

Initial Environmental Examination(updated)

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

Prepared by Tiruchirappalli City Corporation of Government of Tamil Nadu for the Asian Development Bank.

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CURRENCY EQUIVALENTS

(As of 1st September 2020)

Currency Unit– Indian rupee (₹)

₹1.00 – \$0.0156

\$1.00 = ₹70.06

ABBREVIATIONS

ADB	–	Asian Development Bank
ASI	–	Archaeological Survey of India
CMSC	–	Construction Management and Supervision Consultant
CPCB	–	Central Pollution Control Board
CTE	–	Consent to Establish
CTO	–	Consent to Operate
EAC	–	Expert Appraisal Committee
EHS	–	Environmental, Health and Safety
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
ESS	–	Environmental and Social Safeguards
ESZ	–	Eco Sensitive Zone
GRC	–	Grievance Redress Committee
GRM	–	Grievance Redress Mechanism
GOI	–	Government of India
GoTN	–	Government of TamilNadu
IEE	–	Initial Environmental Examination
MOEFCC	–	Ministry of Environment, Forest and Climate Change
NOC	–	No Objection Certificate
PIU	–	Project Implementation Unit
PMU	–	Project Management Unit
ROW	–	Right of Way
SIDCO	–	Small Industries Development Corporation
SPS	–	Safeguard Policy Statement
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
ULB	–	Urban Local Body
WHO	–	World Health Organization
WTP	–	Water Treatment Plant

WEIGHTS AND MEASURES

°C	degree Celsius
km	kilometer
lpcd	liter per capita per day
m	meter
Mgd	million gallons per day
ml	milliliter
Mld	million litres per day
mm	millimeter
nos.	numbers
km ²	square kilometer

NOTE

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

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EXECUTIVE SUMMARY

1. The Tamil Nadu Urban Flagship Investment Program (TNUFIP) will advance India's national urban flagship programs to develop priority urban and environmental infrastructure in ten cities located within strategic industrial corridors of TamilNadu (the State), including those within the East Coast Economic Corridor (ECEC), to enhance environmental sustainability, climate resilience, and livability. It will also strengthen the capacity of state and local institutions and improve urban governance. TNUFIP is Aligned with the following impact: urban livability and climate resilience in cities of economic importance improved. TNUFIP will have the following outcomes: smart and climate resilient urban services delivered in ten cities in priority industrial corridors.
2. The TNUFIP is structured under three outputs:(i) sewage collection and drainage improved and climate-friendly sewage treatment systems introduced,(ii) access to reliable and smart drinking water services improved, and (iii) Institutional capacity, public awareness, and urban governance strengthened. TNUFIP will be implemented over an 8-year period beginning in 2018 and will be funded by Asian Development Bank (ADB). via its multi tranche financing facility (MFF).
3. **The Subproject.** Tiruchirappalli is one of the largest cities in the state of TamilNadu, located on the Chennai – Dindigul National Highway (NH - 45). It is situated in the center of the state, on the banks of the Cauvery River. This subproject, is implemented under the ADB funded TNUFIP. It is proposed to provide underground sewerage system in the presently uncovered areas core part of Tiruchirappalli City and its extended area. These are in eastern part of the Tiruchirappalli City Corporation (TCC). Sub project includes the following civil works components: (i) sewage collection system (312.217 kilometre (km) length of sewers and 12,109 manholes), (ii) 24 nos. of lift stations, (iii) 5 nos. of pump stations, (iv) 24 km length sewage pumping main, (v) new sewage treatment plant (STP) of 37 (MLD) capacity at Keelakalkandarkottai, (vi) rehabilitation of existing 30 MLD STP at Panjapur, and (vii) 44,569 house service connections. Treatment facility is under Design-Build- Operate-Transfer (DBOT) contract and the STP design is based on the Sequential Batch Reactor (SBR) technology
4. **Project implementation arrangements.** The Municipal Administration and Water Supply Department (MAWS) of Government of Tamil Nadu acting through the Tamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL) is the state-level executing agency. A project management unit (PMU) established in TNUIFSL headed by a Project Director and Deputy Project Director (senior official from Commissioner ate of Municipal Administration, CMA), and comprising dedicated full-time staff from TNUIFSL for overall project and financial management. The implementing agencies are project urban local bodies (ULBs). TCC is the Implementing Agency for this subproject. A project implementation unit (PIU) established in TCC headed by a full-time Project Manager (Executive Engineer or above) and comprising dedicated full-time staff of the TCC for day-to-day implementation of the sub project. PIU is assisted by Construction Management and Supervision Consultant (CMSC) for implementation. Environmental and Social Safeguards (ESS) Managers in PMU/TNUIFSL coordinate all the safeguard related activities of the sub project and ensure the compliance with environmental management plan (EMP) and EARF. Environmental Specialist of the CMSC, assists PIU in implementation of subproject in compliance with EMP and EARF, and carries out all necessary tasks.
5. **Screening and assessment of potential impacts.** ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and

the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009 also requires that ADB-financed sub-projects to comply with host country regulations. As per the Government of India (GoI) Environmental Impact Assessment (EIA) Notification, 2006, this subproject does not require EIA study or environmental clearance. For the STP sub-component, the consent to establish would be obtained prior to commencement of works from the Tamil Nadu Pollution Control Board¹. 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, during construction, and operation.

6. **Categorization.** Based on results of the assessment and ADB Safeguard Policy Statement (SPS), 2009, the subproject is classified as environmental Category B, i.e., subproject potential adverse environmental impacts are less adverse than those of category A, and are site- specific, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE) is required.
7. **Description of the Environment.** Subproject components are located in Tiruchirappalli City, an urban area surrounded by land that was converted for agricultural use many years ago. Sewer lines are laid in the public roads, within the road carriage way, and pumping/lifting stations are constructed on identified government owned vacant land parcels, in or close to residential areas. 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, and temples, and is a commercial and tourist hub of TamilNadu. The most prominent landmark is the Archaeological Survey of India (ASI) protected Rock Fort Temple and Erumbeeswarar Temple. No components are located within the boundary of the protected monument; however, sewer network in the surrounding residential areas fall within the 300 m regulated zone of Erumbeeswarar Temple and will require prior permission from National Monument Authority (NMA) to execute the works.
8. **Potential environmental impacts and mitigation measures.** The sub project is unlikely to cause significant adverse impacts that are irreversible, diverse or unprecedented because: (i) the components involve straight forward construction and operation, so impacts are mainly localized; (ii) there are no significant sensitive environmental features in the project sites although careful attention needs to be paid to minimizing disruption to population of urban area and (iii) predicted impacts are site-specific and likely to be associated with the construction process and are produced because the process is invasive, involving excavation and earth movements. Subproject includes construction of new 37 MLD STP. There are no significant impacts Considering the following (i) the location of STP away from the habitations,(ii) design of treatment process to treat wastewater to meet disposal standards, (iii) disposal of treated wastewater into an irrigation channel, in which at present untreated wastewater from subproject areas is discharged.
9. In this IEE, negative impacts were identified in relation to pre-construction, construction, and operation phases. Planning principles and design considerations have been reviewed and incorporated into the site planning and design process wherever possible; thus, environmental impacts as being due to the project design or location were not significant. Sewage pumping and lifting stations, which collect

¹ The Consent to Operate the STP would be obtained from TNPCB prior to commissioning of the STP.

sewage and pump to a higher elevation pump station or to the STP, are likely to generate odor. Lifting stations are comparatively small, and therefore odor nuisance is limited. Although utmost care is taken to locate pumping and lifting stations away from the houses, due to design considerations and land constraints, some sites are located close to the houses. Another impact is that of STP operation: from malfunction or decrease in treatment efficiency and sludge handling and disposal which may occur rarely. This will result in release of untreated or partially treated wastewater rarely, that will pollute environment and cause public health issues. Accumulation of silt in sewers in areas of low over time, overflows, blockages, power outages, harmful working conditions for the workers cleaning sewers etc. may create nuisance, unhealthy and hazardous conditions and can be avoided by proper monitoring of the operation.

10. From the STP, it is proposed to dispose treated wastewater into Uyyakondan channel, flowing at 2.7 km from the STP site. This is a major irrigation channel, taking off from Cauveri River at Kulathalai Kattnali, upstream of Tiruchirappalli, and flows about 40-50km prior to reaching the city, and then flows through the Centre of Tiruchirappalli city for about 18km, carrying stormwater, and wastewater from the unsewered city areas. It finally discharges into Valavandhankottai pond/tank at Thuvakudi, about 20-22km from the proposed STP discharge point. Channel water is used for only irrigation. No water quality data available at present, however, channel mostly carries wastewater within the city, and therefore existing quality likely to be poor except during upstream flow. Baseline water quality of channel established during the detailed design phase. Discharge from STP will be properly treated to meet the disposal standards, and therefore no table impacts envisaged on channel water quality. This open channel flows for another 20-22km downstream, allowing further dilution via self-purification prior to reaching the tank/pond. Pond water is used only irrigation. Wastewater is treated to set standards at the STP prior to its disposal into Uyyakondan channel. Considering the existing status of channel, and the degree of treatment and self-purification via 20-22 km turbulent flow in open channel, there will not be any significant impacts. Proper systems will be put in place at the STP to ensure that treated wastewater always meet the stipulated standards prior to its disposal into this channel.
11. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result, significant measures have already been included in the designs for the infrastructure. Various design related measures suggested for: STP treatment process design to meet disposal standards, ensuring efficient treatment, odor control including: appropriately locating sewage wells within site as far as away from the houses; developing tree cover; enclosed facilities; gas collection and treatment facilities, and design and operation measures to prevent odor buildup; standard operating procedures for operation and maintenance; imparting necessary training; safety and personal protection equipment for workers, etc., For the existing STP, rehabilitation works will ensure that wastewater is properly treated to meet disposal standards prior to its disposal.
12. 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) are confined to the selected sites, and the interference with the public and community around is minimal. In the sewer works, the temporary negative impacts arise mainly from construction dust and noise, hauling of construction material from the existing government licensed mining areas, waste and equipment on local roads (traffic, dust, safety etc.), mining of construction material, occupation health and safety aspects. Sewer works are constructed 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; with some sections involving controlled blasting; especially in narrow roads, access impediment to houses and business, disposal of large quantities of construction waste, etc. The District Collector has accorded permission for executing the controlled blasting. These are all general impacts of construction in urban areas, and there are well developed methods of mitigation that are suggested in the EMP.

13. **Environmental Management Plan.** An environmental management plan (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. Hard rock removal through controlled blasting for excavation has been identified for some sections of the pipeline alignment and in the pumping station sites. Mitigation measures to ensure safety of humans and structures within the area of influence and impacts due to controlled blasting during the implementation have been included in EMP. The 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.
14. The EMP is 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 a site environmental management plan (SEMP) to PIU, for review and approval, which reflecting the associated mitigation and monitoring measures for controlled blasting activities proposed now. The site environmental management plan (SEMP), including (i) the 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, kept on site during the construction period at all times.
15. **Consultation, disclosure and grievance redress mechanism.** The stake holders 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, TCC and TNUIFSL websites. The stakeholders were involved in developing the updated IEE through on-site discussions within the limitations imposed by the district authorities during on-going corona virus disease (COVID-19) pandemic. The consultation process will be further strengthened after relaxation of present restrictions due to COVID-19 pandemic and continued thereafter during project implementation. A grievance redress mechanism (GRM) is described in the IEE has already been made fully functional to ensure quick redressal of public grievances.
16. **Monitoring and Reporting.** Contractors are submitting monthly EMP implementation report to PIU and with the assistance of CMSC, PIU is monitoring the compliance of Contractor and submitting Quarterly Environmental Monitoring Report to PMU. The PMU has been overseeing the implementation and compliance and submits semi-annual monitoring reports to ADB. ADB will post the environmental monitoring reports on its website. Monitoring reports will also be posted on TCC and TNUIFSL websites
17. **Conclusions and Recommendations.** Therefore, as per ADB SPS, this subproject is classified as environmental category B and does not require further environmental impact assessment. To conform to government guidelines, consent to establish (CTE) have been obtained for new 37 MLD STP from Tamil Nadu Pollution Control Board

(TNPCB), and consent to operate (CTO) shall be obtained for the new and the rehabilitation of existing STP prior to operation. For works located within the regulated zone of the protected monument (with in 300m boundary), permission has been obtained from National Monument Authority. This IEE is updated by PIU based on final design during construction and incorporating details of controlled blasting and approved by PMU. The updated IEE is submitted to ADB for concurrence and disclosure.

I.INTRODUCTION

A. Background

1. The Tamil Nadu Urban Flagship Investment Program (TNUFIP) will advance India's national urban flagship programs to develop priority urban and environmental infrastructure in ten cities located within strategic industrial corridors of Tamil Nadu (the State), including those within the East Coast Economic Corridor (ECEC), to enhance environmental sustainability, climate resilience, and livability. It will also strengthen the capacity of state and local institutions and improve urban governance.
2. TNUFIP is implemented over an 8-year period beginning in 2018, and funded by Asian Development Bank (ADB) via its multi tranche financing facility (MFF). The executing agency is the Department of Municipal Administration and Water Supply (MAWS) of the State acting through the Tamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL) who established a program management unit (PMU). The urban local bodies (ULBs) are the implementing agencies for projects and established program implementing units (PIU).
3. TNUFIP is aligned with the following impact: urban livability and climate resilience in cities of economic importance improved. TNUFIP will have the following outcomes: smart and climate resilient urban services delivered in ten cities in priority industrial corridors. The TNUFIP is structured under following three outputs:
 - (i) **Output 1: Sewage collection and drainage improved and climate-friendly sewage treatment systems introduced.** This includes: (i) new (179 million liters per day [MLD]) and rehabilitated sewage (175 MLD) treatment capacity developed with solar power for operations installed on a pilot basis; (ii) reuse of treated sewage water for industrial purposes in selected areas; (iii) new and improved sewage collection pipelines (2,810 kilometers [km]) constructed with 100% household connections made (426,600 household connections); (iv) 173 new sewage pumping stations of 6,390 kilowatts (KW) capacity added; (v) 20 community water and sanitation committees formed with female participation; and (vi) climate resilient drainage and flood management systems established (250 km tertiary and 50 km primary and secondary).
 - (ii) **Output 2: Access to reliable and smart drinking water services improved.** This will include: (i) smart water supply distribution systems (1,520 km pipelines) established within 110 new district metered area stored NRW and provide regular water supply with 100% household connections (171,000 household connections); (ii) new transmission mains (120 km); (iii) 30 number of pump houses of 1,530 KW capacity; and (iv) new water storage reservoirs (40 reservoirs totaling 70 million liters). The TNUFIP will scale up smart water pilots in Chennai under TA-9048 to reduce nonrevenue water levels and optimize operational efficiency through the latest technologies in smart metering and digital diagnostic tools.
 - (iii) **Output 3: Institutional capacity, public awareness, and urban governance strengthened.** This includes: (i) establishing a new state-level Urban Data and Governance Improvement Cell in the Commissionerate of Municipal Administration (CMA); (ii) establishing a new Project Design and Management Center in CMA; (iii) introducing and implementing a state-wide performance-based urban governance improvement program for all 135 cities in Tamil

Nadu to improve financial management, revenues, administration, service delivery, gender and social inclusion, and waste water reuse and fecal sludge management; and (iv) implementing public awareness campaigns in areas of water conservation, sanitation, and hygiene in 10 project cities. Project design consultants (PDC) will be recruited to prepare new projects meeting ADB requirements.

4. **Scope of Project 1.** Tranche 1 is representative of MFF investments and will support subprojects in 6 cities (Chennai, Coimbatore, Rajapalayam, Tiruchirappalli, Tirunelveli, and Vellore). Outputs of tranche 1 includes:
 - (i) **Output 1: Sewage collection and drainage improved, and climate-friendly sewage treatment systems introduced.** This includes: (i) 5 new STPs of 153 MLD treatment capacity including one STP with 2 megawatts (MW) solar-power installation for operations;(ii) 2 rehabilitated STPs of 61 MLD capacity; (iii) 8,000 cubic meter (m³) per day of treated wastewater reused; (iv) 1,860 km of new sewage collection pipelines with 100% household connections; (v) 124 new pump/ lift stations of 4,470 KW capacity; and (vi) 297,500 new household sewer connections. The breakdown by city is as follows: (i) sewage collection system with new 32 MLD STP and one rehabilitated 24 MLD STP in Tirunelveli with treated effluent supplied for industrial reuse; (ii) sewage collection system with new 2 MW solar- powered 30.53 MLD STP in Coimbatore; (iii) sewage collection system with new 37 MLD STP and one rehabilitated 30 MLD STP in Tiruchirappalli;(iv) sewage collection system with new 50 MLD STP in Vellore; (v) sewage collection system in four areas of Chennai; and(vi) sewage collection with new 10 MLD STP in Rajapalayam, and 12 community water and sanitation committees formed with female participation.
 - (ii) **Output 2: Access to reliable and smart drinking water services improved.** This support 4 areas of Chennai with the following:(i) 275.6 km of smart water supply distribution pipes in 20 newly established district metered areas to manage and reduce NRW connected to computerized control and data acquisition systems; (ii) 30,800 household metered connections; (iii) 11 km of new transmission pipes; (iv) 9 new storage reservoirs (4 underground and 5 overhead) of 11 million liters capacity; and (v) 5 pump stations of 230 KW capacity.
 - (iii) **Output 3: Institutional capacity, public awareness, and urban governance strengthened.** This includes: (i) establishing a new state-level Urban Data and Governance Improvement Cell in the CMA; (ii) establishing a new Project Design and Management Center in the CMA; (iii) introducing and implementing a state-wide performance-based urban governance improvement program for all 135 cities under CMA to improve financial management (audited accounts), municipal revenues (taxes, user fees), administration (filling vacancies), and gender mainstreaming (gender equality social inclusion plan implementation); and(iv) implementing public awareness campaigns in areas of water conservation, sanitation, and hygiene. The PDC will be recruited for preparing projects in subsequent tranches.
5. Tiruchirappalli City has an existing underground sewerage scheme covering part of the core (old) city area. TCC has recently implemented Tiruchirappalli-Srirangam sewerage scheme, under the National River Conservation Project (NRCP) grant, to cover part of core area. A considerable portion of the core city area is still unsewered, along with the added areas and poses significant health risk and pollution by way of sewage discharge into low- lying area and water bodies including the Cauvery and kollidam rivers. It is the proposed to provide a sewer system in the presently uncovered area of TCC under the ADB funded TNUFIP. subproject includes: (i) sewage collection system (312.217-

kilometer (km) length of sewers and 12,109 manholes), (ii) 24 nos. of lift stations, (iii) 5 nos. of pump stations, (iv) 24 km length pumping main sewers, (v) new sewage treatment plant (STP) of 37 (MLD) capacity at Keelakalkandarkottai (vi) rehabilitation of existing 30 MLD STP at Panjapur, and (vii) 44,569 house service connections.

B. Purpose of this Initial Environmental Examination Report

6. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. The potential environmental impacts of the subproject have been assessed using ADB Rapid Environmental Assessment (REA) Checklist for Water Supply (Appendix 1). Then potential negative impacts were identified in relation to pre-construction, construction and operation of the improved infrastructure, and results of the assessment show that the subproject is unlikely to cause significant adverse impacts that are irreversible, diverse, or unprecedented. Thus, this initial environmental examination (IEE) has been updated in accordance with ADB SPS's requirements for environment category B projects.
7. This IEE is based on the detailed project report prepared by TCC. The update is to reflect the inclusion of controlled blasting as one of the construction methodologies encountered during implementation and STP detailed design of which has been prepared by the DBOT contractor. The IEE was based mainly on field reconnaissance surveys and secondary sources of information. No field monitoring (environmental survey was conducted), however, the environmental monitoring program developed as part of the environmental management plan (EMP) require the contractors to establish the baseline environmental conditions prior to commencement of civil works. The results are reported as part of the environmental monitoring report and are the basis to ensure no degradation will happen during subproject implementation. Stake holder consultation was an integral part of the IEE.

C. Report Structure

8. This Report contains the following ten (10) sections including the executive summary at the beginning of the report:
 - (i) Executive summary.
 - (ii) Introduction.
 - (iii) Description of the project.
 - (iv) Policy, legal and administrative framework.
 - (v) Description of the environment.
 - (vi) Anticipated environmental impacts and mitigation measures.
 - (vii) Public consultation and information disclosure.
 - (viii) Grievance redress mechanism.
 - (ix) Environmental management plan; and
 - (x) Conclusion and recommendation.

II. DESCRIPTION OF THE PROJECT

A. PROJECT AREA

9. Tiruchirappalli is one of the largest cities in the state of TamilNadu, 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 runs 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), and corporation area increased by 20.33km² to 167.23km². TCC has a population of 916,674 (census 2011) and 65 municipal wards, grouped into four administrative zones: Srirangam, Ariyamangalam, Golden Rock and K. Abishekapuram.
10. 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 one has already been completed, so the ADB supported TNUFIP focus on Phase II, which includes recently added areas in the eastern area and remaining uncovered areas in the core city area. The new UGSS includes piped network, pump/ lift stations and additional treatment capacity through construction of a 37 MLD STP in Keelakalkandar Kottai and improvements to the existing STP in Panjappur located on the Tiruchirappalli–Madurai highway. The project area under TNUFIP has been divided into 13 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 sewage collection system, to the extent possible, has been prepared to convey sewage by gravity.

