்று இடம் ஆலோசிக்கப்பட்டு வருகிறது. அருகாமையில் குளம் பகுதியாக இருப்பதால் தேர்வு செய்ய இயலவில்லை.

ANNEXURE -V
PUBLIC CONSULTAION DETAILS



Public Consultation Photo





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8/1/19
JE 1/2

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8/1/19
ASST. EXE. ENGINEER
Tiruchirappalli City Corporation

Handwritten signature
8/1/19
CITY ENGINEER
Tiruchirappalli City Corporation
8.1.09

For
Ultimate