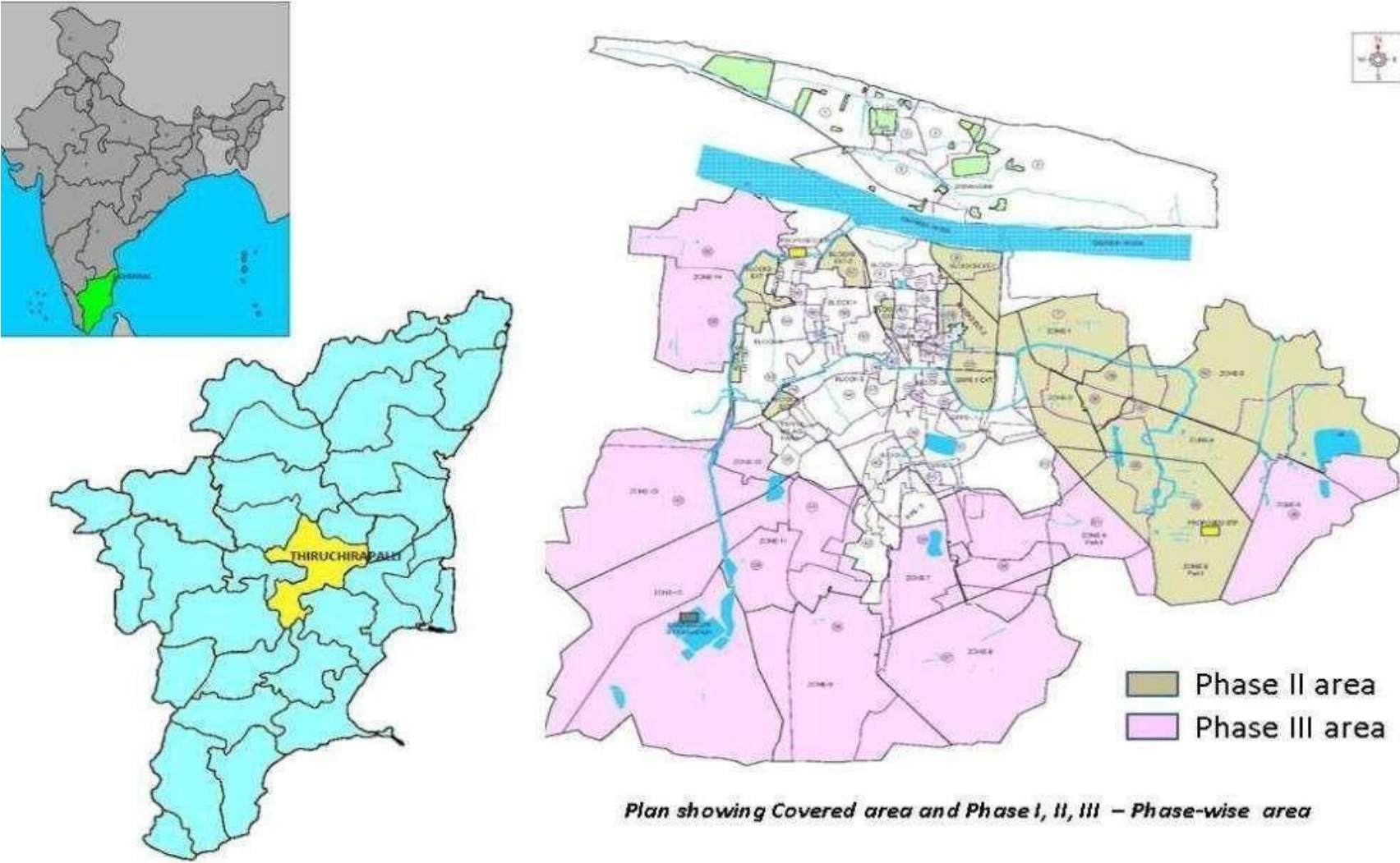
B. EXISTING SEWERAGE SYSTEM

11. The existing UGSS covers most of the higher density old town areas with gravity collection and pumping to the waste stabilization ponds STP at Panjappur on the southern periphery of TCC with effluent discharged to Koraiyar River and ultimately to the Cauvery River. Sewage from the uncovered areas within TCC limits is discharged to open drains which ultimately discharge into the network of channels including the Uyyakondan, Koraiyar and Thirumanjana Cauvery which finally empty into the Cauvery and Coleroon Rivers. A small capacity treatment pond, spread over 10 acre of land and of approximate capacity 2.5MLD, at Panjakarai on Srirangam island discharges effluent to Coleroon River (the northern branch of Cauvery River that skirts Srirangam on the north). Details of sewerage schemes implemented till date in TCC are presented below:
 - (i) **Srirangam UGSS Scheme (1956)**. Srirangam (erstwhile municipality) was the first area to be provided with UGSS in 1956. Gravity UGSS with three pump stations were constructed in the developed areas. Sewage was conveyed to the sewage pond at Panjakarai.
 - (ii) **Trichy UGSS Scheme (1987)**. The next UGSS scheme was implemented during 1987-1992 covering the high-density areas, covering seven (7) blocks constituting the core area of current TCC. 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. Interceptor collectors in major open drains within the city limits were constructed and sewage pumped to the waste stabilization pond (WSP) based STP at Panjappur for treatment and disposal.

- (iv) **UGSS Augmentation Scheme under National River Conservation Plan (NRCP), 2008.** Under this Gol 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 TCC) 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 3 m. 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 afore mentioned GRPS is conveyed through individual pumping mains to the MPS– II at Anna Stadium and ultimately to the STP at Panjappur.
12. Overall, at present, about 31 percent of total TCC area is covered with sewerage system, which serve about 52 percent of the total TCC 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 and discharge into water bodies. 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 areas 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.
13. The sewage master plan of TCC includes three remaining phases for UGSS expansion as follows: Phase II – East Zone; Phase III – West Zone, and Phase IV – South Zone. Phase II and III are implemented under TNUFIP, with Phase II implemented under Tranche 1, and Phase III in subsequent Tranche 2. Phase IV is not yet planned. This subproject therefore focuses on Phase II and includes provision of UGSS to the East Zone (Ariyamangalam) comprising, 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 II completion will be about 75%. The balance 25% will be covered under Phases III and IV.
14. **Existing situation in subproject area (East Zone).** At present in east 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 channel that skirts the southern periphery of the Eastern Zone areas. This is an irrigation channel, and also acts as a major storm water drain traverses the entire width of TCC towards the eastern boundary and ultimately discharges into Vallavandhan Kottai Pond. Additionally, low-lying high-density areas in the city town area also discharge untreated sewage to Koraiyar river. Therefore, TCC has identified the wards in the eastern zone (Ariyamangalam) and un-serviced areas of the old city as high priority areas to be covered by UGSS through this Phase II scheme in order to abate pollution of major channels and Cauvery River.

Figure 1: Location of Subproject



C. PROPSOED PROJECT

15. This subproject shall provide sewerage system in east zone (phase II) which covers all areas in Ariyamangalam Zone and omitted areas in the old city area of TCC. Collection system for Phase-II has been divided into thirteen (13) sewer sub-zones: 1 to 6 are in the Ariyamangalam Zone (added areas and areas located in east zone) and the balance 7 comprise old city area. Sewer sub-zoning is done for design of the collection system to maximize gravity flow. Collection / command area of the sewer sub-zone is designed to be collected at a sewage pumping station (SPS) if 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 runoff generated during rains will be carried by existing open drains and dispose into natural streams / water bodies. Industrial wastewater not disposed into sewers. System is designed for 110 liters per capital per day, based on sewage generation rate of 80% of water supply. System is design with gravity flow as far as possible, however topography do not permit a complete gravity system from collection to inlet at the STP, and therefore wherever required sewage lifting and pumping stations introduced to optimize the system design.

16. Table 1 shows the nature and size of the various components of the subproject. Location of subproject components and conceptual layout plans are shown in Figure 2 to Figure 9.

Table 1: Components of the Subproject

Infrastructure	Function	Description	Location
Sewer network	Collect wastewater from houses and convey by a combination of gravity and pressure pumping to the STP	<p>312.217 km - 200-1000 mm diameter sewers</p> <ul style="list-style-type: none"> - 244. 299 km uPVC pipes - 49.899 km DWC pipes - 18.019 km CI pipes <p>Manholes 12,109 nos. (brickwork & reinforced cement concrete) Minimum distance between manholes of 30 m is adopted for sewer size up to 400 mm and larger spacing upto100m for large diameter sewers. Manholes type and sizes are as follows: For depths up to 2.5 m(Rectangular)</p> <ul style="list-style-type: none"> • Up to 1.2m depth – 0.75m x1.20m • Up to 2.5m depth – 0.90m x 1.50m for depths above 2.5 m(Circular) • Up to 6.0m depth – 1.5mdiameter <p>Above 6.0m depth – 1.8mdiameter</p>	<p>Sewers are laid underground in the roads and internal streets in the project area comprising 13 sewerage sub-zones (Ariyamangalam Zone-6 nos.; and omitted areas in Old Town - 7nos.).</p> <p>Sewer lines are laid in the Centre of road by cutting black top, within the road right of way. In wider road 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 black top 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 (300–1000mm), while the tertiary sewers of small size (200mm to300mm dia) that collect wastewater from each house are laid in all streets in the subproject area.</p> <p>Trench size to bury the sewer will be of 0.8m to1.6 m wide and1.2m to 5m deep (6m in small terminal stretches near pump stations)</p> <p>For manholes, an area of 1.5 mx1.5m to 2.5m x 2.5m will be excavated</p>
Sewage 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.	<p>24 nos.</p> <p><i>Components of LS</i></p> <ul style="list-style-type: none"> • Lift well(circular) • Non-clog submersible pump sets • Control panel box <p><i>Lift stations are essentially are 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></p>	<p>Lift well is constructed on the road (like manhole) where the sewer ends terminates into the lift well. Pumps are installed in the well, and a control panel box installed near the well. Lift stations are proposed at following locations:</p>

	Lifting station has a collection well																																																		
	With submersible Pumps accommodated inside. The Screen arrangement is provided in the previous manhole to the lift station.		<table border="1"> <thead> <tr> <th>S. No</th> <th>Zone</th> <th>Lifting Station Location</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1</td> <td>(Arimangalum) Arputha Sami Puram</td> </tr> <tr> <td>2</td> <td rowspan="3">2</td> <td>Patel Nagar</td> </tr> <tr> <td>3</td> <td>Diamond Layout</td> </tr> <tr> <td>4</td> <td>Gandhi Nagar</td> </tr> <tr> <td>5</td> <td rowspan="5">3</td> <td>Balaji Nagar</td> </tr> <tr> <td>6</td> <td>Papakurichy Village-Kamraj Nagar</td> </tr> <tr> <td>7</td> <td>Mahalaxmi Nagar Extn</td> </tr> <tr> <td>8</td> <td>Muthu Nagar (New town)</td> </tr> <tr> <td>9</td> <td>Cholan Avenue</td> </tr> <tr> <td>10</td> <td rowspan="2">4</td> <td>Amman Nagar East</td> </tr> <tr> <td>11</td> <td>Amman Nagar West Extension</td> </tr> <tr> <td>12</td> <td rowspan="2">B2-U1</td> <td>Devathanam, Jayakumar Nagar</td> </tr> <tr> <td>13</td> <td>Sangeevi Nagar</td> </tr> <tr> <td>14</td> <td></td> <td>John Thoppu</td> </tr> <tr> <td>15</td> <td rowspan="2">B2-U2</td> <td>Vethathrinagar</td> </tr> <tr> <td>16</td> <td>Vishwas Nagar Main Road, Thavallur Extn</td> </tr> <tr> <td>17</td> <td></td> <td>Thigaraj Nagar</td> </tr> <tr> <td>18</td> <td>B3-U1</td> <td>Vekailamman Nagar</td> </tr> </tbody> </table>	S. No	Zone	Lifting Station Location	1	1	(Arimangalum) Arputha Sami Puram	2	2	Patel Nagar	3	Diamond Layout	4	Gandhi Nagar	5	3	Balaji Nagar	6	Papakurichy Village-Kamraj Nagar	7	Mahalaxmi Nagar Extn	8	Muthu Nagar (New town)	9	Cholan Avenue	10	4	Amman Nagar East	11	Amman Nagar West Extension	12	B2-U1	Devathanam, Jayakumar Nagar	13	Sangeevi Nagar	14		John Thoppu	15	B2-U2	Vethathrinagar	16	Vishwas Nagar Main Road, Thavallur Extn	17		Thigaraj Nagar	18	B3-U1	Vekailamman Nagar
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Sewage Treatment Plant (STP)	Treatment of collected wastewater to comply with disposal standards	<p><i>New</i> STP of capacity 37 MLD Proposed process: SBR (Sequential Batch Reactor).</p> <p>Components:</p> <ul style="list-style-type: none"> • Inlet Chamber • Mechanical Coarse Screen Channel. • Manual Coarse Screen Channel • Mechanical Fine Screen Channel • Mechanical Grit Chamber • Inlet Distribution Channel to SBR • Sequential Batch Reactor (SBR)Basin • Disinfection Chlorine Contact Tank • Sludge Handling Thickener Feed Sump • Gravity Sludge Thickener • Thickened Sludge Sump 	<p>Proposed STP is located at Keelakalkandar Kottai in the outskirts of the city. Land is owned by the TCC. Site is surrounded by vacant/agricultural lands. A threshing platform used by local villagers for threshing and drying of crops, occupies a small portion of the proposed site. This is considered in the social impact assessment studies, and the Resettlement Plan being prepared for the subproject addressed the issues related loss of common property resource. A small village temple situated in western side, about 300 m from proposed STP site. Nearest house is located at about 500 m from the site.</p> <p>Treated wastewater from the STP will be disposed into Uyyakondan channel, an irrigation channel that skirts the southern periphery of the Eastern Zone (the subproject area). This is also acting a major storm water drain in the city traversing the entire width of TCC and ultimately discharges into Vallavandhan Kottai Pond (irrigation tank). At present, this channel also caters to the untreated/partially treated wastewater from the subproject area, and ultimately discharging the wastewater into the irrigation tank. With the implementation of this subproject, wastewater from subproject area will be collected by underground drains, treated at the STP, and disposed into Uyyakondal channel.with the following standards as per CTE.</p> <p>pH 5.5 – 9, BOD 10 mg/l, TSS 20 mg/l, COD 50 mg/l, Nitrogen total – 10 mg/l, Phosphorus total – 1 mg/l, Faecal coliform – desirable 100 – permissible 230.MPN. (Most Probable Number per100 millilitre)</p>
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		<p>Improvement of existing STP at Panjappur to handle augmented flows from Old Town STP capacity 30 MLD</p> <p>Process: waste stabilization pond</p> <p>Proposed works include: repairs to pretreatment units, connections, sluice gates, construction of bunds for facultative ponds and polishing ponds, scrapping of sludge, reconstruction of effluent channel, and removal of sludge, old clay bed, and disposal, relaying of clay bed in anaerobic ponds (2 Nos), facultative ponds (2 Nos) and polishing pond (1No).</p>	<p>Existing STP is located at Panjappur approximately 7-km south of the City along Tiruchirappalli – Madurai - Tuticorin Highway (NH-45B).</p> <p>Treated wastewater from STP is being disposed into Koraiar River, a tributary of Cauvery.</p>
Outfall sewer	Disposal of treated water from new STP into Uyyakondan channel	2.7 km length 800 mm dia CI (cast iron) pipe	From STP at KeelakalkandarKottai to Uyyakondan channel situated south of the STP.
House service connections	Collect sewage from individual houses and convey into network	44,569 nos.(domestic)	At each household, connected to wastewater outlet drain

Figure 4: Layout Plan on Revenue Map for SPS 2

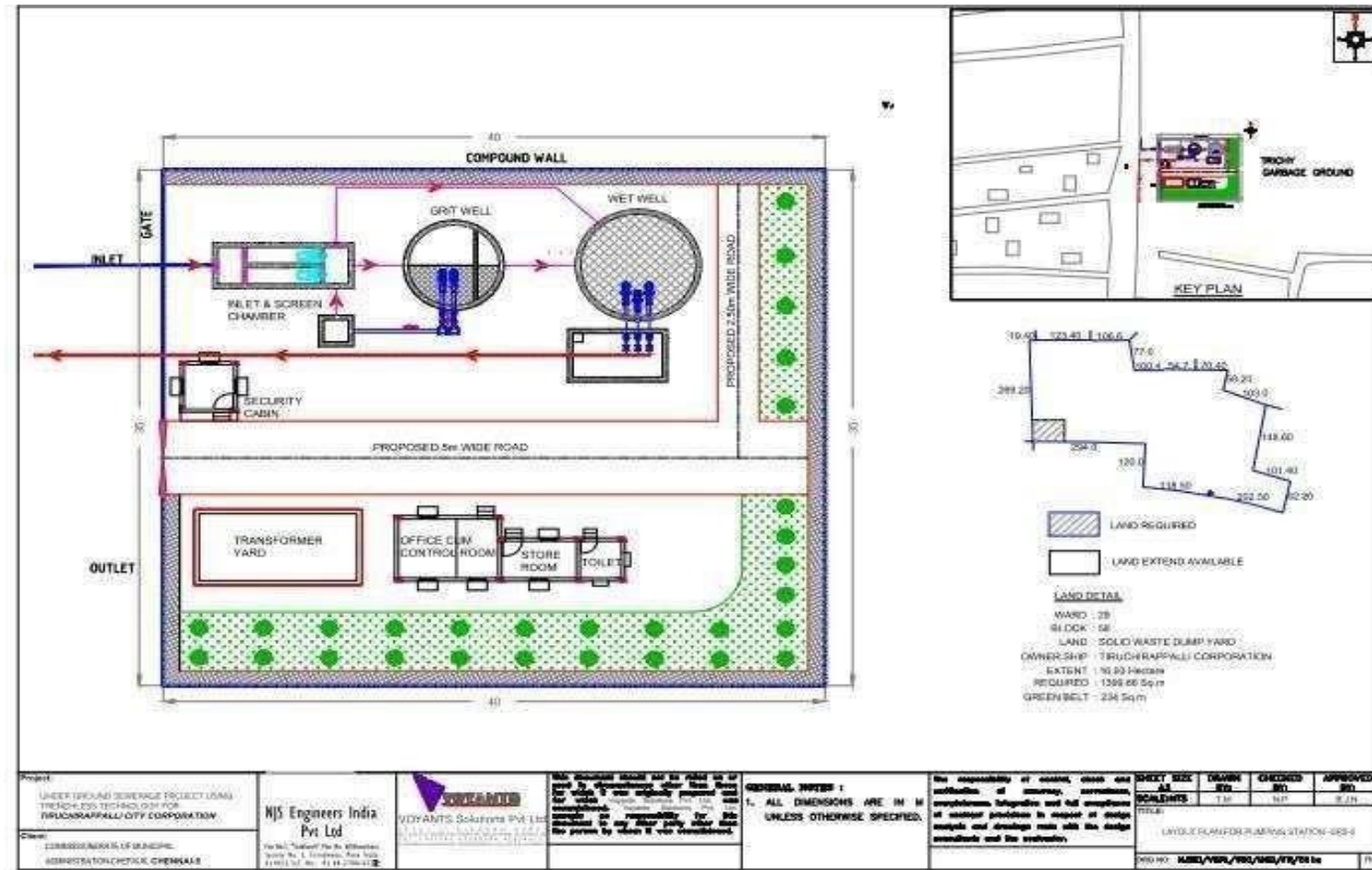


Figure 5: Layout Plan on Revenue Map for SPS 3

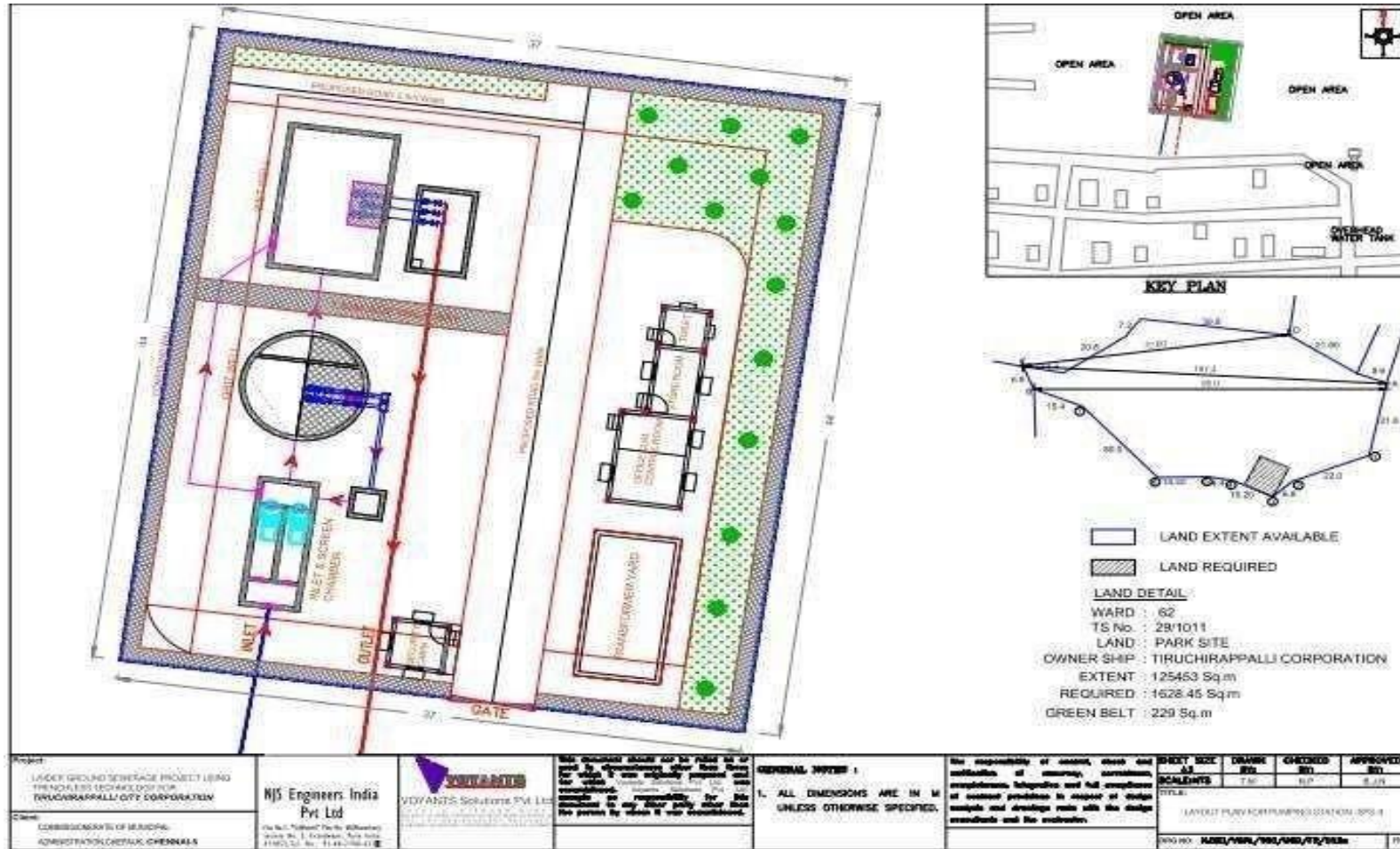


Figure 6: Layout Plan on Revenue Map for SPS-4

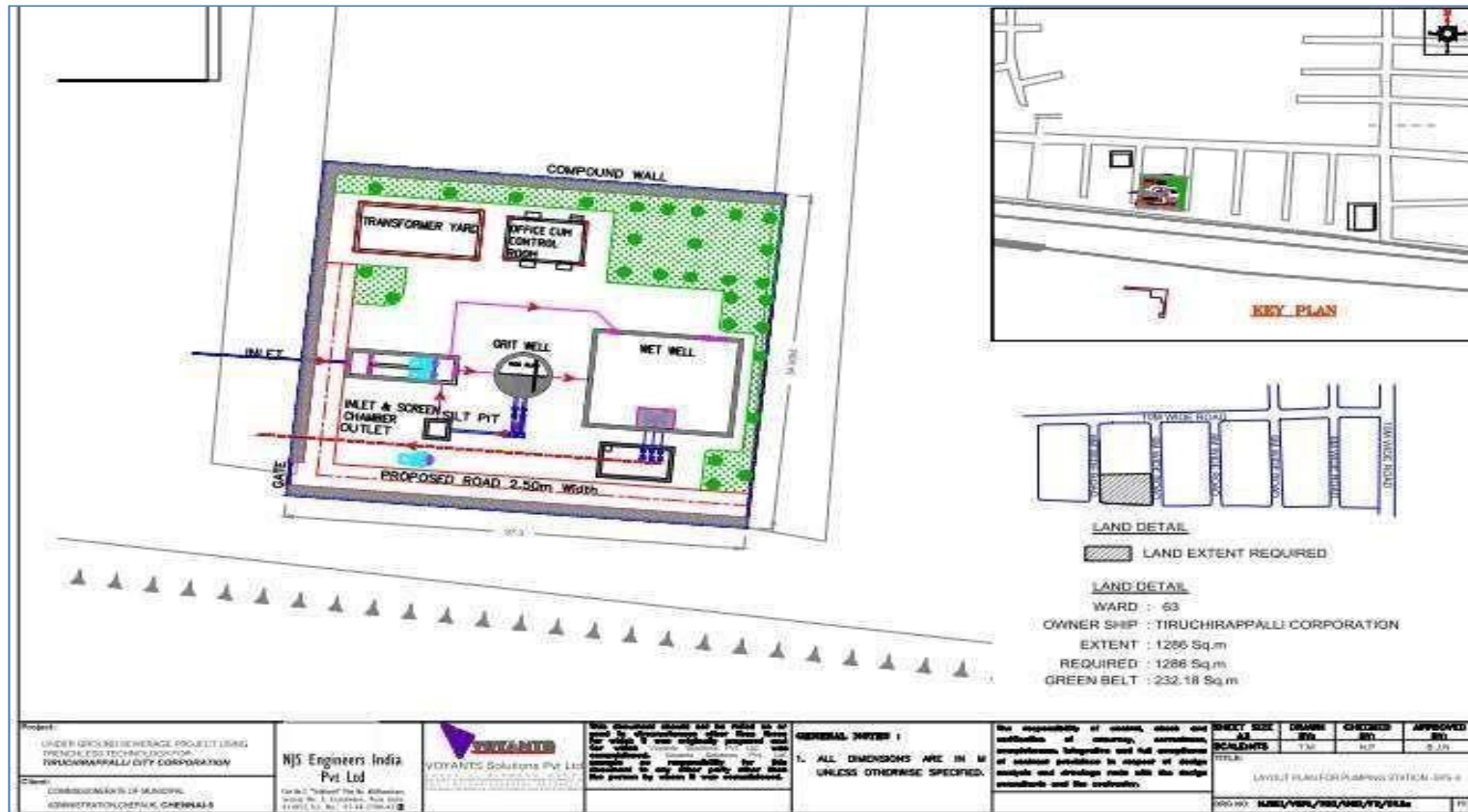


Figure 7: Layout Plan on revenue map for SPS-6

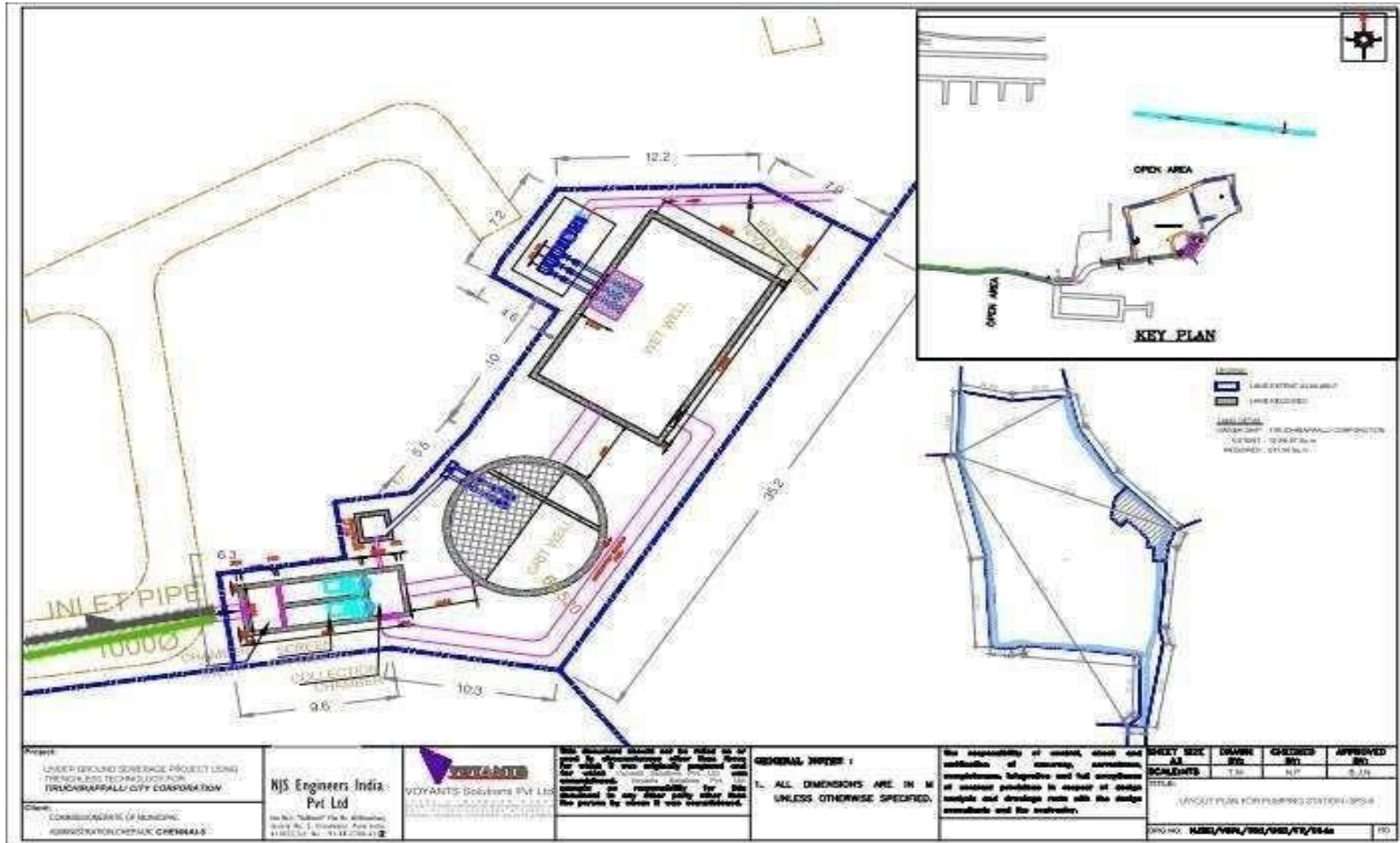


Figure 8: Layout plan for STP

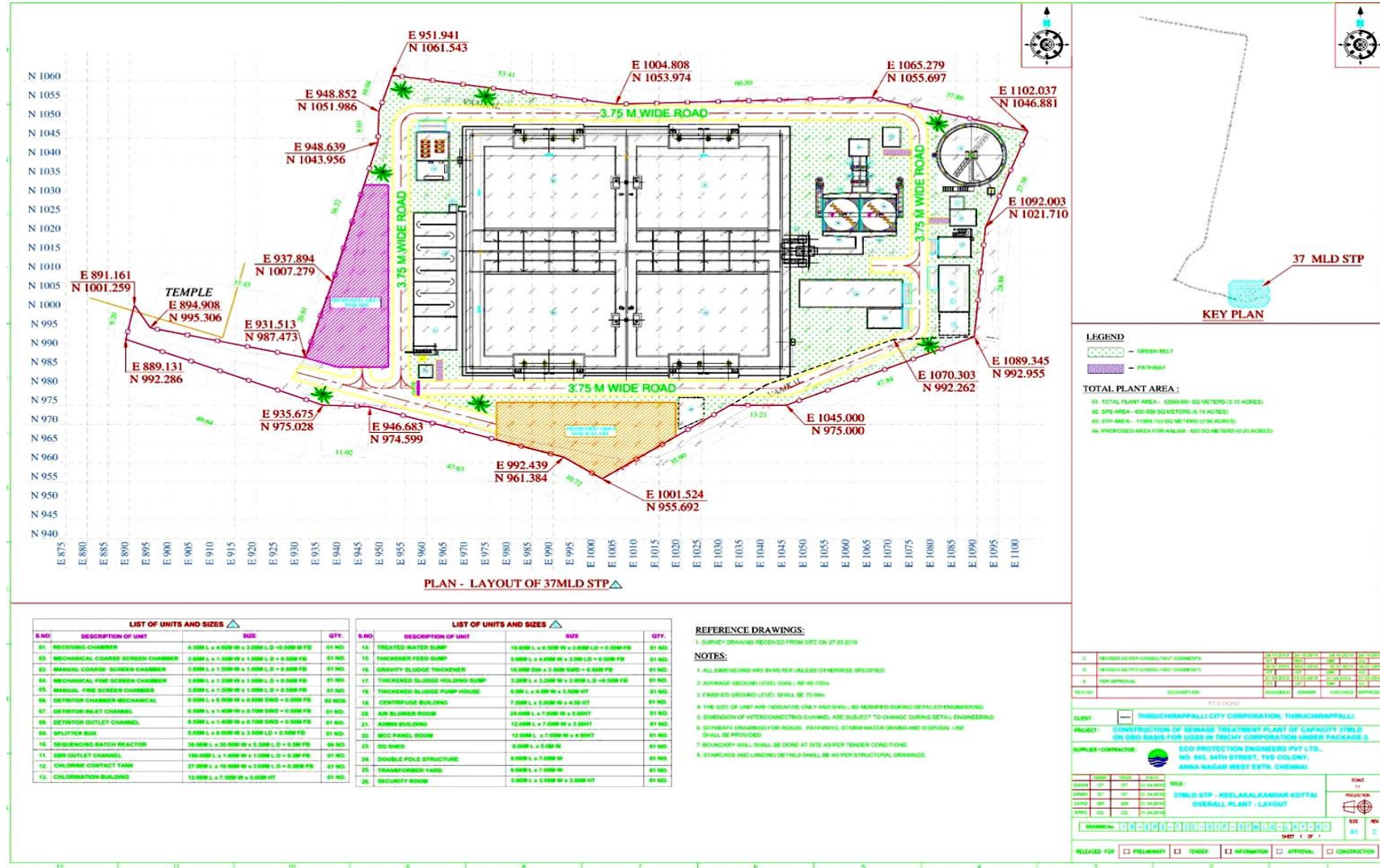


Figure 9: STP Hydraulic Flow Diagram

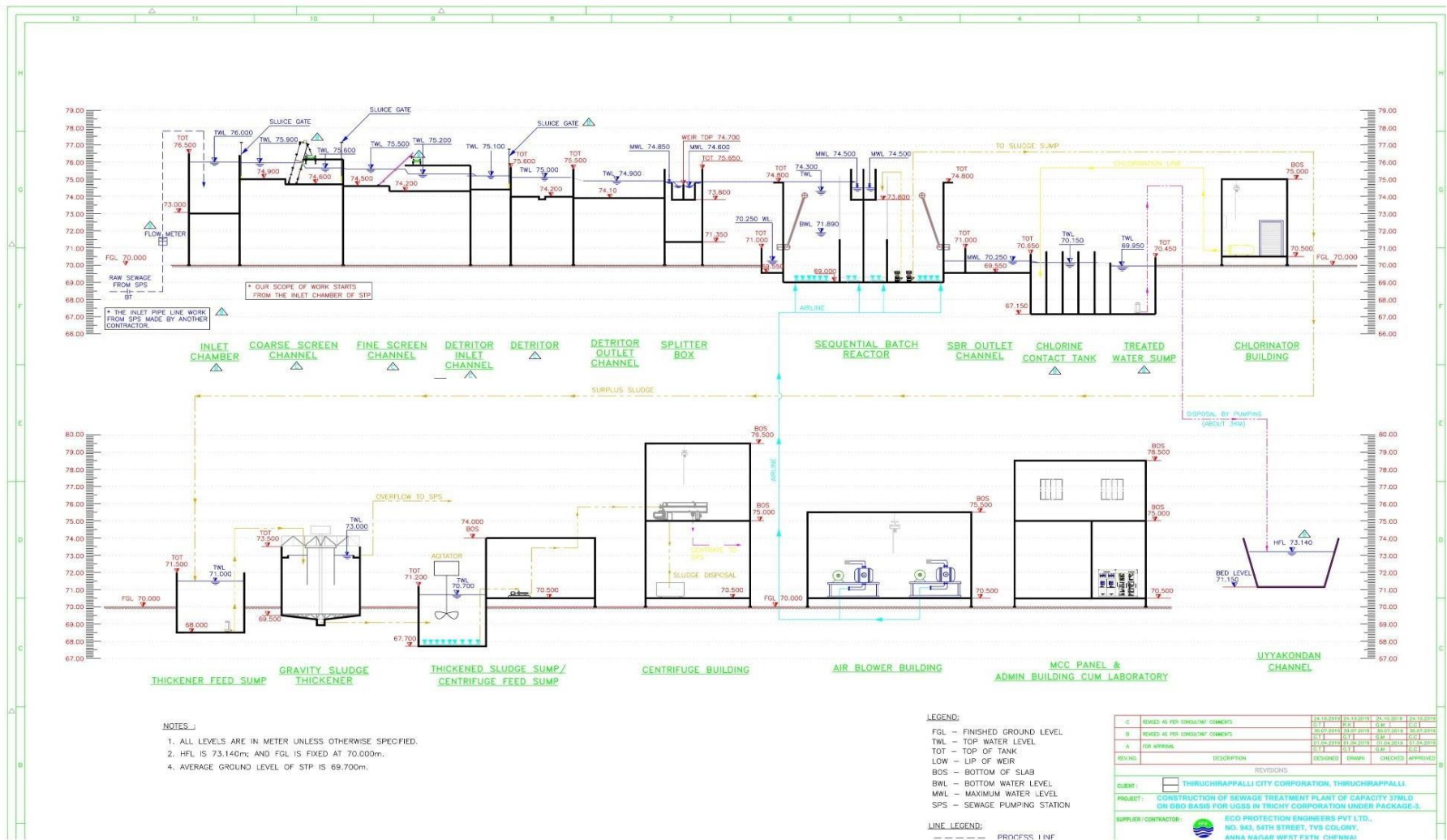
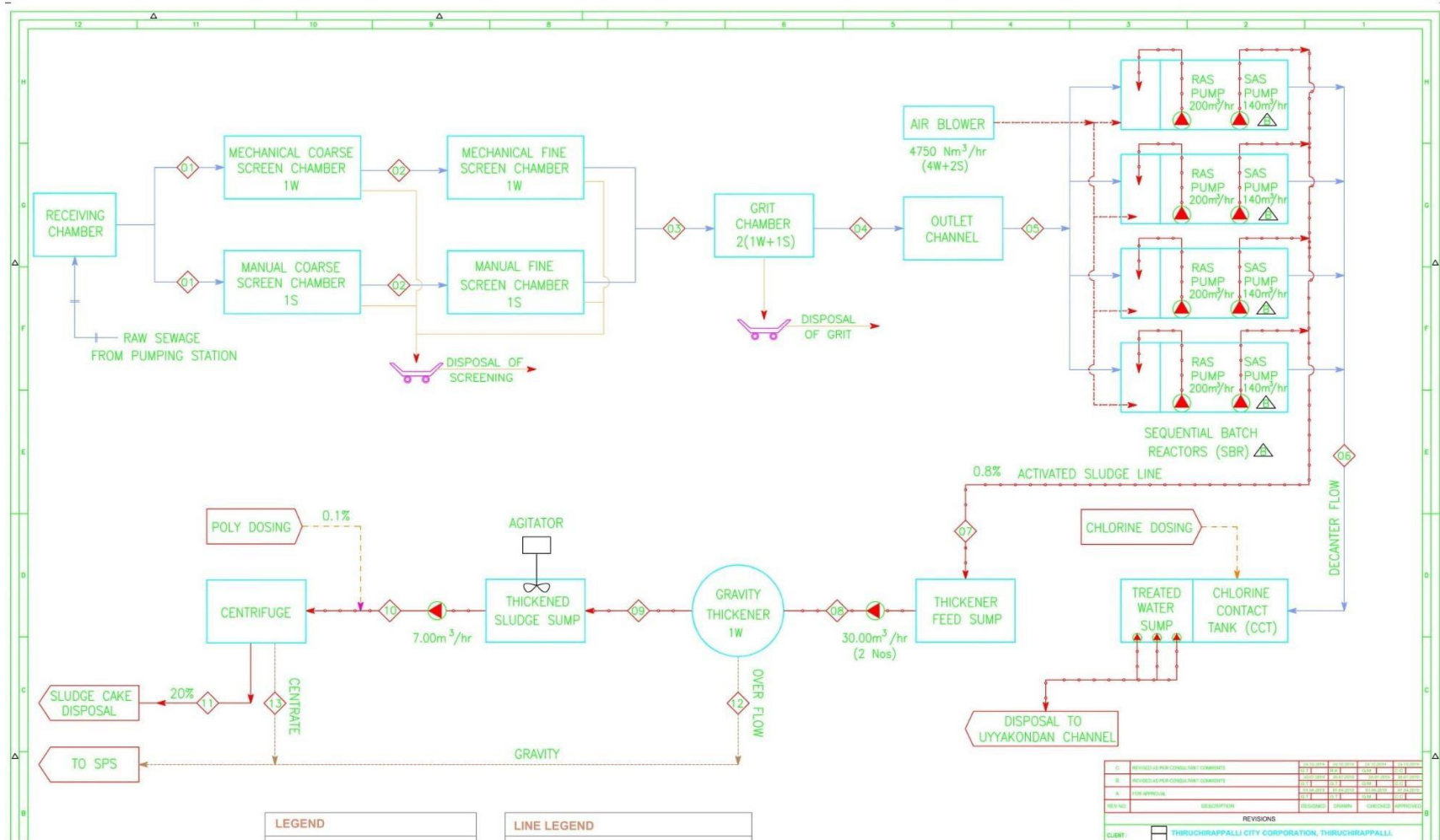


Figure 10:STP Process Diagram



D. Implementation Schedule

17. Contracts have been awarded in three packages. Contract for Package 2 was awarded on 18th May 2018 and the Construction was started in July 2018 and will take 36 months to complete. Contract for Package 1 was awarded on 19th December 2018 and the Construction was started February 2019 and will take 36 months to complete. Contract for Package 3 was awarded on 3rd January 2019 and the Construction was started in March 2020 and will take about 30 months to complete. The detailed implementation schedule (including design/pre-construction, construction, commissioning, and operation phases) are provided in the Table 2, 3 and 4

Table 2: Implementation Schedule for Package - 1

sl. no.	Description of works	Target	Milestone I (6 months)	Milestone II (12 months)	Milestone III (18 months)	Milestone IV (24 months)	Milestone V (30 months)	Milestone VI (36 months)
1	Supply of pipes and specials, etc	257.322 km	20%	40%	60%	95%	100%	Flow test
2	Laying, Jointing and Testing of Pipes Completed for Sewer Line Including Pumping Main and MH, etc.,	257.322 km	10%	40%	60%	90%	100%	100% Balance
3	Sewage Pumping Stations and Lift stations	16 Nos	10%	40%	65%	80%	90%	100% (Including Trial run)
4	House Service Connection	33847 Nos		10%	20%	50%	80%	Flow test
5	Commissioning and trail running.						100%	100%

Table 3: Implementation Schedule for Package - 2

sl. no.	Description of works	Target	Milestone I (6 months)	Milestone II (12 months)	Milestone III (18 months)	Milestone IV (24 months)	Milestone V (30 months)	Milestone VI (36 months)
1	Supply of pipes and specials, etc	78.79 km	20%	40%	60%	95%	100%	Flow test
2	Laying, Jointing and Testing of Pipes Completed for Sewer Line Including Pumping Main and MH, etc,	78.79 km	10 %	40 %	60 %	90 %	100 %	100% Balance

3	Lift Stations including Electromechanical works and Additional well construction	13 Nos	10%	40%	65%	80%	90%	100% (including Trial run)
4	House Service Connection	10722 Nos		10%	20%	50%	80%	Flow test
5	Commissioning and trail running.						100%	100%

Table 4: Implementation Schedule for Package 3

S.No.	Description of Milestones	Time for completion
1	Submission of layout, Unit sizing, Process design and drawings	4 Weeks
2	Mobilization to the site and establishment of field office and quality control laboratory	3 Weeks
3	Approval of design and drawings	4 Months
4	Completion of civil works	19 Months
5	Completion of installation of Plant and equipment	24 Months
6	Completion of Trial run of the Treatment Plant	30 Months
7	Completion of Commissioning and performance guarantee test and Operational Acceptance Certificate by the Employer	30 Months

III. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. ADB POLICY

18. 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.
19. **Screening and categorization.** The nature of the environmental assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project; the sensitivity, scale, nature, and magnitude of its potential impacts; and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impacts, and are assigned to one of the following four categories:
 - (i) **Category A.** A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.
 - (ii) **Category B.** A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required.
 - (iii) **Category C.** A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.
 - (iv) **Category FI.** A proposed project is classified as category FI if it involves investment of ADB funds to or through a Financial Intermediary (FI).
20. **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 are commensurate with the project's impact and risks.
21. **Public disclosure.** ADB will post the safeguard documents on its website as well as disclose relevant information in accessible manner in local communities:
 - (i) Final or updated IEE upon receipt; and
 - (ii) Environmental monitoring reports submitted by the implementing agency during project implementation upon receipt.

B. NATIONAL ENVIRONMENTAL LAWS

22. **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.
23. 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.

24. 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 To R 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.
25. 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.
26. **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 5.

Table 5: Applicable Environmental Regulations

Law	Description	Requirement
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Act was enacted to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water. Control of water pollution is achieved through administering conditions imposed in consent issued under to this Act. All pollution potential activities will require consent to establish (CTE) from Tamil Nadu Pollution Control Board (TNPCB) before starting Implementation and consent to operate (CTO) before commissioning.	Construction of STP require CTE and CTO from TNPCB, before starting of construction and before commissioning of STP respectively. CTE for the new STP has been obtained from TNPCB. For Rehabilitation of the existing defunct STP, CTO from TNPCB is required prior to operation.
Environment (Protection) Act, 1986 and Central Pollution Control Board (CPCB) Environmental Standards.	Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the notified standards	To comply with applicable notified standards. Table 6 and Table 7 below respectively present wastewater disposal standards for STPs and sludge composting standards for use as compost manure
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.

<p>Air (Prevention and Control of Pollution) Act, 1981, amended 1987 and its Rules, 1982.</p>	<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. 	<p>For the subproject, the following will require CTE and CTO from TNPCB: (i) diesel generators; and (ii) hot mix plants, wet mix plants, stone crushers, etc. if installed for construction.</p>
<p>Solid Wastes Management Rules, 2016</p>	<p>Rules to manage municipal solid waste generated; provides rules for segregation, storage, collection, processing, and disposal.</p>	<p>Solid waste generated at proposed facilities shall be managed and disposed in accordance with the SWM Rules</p>
<p>Construction and Demolition Waste Management Rules, 2016</p>	<p>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.</p>	<p>Construction and demolition waste generated from the project construction shall be managed and disposed as per the rules</p>

Law	Description	Requirement
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) Act2010	<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-3 is passing within the 300m of the Erumbeeswarar Temple (an Archaeological survey of India or ASI protected monument). Some sewer lines fall within 100 m boundary of ASI monument.</p> <p>All the works within 300m require prior approval of competent authority (National Monument Authority). NOC has been received from ASI and the same is provided as Appendix-12</p>

Table 6: Effluent Disposal Standards of Sewage Treatment Plants Applicable to All Modes of Disposal

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

4	Fecal Coliform (FC) (Most Probable Number per 100 milliliter, MPN/100ml)	Anywhere in the country	<1000
<p>*Metro Cities are Mumbai, Delhi, Kolkata, Chennai, Bengaluru, Hyderabad, Ahmedabad and Pune.</p> <p>Note:</p> <p>(i) All values in mg/l except for pH and Fecal Coliform.</p> <p>(ii) These standards shall be applicable for discharge into water bodies as well as for land disposal/applications.</p> <p>(iii) The standards for Fecal Coliform shall not apply in respect of use of treated effluent for industrial purposes.</p> <p>These Standards shall apply to all STPs to be commissioned on or after the 1st June 2019 and the old/existing STPs shall achieve these standards within a period of five years from date of publication of this notification in the Official Gazette.</p> <p>In case of discharge of treated effluent into sea, it shall be through proper marine outfall and the existing shore discharge shall be converted to marine outfalls, and in cases where the marine outfall provides a minimum initial dilution of 150 times at the point of discharge and a minimum dilution of 1500 times at a point 100 meters away from discharge point, then, the existing norms shall apply as specified in the general discharge standards.</p> <p>Reuse/Recycling of treated effluent shall be encouraged and in cases where part of the treated effluent is reused and recycled involving possibility of human contact, standards as specified above shall apply.</p> <p>Central Pollution Control Board/State Pollution Control Boards/Pollution Control Committees may issue more stringent norms taking account to local condition under section 5 of the Environment (Protection) Act, 1986".</p>			

Table 7: Standards for Sludge Reuse as Manure

<p>Standards for Composting. As there are no specific standards notified for sludge reuse, the compost quality standards notified under the Solid Waste Management Rules, 2016 (Schedule II A, Standards for Composting) have been adopted here. According to the standards "In order to ensure safe application of compost, the following specifications for compost quality shall be met, namely: -</p>			
Parameters	Units	Organic Compost (FCO 2009)	Phosphate Rich Organic Manure (FCO 2013)
Arsenic	mg/kg	10	10
Cadmium	mg/kg	5	5
Chromium		50	50
Copper		300	300
Lead		100	100
Mercury		0.15	0.15
Nickel		50	50
Zinc		1000	1000
C/N ratio		<20	<20:1
PH		6.5 – 7.5	(1:5 solution) maximum 6.7
Moisture, percent by weight, maximum		15.0 – 25.0	25.0
Bulk density (g/cm ³)		<1	Less than 1.6
Total Organic Carbon, per cent by weight, minimum		12	7.9
Total Nitrogen (as N), per cent by weight, minimum	percent by weight	0.8	0.4
Total Phosphate (as P ₂ O ₅) percent by weight, minimum	percent by weight	0.4	10.4
Total Potassium (as K ₂ O), percent by weight, minimum	percent by weight	0.4	-
Color			

Odor		Absence of foul Odor	
Particle size		minimum 90% material should pass through 4.0 mm is sieve	minimum 90% material should pass through 4.0 mm is sieve
Conductivity, not more Than	dsm-1	4	8.2
* compost (final product) exceeding the above stated concentration limits shall not be used for food crops. however, it may be utilized for purposes other than growing food crops.			

27. **Clearances/permissions to be obtained by Contractor.** Following Table 8 shows the list of clearances/permissions required for project construction. This list indicative and the contractor should ascertain the requirements prior to start of the construction and obtain all necessary clearances/permission prior to start of construction.

Table 8: Clearances and Permissions Required for Construction

Sl. no	Construction Activity	Statutory Authority	Statute under which Clearance is Required	Implementation	Supervision
1	Construction of new STP and Rehabilitation of existing STP	TNPCB	Consent to establish (CTE) and consent to operate (CTO) under Water Act, 1974 for new STP and CTO for Rehabilitation of existing STP.	Project Implementation Unit (PIU) and Contractor	PIU CTE for the new STP has been obtained from TNPCB on 13.02.20
2	Construction of network within 300m of Monument	ASI	Permission obtained from ASI on 10.06.20	Project Implementation Unit (PIU) and Contractor	PIU
3	National Highways	NHAI	5 crossings, 21 along Highway. Permission awaited and is being followed.	Project Implementation Unit (PIU) and Contractor	PIU
4	State Highways	State Highways	5 locations. Permission received for 1 location and awaited for 4 locations.	Project Implementation Unit (PIU) and Contractor	PIU
5	PWD 1) Disposal of treated effluent 2) Canal crossing	PWD/ WRD	1) Effluent Disposal Permission obtained on 02.01.20. 2) Permission awaited for canal crossing and is being followed.	Project Implementation Unit (PIU) and Contractor	PIU
6	Tree Cutting	District Collector	Clearances from the authorities as per the Tamil Nadu Timber Transit Rules, 1968 or latest.	PIU	Implementing Agency and Project Management Unit (PMU)
7	Hot mix plants, Crushers and Batching plants	TNPCB	CTE and CTO under Air Act, 1981	Contractor	PIU
8	Discharges from construction activities	TNPCB	CTE and CTO under Water Act, 1974	Contractor	PIU

ADB SPS Requirements. During the design, construction, and operation of the project the Project Management Unit (PMU) and Project Implementation Units (PIUs) will apply pollution prevention and control technologies and practices consistent with international

9	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
10	Sand mining, quarries and borrow areas	Department of Geology and mining, GoTN	Not applicable Contractor to obtain material from the existing government licensed mines/quarries; Contractor will require prior approval of PIU for obtaining material from a particular source. PIU to review and approve only existing licensed mines	Contractor	PIU
11	Permission for Controlled Blasting for excavation	District Collector, Trichy	Explosives Rules, 2008 Permission obtained from the District Collector dt 22.10.2020 (enclosed in appendix-10)	Contractor	PIU
12	Groundwater extraction	Public Works Department	(Groundwater) Tamil Nadu Groundwater Development and Management Act 2000	Contractor	PIU
13	Disposal of bituminous wastes	Tamil Nadu State Pollution Control Board	Hazardous Wastes (Management and Handling) Rules. 1989	Contractor	PIU
14	Temporary traffic diversion measures	-	MoRTH 112 SP 55of IRC codes	Contractor	PIU

good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines ((both General Guidelines and sector specific guidelines of water and sanitation projects to be referred http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines)). These standards contain performance levels and measures that are normally acceptable and applicable to projects. When Government of India regulations differ from these levels and measures, the PMU and PIUs will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the PMU and PIUs will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

Table 9: WHO Ambient Air Quality Guidelines

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

Table 10: World Bank Group's EHS Noise Level Guidelines

Table 1.7.1- Noise Level Guidelines ⁵⁴		
Receptor	One Hour L _{Aeq} (dBA)	
	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational ⁵⁵	55	45
Industrial; commercial	70	70

IV. DESCRIPTION OF THE ENVIRONMENT

A. METHODOLOGY USED FOR BASELINE STUDY

28. **Data collection and stakeholder consultations.** Data for this study has been primarily collected through comprehensive literature survey, discussion with stakeholder agencies, and field visits to the proposed sub project sites.
29. The literature survey broadly covered the following:
- (i) Project details, reports, maps, and other documents prepared by technical consultants, TCC, ADB project preparatory technical assistance (PPTA) Team, etc.
 - (ii) Discussions with Technical experts of the PPTA team, TNUIFSL, implementing agency, DPR preparation agency, and other relevant government agencies.
 - (iii) Secondary data from previous project reports and published articles and
 - (iv) Literature on land use, soil, geology, hydrology, climate, socio-economic profiles, and other planning documents collected from government agencies and web sites.
30. **Ocular inspection.** Several visits to the project sites were made during IEE preparation period in 2017 to assess the existing environment (physical, biological, and socioeconomic) and gather information about the proposed sites and scale of the proposed project. A separate socioeconomic study was conducted to determine the demographic information, existing service levels, stakeholder needs and priorities.

B. PHYSICAL RESOURCES

1. LOCATION, AREA AND CONNECTIVITY

31. Tiruchirappalli is one of the largest cities 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 the Cauvery river. Tiruchirappalli is well connected with major cities in Tamil Nadu by rail and road network. By virtue of its location, Tiruchirappalli City serves as an important link from north to south and east to west across the state. Tiruchirappalli, Srirangam and Golden rock are part of Tiruchirappalli urban agglomeration and 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. Geographically, 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 6 km. City is connected by air with Chennai, Madurai, Thiruvananthapuram, Srilanka, Singapore and Arab countries.
32. 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.

33. Tiruchirappalli City spreading over an area of 146.90km² was upgraded from Special Grade Municipality to Corporation in the year 1994. During the year 2011, the adjacent local bodies in the eastern direction of City, such as Paappakurichi Village Panchayat, Ellakudi Village Panchayat, Aalathur Village Panchayat, KeelkalkandarKottai Village Panchayat and Thiruverumbur Town Panchayat measuring 20.33km² were added with Corporation. Thus, the total area of TCC became 167 km². TCC area is divided into 65 wards with a population of 9.16 lakhs (2011).

2. TOPOGRAPHY, SOILS AND GEOLOGY

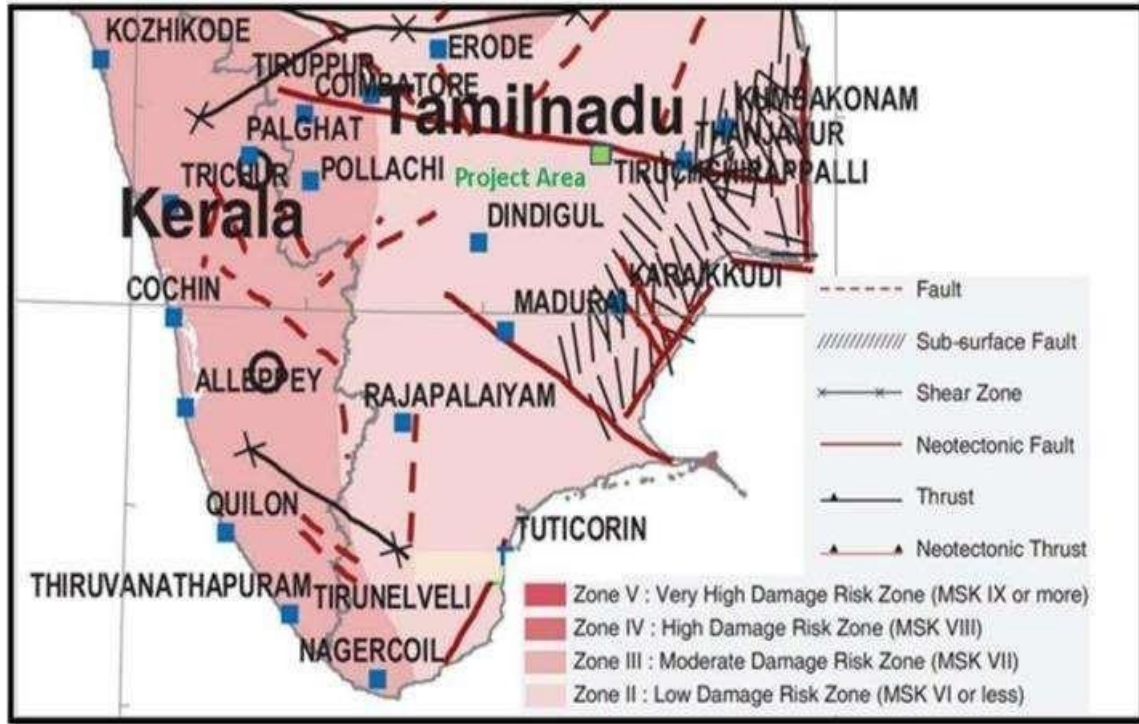
34. Tiruchirappalli lies between 10° 10' and 11° 20' of the northern latitude and 78° 10' and 79° 0' of eastern latitude. The general slope of the city is towards east. Pachamalai Hill is an important peak rising up to 1,015-m, located at Sengattupatti Reserve Forest.
35. Tiruchirappalli falls under 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 channel 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. The gradient of groundwater table, in general, is towards Cauvery river. Cauvery river flows from NW to SE and drains about 81,155 km² of the southern peninsula. The river has been dammed since 2nd century AD at the Grand Anicut. The drainage network of the river is dense, and the river forms a delta at Tiruchirappalli. Prominent geomorphic units identified in Tiruchirappalli are alluvial plains, shallow and deep buried sediments, valley fills and structural hills.
36. 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. There are no known or reported cases of land subsidence in or close to the subproject area. The cretaceous formations consisting of limestone. Calcareous shale, clay, argillaceous sandstones, etc. occur in parts of Tiruchirappalli. The hydrogeology of the city is represented by hard rock aquifers along the northern and north- western part.
37. 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

38. 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. The project area is in Low Damage Risk Zone II and as per the Modified Mercalli (MM) intensity scale, which measures the impact of the earthquakes on the surface of the earth, the project region is in MSK VI or less which indicates low intensity.

Figure 11: Seismic Zone of Project Area



Source: BMTPC.

4. CLIMATIC CONDITIONS

39. The variation of temperature throughout the year exhibits hot and dry climate with high temperatures and low degree of humidity. 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).

40. The normal annual rainfall over the district varies from about 730mm to about 900mm. It is the minimum around Musiri (731.9 mm) in the western part. It gradually increases towards north, east and south and reaches a maximum around Manapparai (908.5mm). The district has a tropical climate. 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%.

Table 11: 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.

SURFACE WATER

41. The entire district forms part of Cauvery river basin. Cauvery is the major, and the only perennial river in the district. The northern branch of Cauvery, known as 'Coleroon' is mainly a flood carried, while the southern branch retains the name Cauvery. The entire district falls in Cauvery basin and drained by Cauvery River and its tributaries like Ayyar, Upper and partly by Maruthaiyar, Ponnaniyar, Koraiyar and partly by Vellar river System. The drainage pattern, in general, is dendritic. The general slope of district is towards the central part where Cauvery and Coleroon rivers flow. There are small residual hills scattered in western and southern part of the district, prominent among the mis Rock Forthill, located in the heart of Tiruchirappalli, Periyakulam, a big lake, and Vathiyar Kulam Lake area located within the project area, and Koraiyar river flows in the west of the project area. Water quality monitoring of Cavery river is conducted regularly by Central Pollution Control Board (CPCB), and sampling points are established throughout its course. In Tiruchirapally City, there are 2 sampling points - one just upstream and one just downstream of the city, and 2 more sampling points are located at about 30 km upstream (at Pettaivaithalai,) and 30km downstream (at Grand Anaicut). Samples are collected regularly from these sampling points. According to the water quality data of 2014, river water quality is classified as B as per the surface water quality classification of central pollution control board2;pH of water ranged between 7.4 and 8.4 and Bio-chemical oxygen demand (BOD) ranged between1.2 and10.8mg/l. Following Table presents the Cauvery River water quality. There are several channels/streams criss-cross the city. These include Uyyakondan, Koraiyar and Thirumanjana Cauvery which finally empty into the Cauvery and Coleroon Rivers. At present, waste water from the unsewered areas of the city enter these channels and ultimately pollute rivers. From the proposed STP, the treated wastewater will be discharged into Uyyakondan Channel that discharges into Vallav and hankottai irrigation Tank/pond. At present water quality data is available, the baseline profile of Uyyakondan channel has been established during the detailed design phase by DBO Contractor.

Designated Best Use Classification of Surface water		
Designated best use	Qual-ity Class	Primary Water Quality Criteria
Drinking water source without conventional treatment but with chlorination	A	<ul style="list-style-type: none"> > Total coliform organisms (MPN*/100 ml) shall be 50 or less > pH between 6.5 and 8.5 > Dissolved Oxygen 6 mg/l or more, and > Biochemical Oxygen Demand 2 mg/l or less
Outdoor bathing (organized)	B	<ul style="list-style-type: none"> > Total coliform organisms(MPN/100 ml) shall be 500 or less > pH between 6.5 and 8.5 > Dissolved Oxygen 5 mg/l or more, and > Biochemical Oxygen Demand 3 mg/l or less
Drinking water source with conventional treatment	C	<ul style="list-style-type: none"> > Total coliform organisms(MPN/100 ml) shall be 5000 or less > pH between 6 and 9 > Dissolved Oxygen 4 mg/l or more, and > Biochemical Oxygen Demand 3 mg/l or less
Propagation of wildlife and fisheries	D	<ul style="list-style-type: none"> > pH between 6.5 and 8.5 > Dissolved Oxygen 4 mg/l or more, and > Free ammonia (as N) 1.2 mg/l or less
Irrigation, industrial cooling, and controlled disposal	E	<ul style="list-style-type: none"> > pH between 6.0 and 8.5 > Electrical conductivity less than 2250 micro mhos/cm, > Sodium Absorption Ratio less than 26, and Boron less than 2 mg/l.

* MPN: Most Probable Number
(Source: CPCB, 1978)

Table 12: 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						<2500MPN/100ml			< 5000MPN/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	350000	54768
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	280000	57494
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	22000000	1939974
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	920000	127304

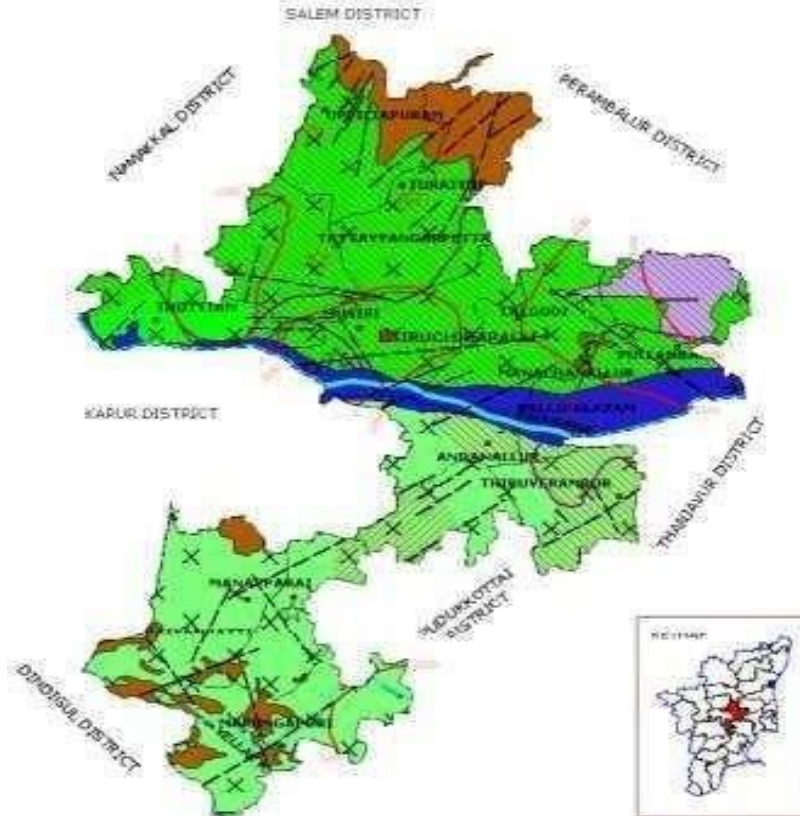
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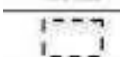



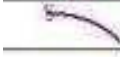






The values that exceed standards are shaded for easy reference

6. GROUNDWATER

42. 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



	Wells Feasible	Rigs Suitable	Depth Of Well (M)	Discharge (LPM)	Suitable Artificial
 Soft Rock Aquifer	Dug Well Tube Well	Manual Direct Rotary	10 - 20 40 - 100	100 - 300	Percolation Pond/Recharge Shaft
 Hard Rock Aquifer	Dug Well Tube Well	Manual Direct Rotary	10 - 20 60 - 150	60 - 380 400 - 1000	Recharge Shaft
 Hard Rock Aquifer	Dug Well Bore Well	Manual DTH	12 - 20 60 - 120	10 - 60	Percolation Pond/Recharge Wells
 Hard Rock	Dug Well Bore Well	Manual DTH	10 - 15 60 - 150	80 To 180	Check Dams/ Percolation Ponds
	District Boundary			Block Boundaries	
	District Headquarter			Block Headquarters	
	Water Level Pre-Monsoon (Decadal Mean 1990-2002) (Mgl)			EC In Microsiemens / Cm At 25°C	
	River			Lineament	
	Fluoride Greater Than Maximum Permissible Limit (1.5mg/L)			Nitrate Greater Than Maximum Permissible Limit (45mg/L)	
	Hilly Area				

Source: CGWB.

43. **Groundwater Quality.** Ground water 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 micro siemens 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 1700 $\mu\text{S}/\text{cm}$. According to Central Pollution Control Board (CGWB), In general the ground water is suitable for drinking and domestic uses in respect of all the constituents except Fluoride of higher concentration at Siruganallur (1.85 mg/L) and few places are having higher concentration of more than BIS permissible limit.
44. **Ambient Air and Noise Quality:** No regular ambient air or noise quality monitoring is conducted by TNPCB in Tiruchirappalli. Following data shows the random monitoring conducted for 24 hours by TNPCB/CPCB to record air quality in 2014. The data shows the oxides of Sulphur and nitrogen in ambient air is well below the ambient air quality standards, however, particulate matter is above the standard. Of the 5 monitoring locations, two locations recorded particulate matter well within the limit, one location slightly above the limits, and at the remaining two locations, particulate matter is much higher than the limit. Dry weather conditions and traffic contribute to the high particulate matter in ambient air. No data on ambient noise levels available.

Table 13: Ambient Air Quality in Tiruchirappalli

	Monitoring Location in the City	Average 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
4	Golden Rock	10	15	48
5	Central bus Stand, Tiruchirappalli	13	19	113
NAAQ standard (24 hrs.)		50	40	60

Source: Air pollution data base in Tamil Nadu ENVIS Center GoTN – 2014.

C. Ecological Resources

45. Tamil Nadu is in the southernmost State of the Indian peninsula is spread over 130,058 km², which constitutes 3.96% of the area of the country. Tamil Nadu has a spectrum of nine major forest types ranging from wet evergreen forest to moist deciduous, dry deciduous, sholas, grass lands and scrub forest. The Western Ghats, the longest hill range in the State is one of the 25 global hotspots of biodiversity and one of the three mega centers of endemism in India.
46. 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.

D. ECONOMIC DEVELOPMENT

1. LAND USE

47. The total geographical area of Tiruchirappalli is 33988 hectares, of which net Land put to non- agriculture occupied 13059 hectares and this accounted for 38.42 percent of the total area in the district. Area under net cultivable area accounted for 28,13 percent of the total land, i.e. 9560 hectares (Table-9).

Table 14: Land Use Pattern in Tiruchirappalli (Area in Ha)

Land Use	2005	
	Area (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

48. The Bharath Heavy Electricals Limited 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 Indl. Estates. The Industrial units are giving gainful and consistent employment to nearly 18,000 people.
49. Other public sector under takings and a Railway Workshop at Ponmalai are part of industrial growth of the District. The district also has a large number of units established in Textiles and apparels followed by engineering and repairing and servicing. 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 15: Small Industries Development Corporation (SIDCO) 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
Vazhavanthankotti – P II	38.00
Kumbakudi	87.50

50. **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.

51. **Education.** About 33 engineering college shave 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

52. **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 upstream of 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. 4,037public 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).
53. Water supply improvement scheme for TCC is currently under implementation at a project cost of ₹2214 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.
54. **Sewerage.** TCC is equipped with a partially implemented UGSS. Sewage from sewered areas within corporation limits is 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 from unsewered areas 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 empty into the Cauvery and Coleroon rivers, except Uyyakondan which terminates at Vallavandhan Kottai Pond/tank. The existing STPs comprises of oxidation ponds (87 MLD). Wastewater from the Panjappur STP is discharged into Koraiyar river in the south Presently the UGSS in TCC covers 42,666 residential and 557 commercial assessments as of 2015.
55. **Solid Waste Management.** Solid waste management in the city is handled by TCC. About 400 tons of solid waste is collected from the city, mostly by door-to-door collection system. From household's 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. TCC 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.
56. **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, Srilanka, Singapore and Arab countries.

E. SOCIO CULTURAL RESOURCES

1. DEMOGRAPHY

57. 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 TamilNadu 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 16: Demographic Characteristics of Tiruchirappalli District (Census)

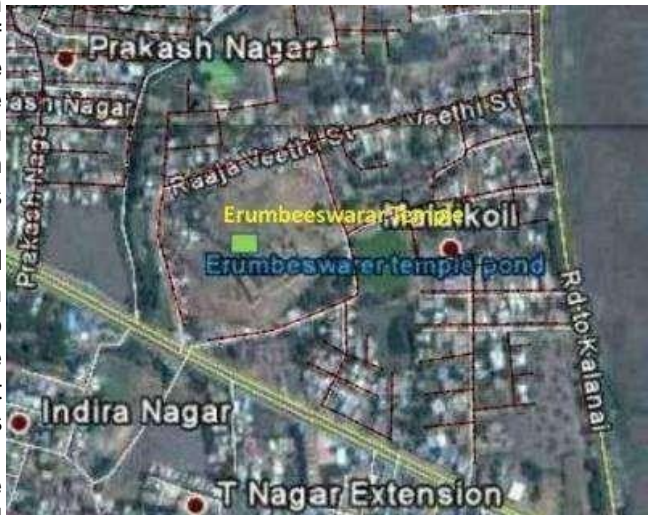
Description	2011	2001
Actual Population	2,722,290	2,418,366
Male	1,352,284	1,208,534
Female	1,370,006	1,209,832
Population Growth	12.57%	10.10%
Area km ²	4,509	4,509
Density/km ²	604	536
Proportion to Tamil Nadu Population	3.77%	3.88%
Sex Ratio (Per 1000)	1013	1001
Child Sex Ratio (0-6 Age)	947	955
Average Literacy	83.23	77.9
Male Literacy	89.72	86.55
Female Literacy	76.87	69.31
Total Child Population (0-6 Age)	272,456	270,043
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

2. HISTORY, CULTURE AND TOURISM

58. 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.
59. 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 Nayak who built the present day Teppakulam and the Fort. The Nayakdynasty came to an end during the days of Meenakshi.
60. 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.

- 61. 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) is located within the project area. No components are located within the temple/monument area, sewer lines proposed in the surrounding residential areas are close to the monument (i.e. within 300m boundary of the monument, which is called regulated boundary of ASI), requiring prior permission to conduct works.
- I. **Erumbeeswarar Temple.** Hindu temple dedicated to the deity Shiva. Built on a 60-foot (18 m) tall hill, it is accessible via a flight of steps. 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. This is located within the project area.
 - II. **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 83m 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. This is located outside the project area.
 2. **Other prominent places of interest around Tiruchirappalli, which are located outside project area are:**
 - III. **Srirangam:** The Sri Ranganatha Swamy 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 2.5km². Enclosed by seven rectangular walled courtyards, this temple has 21 spires ("gopurams"), the largest of which was completed in 1987 and measures 73m 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.
 - IV. **Thiruvanaikaval:** The Jambukeswara Temple, dedicated to Lord Shiva, is situated just 2 km east of Srirangam and houses five concentric walls and seven gopurams. 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
 - V. **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 prime 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.






VI. Natharvali Dargah: It is an ancient Dargah, which is more than 1000 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.




62. **Other Places of Interest.** The other temples in and around the city, but are located outside project area, include Thiruvallarai Vishnu Temple, Uraiyr Nachiyaar Temple, Uraiyr 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 king fisher Subproject Site Environmental Features. Features of the selected subproject sites are presented in the following table.

F. Sub Project Site environmental Features


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

Table 17: Site Environmental Features

Infrastructure	Location and Environmental Features	Site Photograph
Proposed Sewage pumping stations – 1	<p>Sewage pumping stations – 1 at Chidambaram Nagar, Ariyamangalam Proposed site is in ward no 28 near Uyyakondan channel on vacant land owned by TCC</p> <p>Site is located on roadside in between a warehouse and Uyyakondan channel. Development around the site very sparse, houses are located away from the site (> 100 m) t. Site is covered with shrubs and bushes, and couple of trees, which needs to be cut down.</p>	
Proposed Sewage pumping stations – 2	<p>Sewage pumping stations – 2 at Solid waste dumping site, Ariyamangalam</p> <p>This is in village Ariyamangalam within the existing solid waste dumping site. Sufficient vacant land available in the site to accommodate SPS. The land owned by TCC. There are no house close by (>50 m)</p>	
Proposed Sewage pumping stations – 3	<p>Sewage pumping stations – 3 at Win Nagar</p> <p>Site is in the outskirts of the city, there are no houses close by (> 100 m). The SPS is proposed on land owned by TCC.</p> <p>The SPS-3 will be constructed without affected two trees.</p>	

<p>Proposed Sewage pumping stations – 4</p>	<p>Sewage pumping stations – 4 at Rajarajeshwari Nagar</p> <p>The proposed SPS is in the outskirts of the city in Rajarajeshwarinagar near Railway line. The land owned by TCC. Houses are located away from the site (>50 m)</p>	
<p>Proposed Sewage treatment plant and Sewage pumping stations – 6</p>	<p>STP and Sewage pumping stations–6 station and Sewage treatment plant at KeelakalkandarKottai</p> <p>The proposed sewage pumping stations and STP are in the outskirts of the city in KeelakalkandarKottai along with 37 MLD STP. The land is presently owned by the TCC, but it has a crop Threshing platform used by local villagers for Threshing and drying of the crops. New platform has been constructed and is being used by the public.</p> <p>A small village temple situated in western side which will be about 300 meter from the center of the STP campus. At the STP site, a buffer zone of local plants species will be developed and maintained along with STP for protection of aesthetic value of area.</p> <p>Site is located away from the houses (>500 m). Providing a green buffer of 5-10 M wide all around the STP with trees in multi-rows and land scaping. This will act as a visual screen around the facility and will improve the aesthetic appearance.</p>	 
<p>Rehabilitation of Existing Sewage treatment Plant</p>	<p>Rehabilitation of existing 30 MLD plant at Panjappur</p> <p>The existing STP is located at about 7 km from Tiruchirappalli Railway Station lying to the east of the Madurai Road in Panjappur village. The TCC has about 230 ha of land, and STP is in this land. There are no houses nearby the site (>400 m)</p> <p>After treatment from polishing ponds, the treated effluent is discharging into Koraiyar River.</p>	

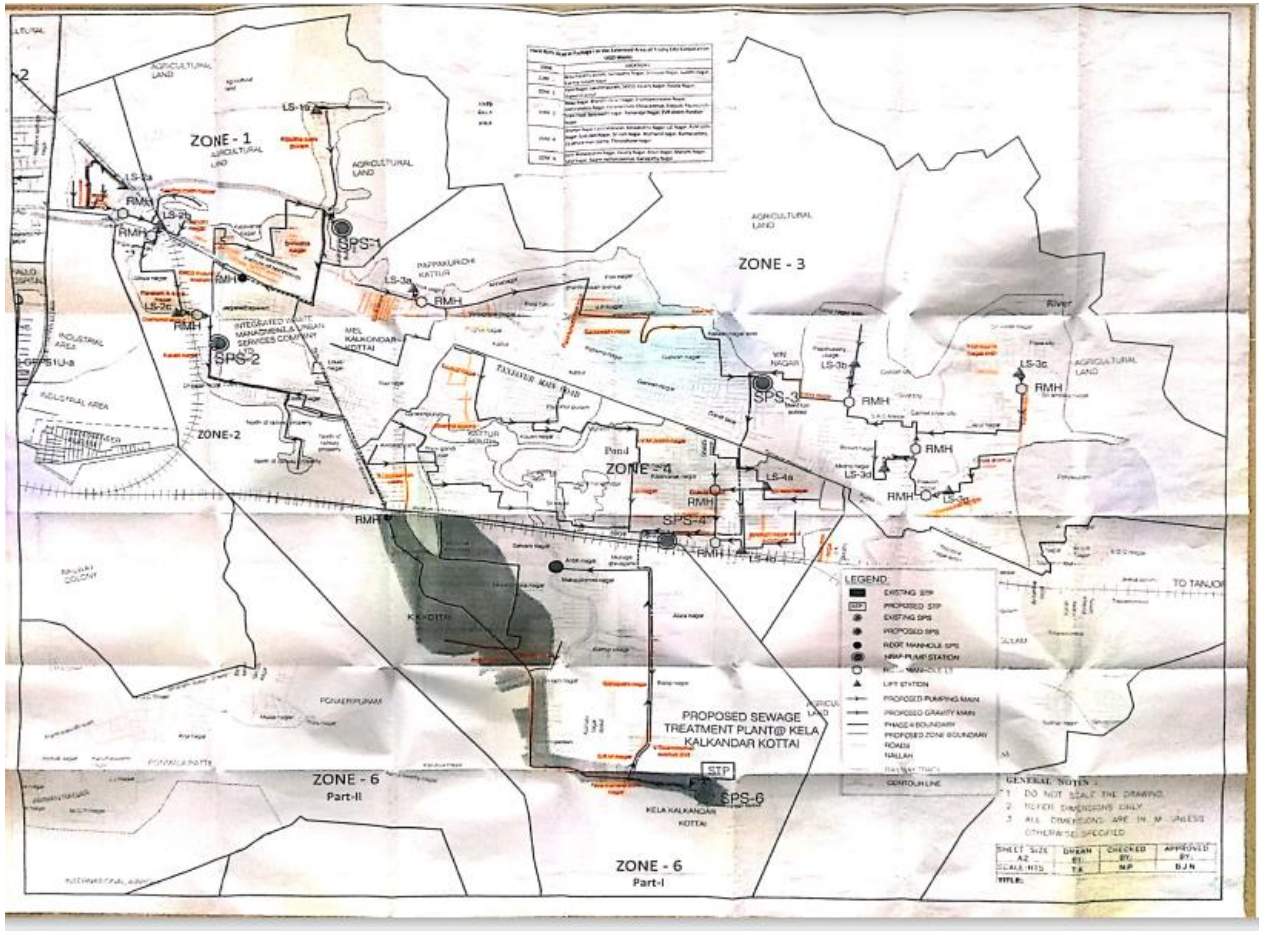
	<p>There are 2 existing STPs at this site:</p> <p>(i) 30 MLD STP constructed in 1987, improved in 2003, and (ii) 50 MLD STP constructed in 2008. Total installed treatment capacity of the existing plants at Panjappur is 80 MLD. Under this subproject, the Old STP of 30 MLD, which is currently not in working condition, is proposed for rehabilitation. This STP will be used to treat additional sewage generated from the areas which are being provided with sewer system under this subproject.</p>	
<p>Sewage lift stations (LS)</p>	<p>Roadside 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 roadside 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 design</p>	 <p>LS 33</p>  <p>LS 44</p>

<p>Sewer network</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 roads located within 300 m of Erumebeeshwarar temple (ASI monument) to provide sewerage system to the areas around the temple</p> <p>Some sections of the sewer line alignment about 65 km and PS sites are identified to involve removal of hard rock for excavation during construction. During construction, alternatives like drilling and chiseling, controlled blasting etc. will be examined and suitable technology shall be finalized depending upon the site conditions, with safety measures.</p>	 <ol style="list-style-type: none"> 1. ZONE-1 - 4.00 Km 2. ZONE-2 - 7.00 Km 3. ZONE-3 - 28.50 Km 4. ZONE-4 - 16.50 Km 5. ZONE-6 - 9.60 Km <p>Total - 65.60 KM</p>
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During excavation for sewer work, wherever removal of rock is identified, alternatives like drilling and chiseling, controlled blasting etc. will be examined and the suitable technology shall be finalized depending upon the site conditions. The following measures for ensuring safety shall be ensured during controlled blasting.

- Carryout controlled blasting in consultation with PIU so that blasting activities with the least potential to generate vibration are conducted during periods of the day which will result in least disturbance, especially near schools and other sensitive receptors.
- Permission has been obtained from The District Collector for controlled blasting for excavation. For the initial stretches proposed for about 30km to 60 km permission is obtained from The District Collector of Trichy.
- Conditions stipulated in the permission issued by the District Collector shall be complied with during implementation.
- The contractor shall submit a blasting plan to PIU; and implement in accordance with the plan.

Fig- 14 Hard Rock area in Package-1



- colored marked Hard Rock Area

TRICHY UGSS PHASE II - PACKAGE 1		
HARD ROCK AREAS LENGTH		
SI NO	ZONE	QUANTITY (LENGTH IN KM)
1	ZONE-1	4.00
2	ZONE-2	7.00
3	ZONE-3	28.50
4	ZONE-4	16.50
5	ZONE-6	9.60
TOTAL		65.60 KM

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

63. 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.
64. 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.
- 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.
 - 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.
 - 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.
 - 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.
65. 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).
66. 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.
67. 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.
68. In the case of this project (i) most of the individual elements involves simple construction and operation, techniques except for blasting activities proposed for sections of sewerage alignment, and pumping stations, so impacts will be mainly localized and not greatly significant; (ii) negative impacts associated with sewage facilities such as odor are already considered in the design and siting, (iii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation and earth movements and (iv) being mostly located in an urban area, will not cause direct impact on biodiversity values. The blasting proposed is “controlled blasting” following necessary precautionary measures including usage of appropriate quantities of explosives hence that the near by structures and properties are unlikely to be affected and impacts related to controlled blasting such as dust generation, increased noise levels and vibrations would be mitigated. The project will be in properties held by the local government and access to the project location is through public rights- of-way and existing roads hence, land acquisition and encroachment on private property will not occur.
- A. Pre-Construction Impacts – Design and Location Design of the Components.**
69. 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.

70. **Sewage treatment.** A new STP and rehabilitation of an existing STP are in the subproject. It is also to utilize the existing 88 MLD capacity waste stabilization pond (WSP) based STP at Panjappur. To installed treatment capacity of the existing plant at Panjappur is 88MLD (58MLD +30MLD) of which 58MLD plant is working and 30MLD plant is defunct. Since additional sewage flow will be generated by proposed sewer network in the currently uncovered areas under the subproject, rehabilitation of 30MLD plant is proposed to handle this additional flow from the sub project area.
71. A new 37 MLD STP is to be constructed at the identified site to treat the sewage generated from the Zone 1,2,3,4 and part of zone-6 under Phase-II. This STP will also meet the demand of zones 5, remaining part of zone-6, where sewer system is proposed under Phase-III. STP will be implemented on DBOT basis, and in 2 modules. It is proposed that the treated wastewater will be discharged into Uyyakondan channel, which is flowing at a distance of 2.7 km northeast of STP site. This channel ultimately discharges into Vallavandhan Kottai Pond (irrigation tank), after flowing for about 20-22 km from the proposed STP discharge point. Water from VallavandhanKottai is used for irrigation in its command area.
72. Uyyakondan is an irrigation channel passing through the Centre of Tiruchirappalli city and also serves as the ultimate carrier of storm water on the southern part of the city. It takes off River Cauvery from the head sluice located at Pettavaithalai, and after flowing over a distance of 70 km it discharges into Vallavandhan Kottai Pond, an irrigation tank. It flows for about 18 km in the city. The initial stretch of 8km passes through the old Trichy town, which is already covered with sewer system. The remaining 10 km stretch passes through the eastern side of Trichy, which does not have a sewer system, and therefore untreated sewage is mostly discharged into this channel. Channel after leaving the Trichy city flows down for about 25 km and discharges ultimately into Vallavandhan Kottai Pond/tank, from where water is used for irrigation.
73. An alternative option of reusing the treated wastewater for industrial purposes is also being explored, and a study has already been initiated to prepare the feasibility report for reuse. If this reuse option is found feasible, the treated wastewater will be further treated to the required quality for industrial reuse. Depending on the demand, wastewater will be reused, and remaining wastewater, if any, will be discharged into Uyyakondan channel.
74. STP is proposed for implementation under design-build Operate & Transfer mode of contract, and therefore the STP has been designed by a successful bidder to meet the treatment standards. The treatment methodology used is Sequential Batch Reactor (SBR) Technology
75. **Nuisance from STP.** The STP Keelakalkandar Kottai is located away from developed areas, and there is no development at present in and around the site, which is mostly comprised of agricultural and vacant lands. Nearest house is at about 500 m, and this area too is sparsely developed. However, considering the future development potential, adequate green buffer around the plant should be developed to minimize/mitigate impacts such as odor, poor aesthetics, etc. Following measures shall be implemented:
 - a. Providing a green buffer of 5 -10 M wide all around the STP with trees in multi-rows and land scaping. This will act as a visual screen around the facility and will improve the aesthetic appearance. The unit shall develop green belt of adequate width around the premises.
76. **Nuisance from STP.** STP at Keelakalkandar Kottai is located away from developed areas, and there is no development at present in and around the site, which is mostly comprised of agricultural and vacant lands. Nearest house is at about 500 m, and this area too is sparsely developed. However, considering the future development potential, adequate green buffer around the plant should be developed to

minimize/mitigate impacts such as bad or, poor aesthetics, etc. Following measures shall be implemented:

- a. Providing a green buffer of 5 -10 M wide all around the STP with trees in multi-rows and land scaping. This will act as a visual screen around the facility and will improve the aesthetic appearance. The unit shall develop green belt of adequate width around the premises.

77. Sewage sludge generally consists of organic matter, pathogens, metals and micro pollutants. The concentration of parameters such as metals can be influenced by input to the sewers system from industry. Since no industrial wastewater is allowed into sewers, it is unlikely that sludge contains heavy metals. The sludge from reactors will be collected in sludge sump and conveyed to centrifuge for dewatering. The sludge in the form of a wet cake will be further air-dried in the sludge drying beds. The treatment and drying processes kill enteric bacteria and pathogens, and because of its high content of nitrates, phosphates, and other plant nutrients the sludge is an excellent organic fertilizer for application to the land. Adequate drying is however necessary to ensure maximum kill of enteric bacteria. To achieve adequate drying minimum drying period shall be ensured. The drying period, which will be varying depending on the season will be determined during operation and be followed. A sludge management plan will be developed by the STP facility designer.

Properly dried sludge can be used as soil conditioner. Periodic testing of dried sludge will be conducted to ensure that it does not contain heavy metals that make it unsuitable for food crops. Tests will be conducted to confirm the concentrations below the following standards. As there are no specific standards notified for sludge reuse, the compost quality standards notified under the Solid Waste Management Rules, 2016 have been adopted here (refer Table 4 for standards to be met).

Following measures to implement during the implementation phase:

- a. Prepare sludge management plant ensures a collection, adequate treatment prior to reuse /disposal
- b. Conduct periodic testing of sludge to check its quality according to set standards for reuse as manure/soil conditioner.
- c. Provide training on safe handling of sludge, along with proper apparatus and personnel protection equipment (PPEs) to worker

78. Existing STP Rehabilitation. The major repair and rehabilitation work proposed in the existing defunct WSP based STP of 30 MLD capacity at Panjappur will improve its functioning and treatment efficiency. Site is located away from residential areas (> 400 m). Sludge drying beds will also be provide to further treat/dry/compost the partially dried sludge collected from the WSP ponds. This is to ensure proper treatment prior to its reuse as manure or disposal. At present, as this is defunct, there is no valid CTO from TNPCB. Hence CTO is to be obtained after completion of works, prior to start of operation of rehabilitated STP. Periodic testing of sludge and provision of training and appropriate apparatus along with PPEs will be provided to workers.

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 rain. 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, TCC 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:

- a. 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.
- b. Limit the sewer depth where possible.
- c. Sewers shall be laid away from water supply lines and drains (at least 1 m), if not possible, sewer lines shall be laid below the waterlines.
- d. 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 300mm);
- e. In unavoidable cases, where sewers are to be laid close to storm water drains, appropriate pipe material (that has no or least infiltration risk) shall be selected (stoneware pipes shall be avoided)
- f. For shallower sewers and especially in narrow roads, uses small inspection chambers in lieu of manholes.
- g. Controlled blasting would be undertaken in some stretches where hard rock is encountered based on the site conditions. For the safety of humans and the structures within the area influenced by the blasting, the vibrations related impacts would be addressed by designing the blast charge by complying with the provisions elaborated in the applicable Indian regulations and standards. All records shall be maintained by the Contractors and PIU. Training related to controlled blasting activity will be included in the overall safeguards training programme meant for PIUs and Contractors.
 - a. Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize silt/garbage entry.
 - b. Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulphide generation.

81. Sewage Pumping stations and lift stations. It is proposed to construct 24 sewage lift stations, 5 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 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. 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 consist 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. Controlled blasting related activities may have to be undertaken at some locations for the presence of hard rock anticipated.

82. 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. Screen well.
- ii. Grit well.

iii. Collection well

- 83.** At the sewage 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. Bypass provisions would be incorporated in the design for addressing unlikely overflow conditions.
- 84. 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 sulphide (H₂S), 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. H₂S is the most dominant odor causing compound and therefore can cause nuisance to nearby households. When sewage becomes stagnant, H₂S is generated in the anaerobic conditions. The quantum of H₂S 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 H₂S 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 condition.

Measures for pumping stations

- a. Maintain buffer distance from nearest residences.
- b. Locate pumping station as far as away from the road.
- c. 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.
- d. 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.
- e. 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.
- f. 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.
- g. 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.
- h. Height of vent to be provided appropriately and a minimum 2m above the lintel level (top level) of window(s)/passageways/doors in the nearby adjoining buildings.
- i. 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.

- j. 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.
- k. 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.
- l. 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.
- m. Develop standard operating procedures / operational manual for operation and maintenance of lifting and pump stations; this shall include measures for emerge situations.
- n. Provide training to the staff in SOPs and emergency procedures;
- o. Periodic monitoring of H₂S levels at sewage pumping and lifting stations using handheld H₂S meters².

85. 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 closet other 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. Many of the sites are located along the river, which is the lowest point, and most of the area are highly dense. 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:

- a. Provide closed wells fitted with necessary ventilation wherever required.
- b. Provide green belt (tree cover) around the lift stations, wherever possible.
- c. 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.

86. Noise from pumping operations. Operation of pumps and motors and diesel generators is a major source of noise. As the pumping and lifting stations are located in the residential areas, with few located very close to the houses, noise generated from lifting/pump stations can have continuous negative impacts on the surrounding population. High inside noise levels can affect the health of operators and staff at the facilities, and therefore, noise levels need to be maintained within and outside the plant as per applicable regulatory standards.

- a. Procure good quality latest technology high pressure pumps that guarantee controlled noise at a level of around 80 dB(A) at a distance of 1m³;

³ Indian Standards require to maintain the noise level of 70 dBA or less during night time. However, in case of STPs/WTPs/Water Supply Head works, where heavy duty pump sets are to be installed and the noise levels may even exceed 80 decibels at 1 m distance, noise level will be measured

- b. Use appropriate building materials and construction techniques for pump houses which can absorb sound rather than reflect noise.
 - c. Use acoustic enclosures – manufacturer specified, for all pumps, motors.
 - d. Procure only CPCB approved generators to meet air emission and noise level requirements.
 - e. Provide sound mufflers for ventilators in the plant rooms, and soundproof doors
 - f. Provide ear plugs designated for noise reduction to workers.
 - g. 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.
 - h. 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; no equipment causing vibration and heavy noise should be used.
- 87. 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.
- 88.** 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:
- a. Using low-noise and energy efficient pumping systems.
 - b. Efficient Pumping system operation.
 - c. Installation of Variable Frequency Drives (VFDs).
- 89. Tree cutting at selected project sites.** As presented in the baseline profile of subproject sites, there are trees present in Keelakalkandarkottai STP site. Eight trees within the area required will be removed and replanted within the site by the contractor in consultation with the TCMC. Hence no tree cutting is required in STP site. Sewers are proposed within the roads, and therefore no tree cutting envisaged. Following measures are being implemented to minimize and/or compensate for the loss of tree cover.
- i. Minimize removal of trees by adopting to site condition and with appropriate; layout design of pumping stations, particularly at Proposed STP Keelakalkandar Kottai site.
 - ii. Obtain prior permission for tree cutting.
 - iii. Plant and maintain 10 trees for each tree that is removed.
- 90. Site selection of construction work camps, stockpile areas, storage areas, and disposal areas.** Priority is to locate these near the project location but at least 100m away from residential areas, groundwater wells and surface water bodies. However, if

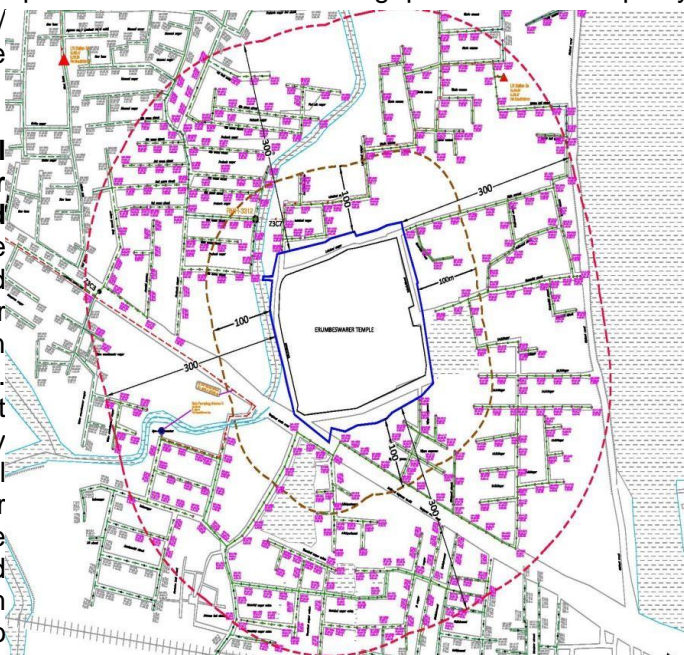
at the time of commissioning the units and necessary mitigation measures such as noise barriers will be installed if required.

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, 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.

- 91. Debris, construction waste, sludge from STP rehabilitation works.** Significant quantities of construction waste, debris etc., will be generated from the repair and rehabilitation works at the existing STP in Panjappur. Dried sludge are scrapped and removed for disposal. Similarly, it is to remove bottom and side clay layer from the STP ponds. Following measures are implemented during the design/preconstruction phase
- Conduct sampling and testing of sludge from all ponds (one composite sample from each pond); parameters to be tested are given in environmental monitoring plan.
 - Devise the disposal method based on sludge characteristics (if it is hazardous, It shall be handled and disposed as per the Hazardous waste rules of MoEFCC);
 - Sludge (if not hazardous) shall be transported to solid waste disposal sites in the city and shall be disposed or used as daily cover for other waste.
 - Clay layer are also be tested if it appears to be contaminated by visual appearance; in any case, a top layer of 6 inch shall be considered as part of the sludge and disposed accordingly.
 - Clay may be used in solid waste disposal site as daily cover on the waste.
 - Devise any suitable reuse method based on the quality of clay.
 - Employ proper methods for removal of sludge and clay with safety of workers, environment utmost priority; provide on-site awareness sessions and training for workers on working conditions and safe handling of sludge and provide PPEs to workers; Any other construction waste / debris shall be properly disposed; priority shall be given to reuse, recycle so that disposal is avoided, provided it is suitable and safe for such usage.

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

- 93. Social and Cultural Resources – Works near Protected Monuments and Chance Finds.** No works are proposed in the protected monument (Erumbeswarar Temple, see fig) located in the subproject area. However, as this monument is located within the city surrounded by residential areas, some works (sewer lines) are also to be conducted in 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/NMA. 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 project, excavation will occur in project sites for foundations, laying pipelines, and for construction of underground structures at pumping/lifting stations. Tiruchirappalli is an historical city, there are few sites protected by or ASI. Given its historical importance, there may be archaeological / historical remains under ground, and risk of uncovering them cannot be ruled out, especially in the old town area. City Corporation will follow chance find protocol to ensure that any chance finds are recognized, and measures are taken to ensure they are protected and conserved Measures for works in regulated buffer zone (300 m) outside monument

Measures for works in regulated buffer zone (300 m) outside monument

- a. Obtain prior permission from ASI/NMA 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
- b. 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.
- c. 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.
- d. No equipment causing vibration (eg, pneumatic drills, excavators etc.) and heavy noise should be used; works shall be conducted manually.
- e. Dust control measures shall be put in place; all work areas to be barricaded and enclosed with dust screens.
- f. Conduct air quality and noise monitoring weekly throughout construction phase in the 300 m regulated area.

MEASURES FOR CHANCE FINDS

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

B. CONSTRUCTION IMPACTS

- 94. Main civil works in the subproject include laying of sewer lines and construction of sewage pumping and lifting stations at the identified sites and the excavation by controlled blasting may be required for sewer lines in some specific areas due to hard rock formation
- 95. Sewage pumping and lifting stations works are confined to sites, and construction include general activities like site clearance, excavation for foundations, and creation of concrete structures is one of the major construction activities for this project, as many of the subproject components are fixed to concrete plinths and mostly housed in buildings with at least some concrete structural elements. Most such structures are 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 form work is bolted around the outside to build a mould into which pre-mixed concrete is poured. Once the concrete has set the form work 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. Since these works are confined to the boundary of identified sites, there is no direct or significant interference of construction work with the surrounding land use. However, construction dust, noise, use of local roads for transportation of construction material, waste, labour camps etc., have negative impacts, which needs to be avoided or mitigated properly

96. Subproject also include linear works (laying of 312 km of tertiary sewers, and 24 km of pumping mains along the roads). This covers entire all uncovered and newly extended 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 are laid mostly on wider main roads. Sewers are laid by open cut method and Pipe Jacking method are used for NH, Rail and Canal Crossing.
97. 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. The 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. The diameter of gravity sewer ranges from 200 mm to 1000mm of which nearly 92% of the sewers are of size between 200 mm and 250mm. The size of pumping main ranges from 150mm to 700mm. 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 are vary from 0.8 m to 1.4 m and the depth varies from a minimum of 1m to 6.5m. 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 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 18

Table 18: Sewer Construction

Proposed Depth of Sewers	Total Length of Sewers to be Laid (in m)	% of Length
Up to 2m	220979	71%
2m – 4m	70093	23%
4m – 6.5m	19550	6%

98. Earth work excavation is undertaken by machine (backhoe excavator) and includes danger lighting and using sight rails and barricades. The work also supplemented manually where there is no proper working area (e.g., very narrow streets) for the back house excavators. As trenches are deep (up to 6.5m), 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 542,565 m³, of which nearly 98% will be reused, and the remaining 10,851 m³ of excess soil needs to be disposed safely to areas approved

by the authorities. The bituminous would be reused to the extent possible and remaining bituminous waste would be disposed as per the regulatory requirements. Some sections of the alignment and the pumping stations hard rock formation are encountered, and controlled blasting may require in such locations for excavation. Necessary statutory permits for undertaking controlled blasting has been obtained from the district collector (Appendix-10) and necessary precautions to prevent safety risk to both public and nearby structures as provisioned in the prevailing Indian regulations and standards would be adhered.

99. Although sewer laying work involves quite simple techniques of civil work, except the stretches where controlled blasting is proposed, 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.
100. 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 have 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.
101. Anticipated impacts during the construction phase are discussed below along with appropriate mitigation measures to avoid, minimize, or mitigate those impacts to acceptable levels.
102. **Sources of Materials.** Significant amount of sand and coarse aggregate will be required for this project, which will be sourced from quarries. Quarries inevitably cause extensive physical changes; as construction materials are excavated from the ground, leaving large cavities, or levelling hillsides, etc. The physical damage caused by quarries is controlled by allowing them to operate within specific limited areas only, so the damage is restricted in extent and not allowed to spread indiscriminately. New quarries are subject to a rigorous process of environmental assessment to ensure appropriate siting and adequate environmental controls on the operation. It will therefore be important to ensure that construction materials for this project are obtained from existing government approved licensed quarries only, to ensure these controls are in place. In Tiruchirappalli, construction sand is normally obtained from Public works department, GoTN's authorized mining areas, and gravel and aggregate is available locally in Tiruchirappalli district (about 10 km from the city). Contractor should not create any new borrow pits / quarries. The contractor should also make a concerted effort to re-use as much excavated material from this project as possible. The construction contractor will be required to:
 - a. Obtain construction materials only from government approved quarries with prior approval of PIU.
 - b. PIU to review and ensure that proposed quarry sources have all necessary clearances/ permissions in place prior to approval.
 - c. Contractor to submit to PIU on a monthly basis documentation on material obtained from each source (quarry/ borrow pit).
 - d. 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.
103. **Air Quality.** Construction work, especially from earthwork activities, including controlled blasting works, 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 542,565 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. Dust generation will be significant during sewer laying along the roads. Increase in dust/ particulate matter in ambient air is detrimental and may have adverse impacts on people and environment. To mitigate the impacts, construction contractors will be required to:

For all construction works

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

FOR SEWER WORKS

- i. Inform the residents likely to be affected by the work in the locality about the upcoming sewer laying works well in advance so that necessary are planned by the residents with reduced inconvenience.
- ii. For sections where the controlled blasting is proposed, the residence shall be provided with the schedule of blasting at least three days in advance and residence are explained about the preventive, precautionary, mitigation and emergency response measures being taken to address their concerns.
- iii. The project staff from the PIU, consultants and contractors would undertake a survey of structures (including videography and/or photography) lying within the area of influence of blasting from the vibrations related impacts (preferably in the presence of the owners of the said structures) during pre- and post-blasting situations to assess and/or ascertain regarding the damages, if any, caused to the structures because of blasting activities.
- iv. Barricade the construction areas using hard barricades (of 2m height) on both sides

- v. Initiate site clearance and excavation work only after barricading of the site is done.
 - vi. Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes etc.), to the barricaded area.
 - vii. Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area.
 - viii. 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;
 - ix. The section proposed for blasting shall be supervised by properly trained staff to ensure no movement of pedestrians, motorized or non-motorized vehicles, and residents takes place during blasting within the area of influence.
 - x. For sections involving controlled blasting, ensure that adequate cover is provided to the trenches to prevent emission of dust during controlled blasting.
 - xi. Ensure that the excavated soil and debris along the section identified for blasting is sprinkled with adequate water prior to blasting to reduce dust emissions upon explosion of charge placed for breaking the hard rock.
 - xii. Ensure that adequate precautions are taken to avoid flying debris post blasting (such as covering the trench with sturdy metallic sheets having sufficient weights to absorb the blast waves);
 - xiii. 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.
 - i. 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.
 - ii. 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.
- 104. Immediate road restoration after refilling the trench.** Excavation and refilling activities disturb the topsoil, 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 topsoil along the roads will generate maximum dust and create very unhealthy conditions. Moreover, as the barricades/dust screens will be removed after the trench is refilled, there will be absolutely nothing to control the dust generation. Dust control activities like wetting of topsoil will not be effective given the site conditions. It is therefore necessary to restore/relay the road surface immediately or take suitable steps to arrest the dust. Soil consolidation technique shall be used so that road can be restored immediately.
- i. Immediately consolidate the backfilled soil and restore the road surface; if immediate road restoration is not possible, provide a layer of plain cement concrete (PCC) of suitable mix on the backfilled trench so that dust generation, erosion is arrested and it will also provide a smooth riding surface for the traffic until the road is properly restored. Backfilled trench without any road restoration is a major source of dust.
- 105. 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 channel 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 the water bodies. Impact will be temporary but needs to be mitigated. Construction contractor will be required to

- a. All earthworks be conducted during the dry season to prevent the problem of soil/silt run-off during rain.
 - b. Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; do not stock earth/material close to water bodies (at least 100m)
 - c. Prioritize re-use of excess spoil sand materials in the construction works. If spoils will be disposed, only designated disposal areas shall be used.
 - d. Install temporary silt traps, oil traps, or sedimentation basins along the drainage leading to the water bodies.
 - e. Place storage areas (with impermeable surface) for fuels and lubricants away from any drainage leading to water bodies; these should be at least 100m away from water bodies and groundwater wells;
 - f. Store fuel, construction chemicals etc., on an impervious floor, also avoid spillage by careful handling; provide spill collection sets for effective spill management.
 - g. Dispose any wastes generated by construction activities in designated sites and
 - h. Conduct surface quality inspection according to the Environmental Management Plan (EMP).
- 106.** Construction of bridges across canals/streams to cross over sewers will have negative impact on water quality of canals/streams. Following measures to be implemented:
- a. Conduct works in the water body (especially foundation work) only during no-flow season.
 - b. Select a construction method which is less disruptive (e.g., precast type);
 - c. Do not spill construction chemicals, fuels, lubricants in the water body.
- Clean up the site immediately after construction is complete; construction debris, materials, etc., shall be cleared and pre-project condition restored or improved
- 107. 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.
 - III. Consider safety aspects related to pit collapse due to accumulation of water.
- 108. 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 542,565 m³, of which nearly 98% will be reused, and the remaining

10,851m³ of excess oil needs to be disposed safely. The following mitigation measures to minimize impacts from waste generation shall be implemented by the contractor:

- a. Prepare and implement a Construction Waste (Spoils) Management Plan (format is given in Appendix3);
 - b. 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.;
 - c. Avoid stockpiling any excess spoils at the site for long time. Excess excavated soils should be disposed of to approved designated areas immediately.
 - d. If disposal is required, the site shall be selected preferably from barren, in fertile lands; sites should locate away from residential areas, forests, water bodies and any other sensitive land uses.
 - e. Domestic solid wastes should be properly segregated in biodegradable and non-biodegradable for collection and disposal to designated solid waste disposal site; create a compost pit (with impermeable bottom and sides) at workers camp sites for disposal of biodegradable waste; non-biodegradable/recyclable material shall be collected separately and sold in the local recycling material market;
 - f. Residual and hazardous wastes such as oils, fuels, and lubricants shall be disposed of via licensed (by TNPCB) third parties.
 - g. Prohibit burning of construction and/or domestic waste.
 - h. Ensure that wastes are not hardly thrown in and around the project site; provide proper collection bins, and create awareness to use the dust bins; recycle waste material where possible
 - i. 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.
- 109.** Significant quantities of construction waste, debris, etc., will be generated from the proposed repair and rehabilitation works at the existing STP in Panjappur. These are discussed in the preconstruction stage impacts, and measures as suggested shall be implemented.
- 110. Noise and Vibration Levels.** Except new pumping all the work sites i.e., pumping stations, lifting stations and sewers are located within the town area. 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, controlled blasting for hard rocks along the alignment 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 and vibrations such as controlled blasting are conducted during periods of the day which will result in least disturbance, especially near schools and other sensitive receptors
 - II. Minimize noise from construction equipment by using vehicle silencers, fitting jack hammers with noise-reducing mufflers, and use portable street barriers to minimize sound impact to surrounding sensitive receptor; and
 - III. Maintain maximum sound levels within the limits as permitted by the prevailing Indian regulations and standards.
 - IV. Ensure to conduct a pre-blasting survey through videography and photography of residential properties and other structures falling along the sewerage alignment to ascertain the prevailing conditions of structures likely to be impacted by the

- controlled blasting and take adequate measures to minimise such impacts.
- V. Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach.
 - 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.
 - VII. All the controlled blasting shall be done by an approved and licensed Explosive contractor after submitting a blasting plan to PIU.
- 111.** 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/NMA 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 near the monuments (within the regulated area of 300 m of any monument) shall be in line with the ASI recommendations
 - III. No equipment causing vibration (eg, 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.
- 112. Accessibility and Traffic Disruptions.** Excavation along the roads for laying of sewers, (especially controlled blasting) 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 center 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.
- 113.** Works related to all there maintaining 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.
- 114.** Hauling of construction material, equipment, construction waste, etc., to and from the work site may increase the road traffic on local roads. This will further inconvenience the local community and road users. Potential impact is negative but short term and reversible by mitigation measures. The construction contractor will be required to:

SEWER WORKS

- a. 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;
- b. Plan the sewer work in coordination with the traffic police; provide temporary diversions, where necessary with clear signage and effectively communicate with general public.
- c. 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 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. 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.
- d. 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;
 - e. 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.
 - f. Provide pedestrian access in all the locations; provide wooden/metal planks with safety rails over the open trenches at each house to maintain the access.
 - g. Inform the affected local population in advance about the work schedule, a week before, and a day before start of work.
 - h. Plan and execute the work in such a way that the period of disturbance/loss of access is minimum.
 - i. Keep the site free from all unnecessary obstructions.
 - j. 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.
 - k. At work site, public information/caution boards shall be provided including contact number for public complaints.
 - l. For sections where the controlled blasting is proposed, the residents are provided with the schedule of blasting at least three days in advance and the residents are explained about the preventative precautionary, mitigation and emergency response measures being taken to address their concerns
 - m. The contractor in coordination with urban local body officials would conduct pre-blasting physical surveys through videography and photography of adjacent residential properties and other structure along the sewerage alignment and take adequate measures to minimize such impacts.

Hauling (material, waste/debris and equipment) activities

- i. Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites.
 - ii. Schedule transport and hauling activities during non-peak hours (peak hours 7 to 10 AM and 4 to 7 PM);
 - iii. Locate entry and exit points in areas where there is low potential for traffic congestion.
 - iv. Drive vehicles in a considerate manner.
 - v. Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.
 - vi. For controlled blasting required quantity of explosives shall be transported to the blasting site only through suitable explosive vehicle. After blasting is over, the balance explosives shall be returned to the licensed storage.
- 115. Socio-Economic – Income.** Sites for all project's components are carefully selected in government owned vacant lands and therefore there is no requirement for land acquisition or any resettlement. Blocking of access to the business / livelihood

activities, especially during pipeline laying along the roads, may impact the income of households. However, given the alignment of pipeline within the road carriage way, and also the measures suggested for ensuring accessibility during sewer works, notable but temporary impact is envisaged. Some shops and other premises along the roads may lose business income if the access will be impeded by excavation of trenches, the presence of heavy vehicles and machinery, etc. Access disruption to hospitals, socio cultural places etc., will inconvenience public. Implementation of the following best construction measures will avoid the disturbance reduce the inconvenience and disturbance to the public. Resettlement and social issues are being studied in a parallel resettlement planning study of this subproject.

- a. Informal businesses and residents about the nature and duration of any work well in advance so that they can make necessary preparations;
- b. 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;
- c. 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;
- d. Control dust generation;
- e. 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
- f. Employee best construction practices, speed up construction work with better equipment, increase work force, etc., in the areas with predominantly commercial and with sensitive features like hospitals, and schools;
- g. Consult businesses and institutions regarding operating hours and factoring this in work schedules; and
- h. Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.

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

117. 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, controlled blasting etc. Potential impacts are negative and long-term but reversible by mitigation measures. The construction contractor will be required to:

- a. Follow all national, state and local labor laws (indicative list is in Appendix2);
- b. Develop and implement site-specific occupational health and safety (OHS) Plan, informed by OHS risk assessment seeking to avoid, minimize and mitigate risk, including controlled blasting activity, 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 Training⁴⁴ for all site personnel, (d) excluding public from the work sites; and (e) documentation of work- related accidents; Follow International

⁴ 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.

Standards such as the World Bank Group's Environment, Health and Safety Guidelines⁵

- c. Ensure that qualified first aid is provided at all times. Equipped first-aid stations shall be easily accessible throughout the sites.
- d. Secure all installations from unauthorized intrusion and accident risks.
- e. Provide Health and Safety orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers.
- f. 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.
- g. Ensure the visibility of workers through their use of high visibility vests and other PPE when working in or walking through heavy equipment operating areas.
- h. Ensure moving equipment is outfitted with audible back-up alarms.
- i. 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
- j. Disallow worker exposure to noise level greater than 85 dBA for duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.
- k. Provide supplies of potable drinking water.
- l. Provide clean eating areas where workers are not exposed to hazardous or noxious substances

118. 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:

- l. Confine work areas: prevent public access to all areas where construction works are on-going through the use of barricading and security personnel.
- m. Attach warning signs, blinkers to the barricading to caution the public about the hazards associated with the works, and presence of deep excavation
- n. 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.
- o. Control dust pollution – implement dust control measures as suggested under air quality section.
- p. Ensure appropriate and safe passage for pedestrians along the worksites.
- q. Provide road signs and flag persons to warn of on-going trenching activities.
- r. Restrict construction vehicle movements to defined access roads and demarcated working areas (unless in the event of an emergency);
- s. Enforce strict speed limit (20-30 kmph) for plying on unpaved roads, construction tracks.
- t. Provide temporary traffic control (e.g. Flagmen) and signs where necessary to improve safety and smooth traffic flow.
- u. 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.

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

- v. At sensitive locations particularly where there are schools and markets close to the road, awareness of safety issues will be raised through neighbour hood awareness meetings.
- w. All drivers and equipment operators will undergo safety training.
- x. Maintain regularly the construction equipment and vehicles; use manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction.

Safety Measures for Controlled blasting during excavation: Presence of sub-surface rock in the alignment has been identified in few locations in Trichy Corporation. During excavation, alternatives like drilling and chiseling, controlled blasting etc. have been examined and suitable technology has been identified depending upon the site conditions. Wherever controlled blasting is proposed, the following measures shall be carried out for execution in a safe manner.

- (i) Carryout Controlled blasting in consultation with PIU so that blasting activities with generating least vibration are conducted during periods of the day which will result in least disturbance, especially near schools and other sensitive receptors
- (ii) The contractor shall submit a blasting plan in advance to PIU: and implement in accordance to the plan
- (iii) Permission shall be obtained from the District Collector for controlled blasting for excavation and the conditions issued shall be complied with during implementation
- (iv) Blasting shall be done through a licensed Explosive Contractor only
- (v) For controlled blasting, explosives including blasting caps, shall be transported to the blasting site only through exclusive vehicle in safe manner in accordance with the requirements of the blasting license. After blasting is over, the balance explosives shall be returned to the licensed storage.
- (vi) Cost for implementation of mitigation measures and liability are the responsibility of Contractor
- (vii) Proper prior notice will be issued to the residents before Commencing UGSS activity works Schedule
- (viii) Prior information will be given to Police Officials
- (ix) Workers(flagman) shall be stationed on both end of roads to warn people before firing any blasts and not to permit the traffic
- (x) When blasting, ample warning shall be given to all persons within the vicinity prior to blasting. Warning signs shall be erected a minimum of 24 hours prior to blasting. Warning signs shall be erected a minimum of 24 hours prior to the blast time. The warning signs will state the time and date of each blast
- (xi) Contractor shall ensure necessary precautions/protection (like excavated earth, sand-filled bags, etc) to reduce dust emissions, noise levels and vibrations. Sites shall be provided with necessary shields all around.
- (xii) Minimum explosive will be used for Control Blasting for residential areas.
- (xiii) After a blast has been fired, careful inspection shall be made to determine that all charges have exploded before employees are returned to the operation
- (xiv) The contractor shall be responsible for any and all damages to property or injury to persons resulting from blasting or accidental or premature explosions that may occur in connection with use of explosives. The

contractor shall do the activities after obtaining the blasting permission from District Collector, Trichy

- (xv) For the diversion of traffic in the blasting area, the contractor shall prepare a traffic management plan and obtained permission from Trichy Corporation and traffic police.

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

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

C. OPERATION AND MAINTENANCE IMPACTS

120. Operation and Maintenance of the sewerage system will be carried out by TCC. Operation will involve collection and conveyance of wastewater from houses to nearest lifting / pumping stations; operation of lifting / pumping stations to pump accumulated sewage main pumping stations; operation of main pumping stations to pump accumulated sewage to STP, treatment of sewage at STP to meet the disposal standards; and final disposal of treated wastewater, and treatment and disposal of sludge. STP is proposed under DBOT modality, and the contract or will prepared entailed designs for STP including the outfall sewer and disposal arrangements. At present, treatment and disposal system is designed in outline only (preliminary design); and during the detailed design phase, the assessment will be updated accordingly.
121. **Treated wastewater disposal from STP.** As per the design, it is to dispose treated wastewater into Uyyakondan channel, flowing at 2.7 km from the STP site. This is a major irrigation channel, taking off from Cauvery River at Kulathalai Kattnali, upstream of Tiruchirappalli, and flows about 40-50 km prior to reaching the city, and then flows through the Centre of Tiruchirappalli city for about 18 km, carrying storm water, and wastewater from the unsewered city areas. It finally discharges into Valavandhankottai pond/tank at Thuvakudi, about 20-22 km from the proposed STP discharge point. Channel water is used for only irrigation. Channel mostly carries wastewater within the city, and therefore existing quality likely to be poor except during upstream flow.
- Baseline water quality of channel has been established by the STP contractor during the detailed design phase. Discharge from STP will be properly treated to meet the disposal standards, and therefore no notable impacts envisaged on channel water quality. This open channel flows for another 20-22 km downstream, allowing further dilution via self-purification prior to reaching the tank/pond.
- Waste water is treated to set standards at the STP prior to its disposal into Uyyakondan channel. Considering the existing status of channel and the degree of treatment and self-purification via 20- 22 km turbulent flow in open channel, no significant impacts envisaged. Proper systems should be put in place at the STP to ensure that treated wastewater at all times meet the stipulated standards prior to its disposal into this channel.
122. As stated above, the existing capacity of channel is adequate to convey the discharge to downstream water bodies. This proposal has been reviewed by DBOT Contractor during detailed design to ensure its techno economic and environmental feasibility by studying the water quality and hydrologic characteristics of the receiving water bodies (Uyyankondan channel) to avoid any inundation risks due to channel discharge from STP and possible water quality degradation etc. The permission of disposal of effluent has obtained from PWD and final discharge point has been firmed up.
123. **Sewage sludge.** No estimate sewage sludge generation from the STP is available. Since start of its operation, sludge has not been removed from the ponds. Sewage sludge contains harmful substances such as bacteria and pathogens, and nutrients like nitrogen, phosphates. Improper handling and disposal of the sludge will have adverse impacts on health and environment. A sludge management plan will be prepared; this will be simple activity for the WSP based STP. The ponds will be allowed to dry naturally, and the sludge will be collected from the basins by mechanical means. Sludge will be further air dried/composted in sludge drying beds for adequate time. The treatment and drying processes kill enteric bacteria and pathogens, and because of its high content of nitrates, phosphates and other plant nutrients. The sludge is an excellent organic fertilizer for application to the land. The reuse of sludge should be preceded by rigorous bacteriological tests to confirm that the treatment methods render all dried sludge and effluent free from enteric bacteria and pathogens, so that it is safe to humans, animals and crops. Sludge shall also need to be periodically tested for presence of heavy metals, to

check if it meets the compost standards specified the Solid Waste Management Rules, 2016.

- 124. Quality of Raw Sewage.** As discussed previously, one of the critical aspects in STP operation is, change in raw sewage characteristics at inlet of STP may affect the process and output quality. The system is designed for municipal waste water, 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:
- No wastewater from industrial premises (including domestic waste water) shall be allowed to dispose into municipal sewers;
 - Monitor regularly and ensure that there is no illegal discharge through manholes or inspection chambers; conduct public awareness programs; in coordination with TNPCB.
- 125. 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:
- Strictly follows and hard operating procedures/operational manual for operation and maintenance of lifting and pump stations.
 - Ensure that operating staff is properly trained and have clear understanding of odor issues vis a vis its relation with operational practices.
 - Ensure that pumping cycles are properly followed; and there is no buildup of sewage beyond design volume in the wells.
 - Conduct periodic H₂S monitoring at pumping and lifting stations using hand held H₂S meters.⁶
- 126. Sewer network.** During the system design life (15/30 years for mechanical/civil components) it shall not require major repair so 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.
- 127.** There are also certain environmental risks from the operation of the sewer system,

⁶ There are no any standards notified by Government of India or Government of Tamil Nadu. However, Central Pollution Control Board (CPCB) has stipulated Guidelines on Odor Pollution and its Control. These guidelines deal only with the basics of odor pollution, its sources and measurement, technologies for its control etc. but do not specify any threshold limits for odor-causing pollutants. Therefore, as part of mitigation, provision for odor control measures has been made in the sewage pumping stations for all UGSS subprojects. However, in case of STPs, the odor-causing processing units will be located far off to the extent possible within the premises so as to mitigate the odor nuisance. Further, the technology for treating sewage plays a vital role since release of gases like H₂S cannot be avoided in the process involving anaerobic decomposition whereas release of H₂S will almost be nil in case of aerobic treatment. PIU and design engineers have not specified any odor standards adopted elsewhere in the preliminary design as not to limit the technology that can be considered by the bidders in the treatment of domestic sewage. Sufficient mitigation measures have been taken for all sewage pumping stations and will be taken for all STPs when finalizing/revising the IEEs based on the detailed engineering design.

most notably from leaking sewer pipes as untreated faecal material can damage human health and contaminate both soil and groundwater.

There is an occupation health risk to workers engaged in sewer maintenance activities. Following measures should be followed:

(i) Establish regular maintenance program, including:

- a. Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas
 - b. Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration; and
 - c. Monitoring of sewer flow to identify potential inflows and outflows
 - d. Conduct repairs on priority based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages);
- (ii) Maintain records; review previous sewer maintenance records to help identify “hot spots” or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed;
- (iii) When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.
- (iv) Prohibit/prevent disposal of wastewater/effluent from industrial units in the sewers; ensure regular checking to ensure no illegal entry of industrial wastewater into sewers.
- (v) Develop an Emergency Response System for the sewerage system leaks, burst and over flows, etc.
- (vi) Provide necessary health and safety training to the staff in sewer cleaning and maintenance.
- (vii) Provide all necessary personnel protection equipment.
- (viii) Do not conduct manual cleaning of sewers; for personnel engaged sewer maintenance work, there is a risk due to oxygen deficiency and harmful gaseous emissions (hydrogen sulphide, methane, etc.); provide for adequate equipment (including oxygen masks) for emergency use.

VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. OVERVIEW

- 128.** 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.
- 129.** 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

- 130.** 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

- 131.** The subproject proposal is formulated by Tiruchirappalli corporation in consultation with the public representatives' bodies in the project area to suit their requirements.
- 132.** 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 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. The formal consultations were held on November 3, 2017 (details are provided in Appendix9)..
- 133.** Prior to start of construction, PIU had conducted information dissemination sessions at various places and solicit the help of the local community, leaders/prominent for the project work. Focus group meetings conducted to discuss and plan construction work (mainly pipe line work) with local communities to reduce disturbance and other impact and also regarding the project grievance redress mechanism .Project information and construction schedule are provided to the public via mass media (newspapers, television, ULB websites etc.). A constant communication also established with the affected communities to redress the environmental issues likely to surface during construction phase. Contractors are providing prior public information (in Tamil and English) about the construction work in the area, 7 days prior to the start of work and again a day before the start of work via pamphlets (a sample

public information template is provided in Appendix 4).At the work sites, public information boards also provided to disseminate project related information. Further consultation and awareness program conducted on 24th October 2019 at keelakalkandar kottai in regard to construction of new STP site and also LS site. Enclosed in appendix-9

2. Consultation during construction

Prior to start of construction, PIU had conducted information dissemination sessions at various places and solicit the help of the local community, leaders/prominent for the project work. Focus group meetings conducted to discuss and plan construction work (mainly pipe line work) with local communities to reduce disturbance and other impact and also regarding the project grievance redress mechanism .Project information and construction schedule are provided to the public via mass media (newspapers, television, ULB websites etc.,). A constant communication also established with the affected communities to redress the environmental issues likely to surface during construction phase. Contractors are providing prior public information (in Tamil and English) about the construction work in the area, 7 days prior to the start of work and again a day before the start of work via pamphlets (a sample public information template is provided in Appendix 4).At the work sites, public information boards also provided to disseminate project related information. Further consultation and awareness program conducted on 24th October 2019 at keelakalkandarkottai in regard to construction of new STP. During construction stage of the project, dissemination programs was conducted at various locations like i.e Win Nagar and Rajrajeswari Nagar of the Trichy City Corporation created awareness among the public about the proposed controlled blasting activity for hard rock removal during excavation. The dissemination for the controlled blasting, regulatory requirements & compliance to conditions, safety measures will be followed, etc.

C. INFORMATION DISCLOSURE

- 136.** Executive summary of the IEE has been translated in Tamil and made available at the offices of PMU, PIU, and TCC 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 TCC after approval of the IEE by ADB. Stakeholders will also be made aware of grievance register and redress mechanism.
- 137.** 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
- 138.** 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.

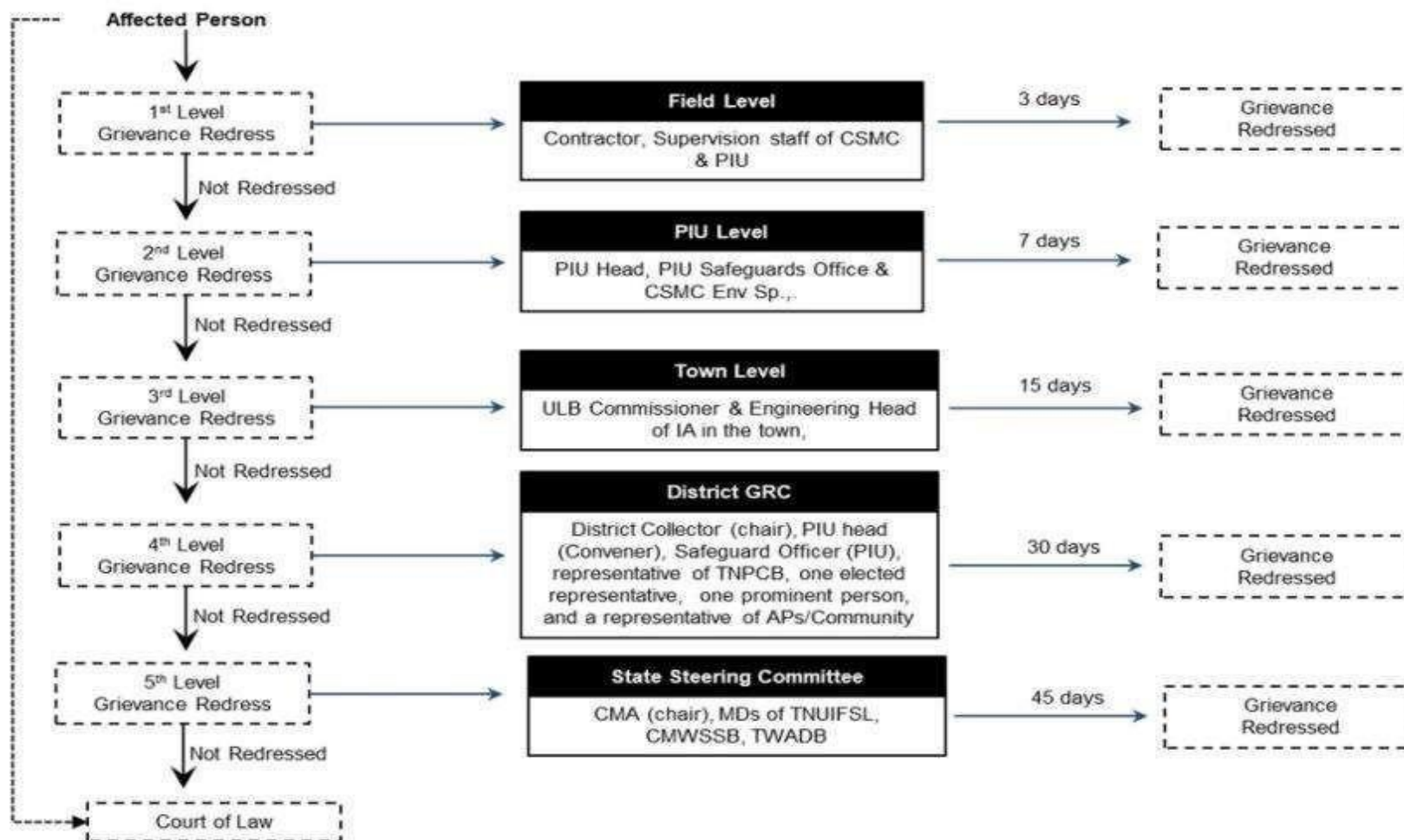
VII.GRIEVANCE REDRESS MECHANISM

139. A common GRM is in place to redress social, environmental or any other project related grievances. The GRM described below has been developed in consultation with stakeholders. Public awareness campaign will be conducted to ensure that awareness on the project and its grievance redress procedures is generated. The campaign will ensure that the poor, vulnerable and others are made aware of grievance redress procedures and entitlements per project entitlement matrix, and Project Management Unit (PMU) and Trichy Project Implementation Unit (PIU) will ensure that their grievances are addressed.
140. 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 complaint register in ULB or PIU or TCMC 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.
141. GRM provides an accessible inclusive, gender-sensitive and culturally appropriate platform for receiving and facilitating resolution of affected person grievances related to the project. A two- tier grievance redress mechanism is conceived, one, at project level and another, beyond project level. For the project level GRM, a Grievance Redress Committee (GRC) will be established in PIUs; Safeguards officer, supported by the social, gender and environmental safeguards specialist of 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.
142. 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. -through for each grievance, periodic information dissemination to complainants on the status of their grievance and recording their feedback (satisfaction/dissatisfaction and suggestions).
143. 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 TCMC level. In the event that certain grievances cannot be resolved even at TCMC 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.
144. 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- failing which the grievance will be addressed by the state-level Steering Committee. The Steering Committee will resolve escalated/unresolved grievances received.
145. **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.

146. **State level steering committee** will include Commissioner of Municipal Administration as chair, member include managing directors of TNUIFSL, CMWSSB, TWAD Board and others as necessary.
147. **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).
148. The multi-tier GRM for the project is outlined in Figure 14, 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 15: Proposed TNUFIP Grievance Redress Mechanism



149. **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 the sewer effected and final outcome will be kept by PIU(with the support of CMSC)and submitted to PMU.
150. **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 Appendix5.
151. **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.
152. **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.
153. **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.
154. **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 (inwriting) 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

155. An environmental management plan (EMP) has been developed to provide mitigation measures to reduce all negative impacts to acceptable levels.
156. The EMP will guide the environmentally-sound construction of the subproject and ensure efficient lines of communication between TNUIFSL, PMU, TCMC, PIU, consultants and contractors. The EMP will (i) ensure that the activities are undertaken in a responsible non-detrimental manner.
157. (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
158. The contractor will be required to submit to PIU, for review and approval, a site environmental management plan (SEMP) including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; and (iii) monitoring program as per SEMP. No works are allowed to commence prior to approval of SEMP.
159. A copy of the EMP/approved SEMP are always kept on site during the construction period. The EMP included in the bid and contract documents. Non-compliance with or any deviation from, the conditions set out in this document constitutes a failure in compliance.
160. For civil works, the contractor required to (i) carry out all of the mitigation and monitoring measures set forth in the approved EMP; 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, EMP and SEMP. The contractor shall allocate budget for compliance with these IEE, EMP and SEMP measures, requirements and actions.
161. The following tables show the potential environmental impacts, proposed mitigation measures and responsible agencies for implementation and monitoring

Table 19: Design Stage Environmental Impacts and Mitigation Measures (included in DPR)

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
Design of STP	Deficient treatment due to substandard operation / system malfunction	<ul style="list-style-type: none"> (i) Design process to meet the Central Pollution Control Board (CPCB) disposal standards of inland water disposal (ii) Ensuring continuous uninterrupted power supply, including a back-up facility (such as generator). (iii) Providing operating manual with all standard operating procedures (SOPs) for operation and maintenance of the facility (iv) Necessary training to ULB staff dealing with STP. (v) Extended contractor period for O&M, proper transfer of facility to ULB with adequate technical know-how on O&M and hands-on training to ULB staff (vi) Provision for online monitoring of crucial wastewater quality parameters at the inlet and out let of the plant 	DBOT and PIU Contractor	Project cost Contractor - DB
	Degradation of receiving water body quality and inundation risk	<ul style="list-style-type: none"> (i) Conduct baseline water quality assessment of Uyyakondan channel, Valavandhankottai pond/tank and River Cauvery at discharge points; assess impacts on water quality due to STP discharge, and ensure that water quality is not degraded from the existing condition (ii) Assess hydrological parameters of receiving water bodies (Uyyakondan channel and Valavandhankottai pond/tank) for safe discharge of STP water, implement appropriate measures as required based on the assessment to eliminate risk of inundation (iii) Obtain TNPCB and Public Works Department (PWD) consent to dispose treated wastewater into Uyyakondan channel 	DBOT and PIU Contractor	Project cost Contractor - DB
	Odor nuisance	<ul style="list-style-type: none"> (i) Providing a green buffer of 15-20 m wide all around the STP with trees in multi-rows and land scaping. This will act as a visual screen around the facility and will improve the aesthetic appearance. 	DBOT and PIU Contractor	Project cost Contractor - DB

	Sludge disposal	(i) Prepare sludge management plan to ensure safe collection, adequate treatment prior to reuse / disposal (ii) Conduct periodic testing of sludge to check its quality according to set standards for reuse as manure/soil conditioner	DBOT and PIU	Contractor	Project cost Contractor - DB
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Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(iii) Provide training on safe handling of sludge, along with proper apparatus and personnel protection equipment (PPEs) to workers		
	Tree cutting	(i) Minimize removal of trees by adopting to site condition and with appropriate layout design/alignment, particularly at Proposed STP site (ii) Obtain prior permission for tree cutting (iii) Plant and maintain 10 trees for each tree that is removed	PIU/TCC	Project Costs
Sewer network	Nuisance due to leaks, overflows, contamination of water supplies, occupation health and safety of workers, etc.	(i) Limit the sewer depth where possible (ii) Sewers shall be laid away from water supply in sand drains (at least 1 m). If not possible, sewer lines shall be laid below the waterlines (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 300mm) (iv) In unavoidable cases, where sewers are to be laid close to storm water drains, appropriate pipe material (that has no or least infiltration risk) shall be selected (stoneware pipes shall be avoided) (v) For shallower sewers and especially in narrow roads, use small inspection chambers in lieu of manholes. (vi) Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize silt/garbage entry (vii) Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulfide generation. (viii) Ensure to conduct a pre-controlled blasting survey through videography and photography of residential properties and other structures falling along the	PIU/TCC	Project Costs

		sewerage alignment to ascertain the prevailing conditions of the structures likely to be impacted by the controlled blasting and take adequate measures to minimize such impacts.		
Construction works in the regulated buffer zone of ASI monument (Erumbeswarar Temple)	Disturbance / damage to monument	<ul style="list-style-type: none"> (i) Obtain prior permission from ASI/NMA 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 	PIU/TCC	Project Costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		<p>working at sensitive times, such as religious and cultural festivals.</p> <p>(iii) 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>(iv) No equipment causing vibration (eg, pneumatic drills, excavators etc.,) and heavy noise should be used; works shall be conducted manually</p> <p>(v) Dust control measures shall be put in place; all work areas to be barricaded and enclosed with dust screens</p> <p>(vi) Conduct air quality and noise monitoring weekly throughout construction phase in the 300 m regulated area</p>		
Sewage pumping stations	Odor nuisance	<p>Measures specific (additional) to New Pumping Station near household area</p> <p>(i) Maintain maximum buffer distance from the nearest residences to the pumping station wells;</p> <p>(ii) Locate pumping station as far as away from the road</p> <p>(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.</p> <p>Design measures for all pumping stations</p> <p>(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.</p> <p>(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.</p> <p>(iii) Since human intervention is involved and safety shall be primary and critical consideration, additional protection by way of a metallated 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.</p> <p>(iv) Provision of passive gas ventilation arrangement by providing a take-of vent from top of well by</p>	PIU/TCC	Project Costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		<p>positioning vent in such a way that cover slab fitment / movement / drawl if required for maintenance purposes is not compromised.</p> <p>(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.</p> <p>(vi) Provision of odor control / mitigation system as per site conditions /requirements</p> <ul style="list-style-type: none"> • 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>(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>		

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(xi) Provide training to the staff in SOPs and emergency procedures Conduct periodic H ₂ S monitoring		
Sewage lifting stations	Odor nuisance	(i) Provide closed wells fitted with necessary ventilation and odor abatement systems such as GAC air filters fitted to the ventilation shaft out let(s). (ii) Provide greenbelt (tree cover) around the lift stations, wherever possible	PIU/TCC	Project costs
Sewage pumping and lifting stations	Noise	(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 1m (ii) Use appropriate building materials and construction techniques for pump houses which can absorb sound rather than reflect noise (iii) Use acoustic enclosures – manufacturer specified, for all pumps, motors (iv) Procure only CPCB approved generators to meet air emission and noise level requirements (v) Provide sound mufflers for ventilators in the plant rooms; and sound proof doors (vi) Provide ear plugs designated for noise reduction to workers (vii) Consult the Archaeological survey of India (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. (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 consultation with ASI; no equipment causing vibration and heavy noise should be used (ix) Obtain prior permission from ASI/NMA for components located within the regulated zone of monument; incorporate any suggestions/recommendations of ASI in project design and implementation (x) Ensure to conduct a pre blasting survey through videography and photography of residential properties and other structures falling along the sewerage alignment to ascertain the d prevailing conditions of the structures likely to be impacted by the controlled blasting and take adequate measures to minimize such impacts	PIU/TCC	Project costs

Sewage pumping and lifting stations	Energy consumption	(i) Using low-noise and energy efficient pumping systems (ii) Efficient Pumping system operation (iii) Installation of Variable Frequency Drives (VFDs)	PIU/TCC	Project Costs
Controlled blasting	Ground vibrations Noise (airblast) Flying debris Dust	<p>For the safety of humans and the structures within the area influenced by the blasting, the vibrations related impacts would be addressed by designing the blast charge by complying with the provisions elaborated in the applicable Indian regulations and standards.</p> <p>All records shall be maintained by the Contractors and PIU. Training related to controlled blasting activity will be included in the overall safeguards training programme meant for PIUs and Contractors.</p> <p>An emergency response system shall be developed at the site level to address the situations emerging due to accidents or any other unfortunate incidents pertaining to human and structure safety. Training related to controlled blasting activity will be included in the overall safeguards training programme meant for PIUs and Contractors.</p> <p>The project staff from the PIU, consultants and contractors would undertake a pre-blasting survey of structures (including videography and/or photography) lying within the area of influence of blasting from the vibrations related impacts (preferably in the presence of the owners of the said structures) to assess and/or ascertain regarding the prevailing conditions of the structures prior to blasting activities. Based on the assessment, the Project staff would consider necessary measures to avoid, minimize or mitigate such impacts.</p>	Contractor and PIU	Contractor Costs

Table 20: 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 / SEP EMP implementation and reporting	Unsatisfactory compliance to EMP	<ul style="list-style-type: none"> (i) Appoint EHS Supervisor to ensure EMP implementation (ii) Submission of updated EMP/SEP (iii) Timely submission monthly of monitoring reports including documentary evidence on EMP implementation such as photographs 	Contractor	Contractor cost
Generation of sludge, clay, construction waste/debris from repair work of existing STP	Health and environmental impacts due to improper handling and disposal	<ul style="list-style-type: none"> (i) Conduct sampling and testing of sludge from all ponds (one composite sample from each pond); parameters to be tested are given in environmental monitoring plan (ii) Devise the disposal method based on sludge characteristics (if it is hazardous, it shall be handled and disposed as per the Hazardous waste rules of MoEFCC) (iii) Sludge (if not hazardous) shall be transported to solid waste disposal sites in the city, and shall be disposed or used as daily cover for other waste (iv) Clay layer shall also be tested if it appears to be contaminated by visual appearance; in any case, a top layer of 6 inch shall be considered as part of the sludge and disposed accordingly (v) Clay may be used in solid waste disposal site as daily cover on the waste (vi) Devise any suitable reuse method based on the quality of clay (vii) Employ proper methods for removal of sludge and clay with safety of workers, environment utmost priority; provide on-site awareness sessions and training for workers on working conditions and safe handling of sludge and provide PPEs to workers (viii) Any other construction waste / debris shall be properly disposed; priority shall be given to reuse, recycle so that disposal is avoided, provided it is suitable and safe for such usage 	PIU/DBOT Contractor	Contractor cost
Utilities	Telephone lines, electric poles and wires, water lines within proposed project area	<ul style="list-style-type: none"> (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 contractor to prepare a contingency plan to include actions to be taken in case of unintentional interruption of services. 	Contractor in Coordination with PIU	Contractor cost
Construction work camps, stockpile areas, storage areas, and disposal areas.	Conflicts with local community; disruption to traffic flow and sensitive receptors	<ul style="list-style-type: none"> (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 	Contractor to finalize locations in consultation and approval of PIU	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Cost and Source of Funds
		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.		
Sources of Materials	Extraction of materials can disrupt natural and contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution.	(i) Obtain construction materials only from the existing government approved quarries with prior approval of PIU (ii) PIU to review, and ensure that proposed quarry sources have all necessary clearances/permissions in place prior to approval (iii) Contractor to submit to PIU on a monthly basis documentation on material obtained from each source (quarry/ borrow pit) (iv) None borrow are as, quarries etc., shall be developed for the project	Contractor to prepare list of approved quarry sites and sources of materials with the approval of PIU	Contractor cost
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 and PIU	Cost of obtaining all consents, permits, clearance, NOCs, etc. prior to start of civil works 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 dissuspected, and taking any action they require to ensure its removal or protection in situ.	Contractor and PIU	Contractor cost

Temporary economic impacts	Disruption to vendors, hawkers on ROW during sewer laying works.	<ul style="list-style-type: none"> (v) Construction contractors to follow these measures in conducting any excavation work (vi) Create awareness among the workers, supervisors and engineers about the chance finds during excavation work (vii) Stop work immediately to allow further investigation if any finds are suspected; (viii) Inform State Archaeological Department if a dissuspected and taking (i) any action they require to ensure its removal or protection in situ. 	CC and PIU	Contractor / PIU
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Table 21: Construction Stage Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
EMP Implementation Training	Irreversible impact to the environment, workers, and community	(i) Project manager and all key workers will be required to undergo training on EMP implementation including spoils/waste management, Standard operating procedures (SOP) for construction works; occupational health and safety (OHandS), core labor laws, applicable environmental laws, etc.	Contractor	Contractor cost
Air Quality	Dust, emissions from construction vehicles, equipment, and machinery used for installation of pipelines resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons.	<p>For all construction works</p> <ul style="list-style-type: none"> (i) Provide a dust screen (6 m high) around the construction sites of pumping and lifting stations, and STP; provide 2 m high barricades for the sewer works (ii) Damp down the soil and any stockpiled material on site by water sprinkling; (3-4 times a day - before the start of work, 1-2 times in between, and at the end of the day); when working in the roads there should permanently be one person responsible for directing when water sprinkling needs to take place to stop the dust moving; (iii) Reduce the need to sprinkle water by stabilizing surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition (iv) Apply water prior to leveling or any other earth moving activity to keep the soil moist throughout the process (v) Cover the soil stocked at the sites with tarpaulins and surround by dust screens. (vi) Control access to work area, prevent unnecessary movement of vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation (vii) Use tarpaulins to cover the loose material (soil, sand, aggregate etc.,) when transported by open trucks. (viii) Control dust generation while unloading the loose material (particularly aggregate, sand, soil) at the site by sprinkling water and unloading inside the barricaded area; minimize the drop height when moving the excavated soil. 	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<p>(ix) Clean wheels and undercarriage of haul trucks prior to leaving construction site</p> <p>(x) Ensure that all the construction equipment, machinery are fitted with pollution control devices, which are operating correctly, and have a valid pollution under control (PUC) certificate</p> <p>(xi) no vehicles or plant to be left idling at site generators to be at placed maximum distance from properties</p> <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) Ensure that adequate cover is provided to the trenches to prevent emission of debris during controlled blasting.</p> <p>(v) Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area</p> <p>(vi) Undertake the work section wise: a 500 m 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>(vii) 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. 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 under taken 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 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.</p> <p>(x) For sections involving controlled blasting, ensure that dust curtains of adequate height are provided to the trenches to prevent emission of dust during drilling for charge holes and controlled blasting. Ensure that the excavated soil and debris along the section identified for blasting is sprinkled with adequate water prior to blasting to reduce dust emissions upon explosion of charge placed for breaking the hard rock;</p>		
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Surface water quality	<p>Mobilization of settled Silt materials, 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 stock piling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; do not stock earth/material close to water bodies (at least 100m)</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, oil traps or sedimentation basins along the drainage leading to the water bodies;</p> <p>(v) Place storage areas (with impermeable surface) for fuels and lubricants away from any drainage leading to water bodies; these should be at least 100 m away from water bodies and ground water wells)</p> <p>(vi) Store fuel, construction chemicals etc., on an impervious floor, also avoid spillage by careful handling; provide spill collection sets for effective spill management</p> <p>(vii) Dispose any wastes generated by construction activities in designated sites;</p> <p>(viii) Conduct surface quality inspection according to the Environmental Management Plan(EMP).</p>	Contractor	Contractor cost
Pipe bridge construction across	Degradation of water quality / silting of water	<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 accidental spill construction chemicals, fuels, lubricants in the water body, by using spill traps /</p>	Contractor	Contractor cost

streams and canals bridge construction across streams and canals	body	metal basins (iv) Clean up the site immediately after construction is complete; construction debris, materials, etc., shall be cleared and pre-project condition restored or improved		
	Water accumulation in trenches/pits	(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 Consider safety aspects related to pit collapse due to accumulation of water	Contractor	Contractor cost
Noise and vibration level and vibration Levels and vibration Levels	Increase in noise level due to earth-moving and excavation equipment, and the transportation of	(i) Plan activities in consultation with PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; especially near schools and other sensitive receptors	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
	equipment, materials, and people	<ul style="list-style-type: none"> (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 (iii) Maintain maximum sound levels not exceeding 70 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s. (iv) Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity; if any building at risk, structural survey be completed prior to work, to provide baseline in case any issues from vibration, and if building is structurally unsound that measures taken to avoid any further damage (V) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach. (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>Works near the ASI monument</p> <ul style="list-style-type: none"> (i) Obtain prior permission from ASI/NMA 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 near the monuments (within the regulated area of 300 m of any monument) shall be in line with the ASI recommendations (iii) No equipment causing vibration (eg, 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 		
Landscape and aesthetics – Waste Generation	Impacts due to excess excavated earth, excess construction	<ul style="list-style-type: none"> (i) Prepare and implement a Construction Waste Management Plan (refer Appendix3) (ii) As far as possible utilize the debris and excess soil in construction purpose, for example for raising the ground level or construction of access roads etc., (iii) Avoid stockpiling any excess spoils at the site for long time. Excess excavated soils should be disposed off to approved designated areas immediately 	Contractor	Contractor cost

	<p>Materials ,and solid waste such as removed concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items.</p>	<p>(iv) If disposal is required, the site shall be selected preferably from barren, infertile lands; sites should locate away from residential areas, forests, water bodies and any other sensitive landuses</p> <p>(v) Domestic solid wastes should be properly segregated in biodegradable and non-biodegradable for collection and disposal to designated solid waste disposal site; create a compost pit (with impermeable bottom and sides) at workers camp sites for disposal of biodegradable waste; non-biodegradable / recyclable material shall be collected separately and sold in the local recycling material market</p> <p>(vi) Residual and hazardous wastes such as oils, fuels, and lubricants shall be disposed off via licensed (by TNPCB) third parties</p> <p>(vii) Prohibit burning of construction and/or domestic waste;</p> <p>(viii) Ensure that wastes are not haphazardly thrown in and around the project site; provide proper collection bins, and create awareness to use the dust bins, , recycle waste material where possible</p> <p>(ix) Conduct site clearance and restoration to original condition after the completion of construction work; PIU to ensure that site is properly restored prior to issuing of construction completion Certificate</p>		
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Removal of rock during excavation for sewer works	Increase in vibration due to the controlled blasting and associated activities	<p>During excavation for sewer works, wherever removal of rock is identified, alternatives like drilling and chiseling, controlled blasting etc. will be examined and the suitable technology shall be finalized depending upon the site conditions. Following measures for ensuring safety shall be ensured during controlled blasting.</p> <ul style="list-style-type: none"> (i) Carryout controlled blasting in consultation with PIU so that blasting activities with the least potential to generate vibration are conducted during periods of the day which will result in least disturbance, especially near schools and other sensitive receptors. (ii) Permission obtained on 22.10.2020 from The District Collector for controlled blasting for excavation. Conditions stipulated in the permission issued by the District Collector shall be complied with during implementation. (iii) The contractor shall submit a blasting plan to PIU; and implement in accordance with the plan. (iv) Blasting shall be done through a licensed Explosive Contractor only (v) For controlled blasting, explosives including blasting caps, shall be transported to the blasting site only through exclusive vehicle in safe manner in accordance with the requirements of the blasting license. After blasting is over, the balance explosives shall be returned to the licensed storage. (vi) Cost for implementation of mitigation measures and liability are the responsibility of contractor. (vii) Proper prior notice will be issued to the Residents before Commencing UGSS activity works Schedule (viii) Proper information will be Given to Police Officials (ix) Workers (Flagman) shall be stationed on both end of roads to warn people before firing any blasts and not to permit the traffic. (x) When blasting, ample warning shall be given to all persons within the vicinity prior to blasting. Warning signs shall be erected a minimum of 24 hours prior to the blast time. The warning signs will state the time and date of each blast. (xi) Contractor shall ensure necessary precautions / protection (like excavated earth, sand-filled bags, etc.) to reduce Ground Vibrations, Reduce noise levels, etc. Sites shall be provided with necessary shields all around. (xii) Minimum Explosive will be used for Control Blasting for Residential areas (xiii) After a blast has been fired, the Blast Control Specialist shall make a careful inspection to determine that all charges have exploded before employees can return to the operation. (xiv) The contractor shall be responsible for all damage to property or injury to persons resulting from blasting or accidental or premature explosions that may occur in connection with his use of explosives. (xv) The contractor shall do the activities after obtaining the blasting permission from District Collector, Trichy. (xvi) For the diversion of traffic in the blasting area, the contractor shall prepare a traffic management plan and obtain permission from Trichy Corporation and traffic police. (xvii) Ensure to conduct a pre-blasting survey through videography and photography of residential properties and other structures falling along the sewerage alignment to ascertain the prevailing conditions of the structures likely to be impacted by the controlled blasting and take adequate measures to minimize such impacts 	Construction Contractor	Cost for implementation of mitigation measures responsibility of contractor.
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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
Generation of sludge, clay, construction waste/debris from repair work of existing STP	Health and environmental impacts due to improper handling and disposal	(i) Conduct sampling and testing of sludge from all ponds (one composite sample from each pond); parameters to be tested are given in environmental monitoring plan (ii) Devise the disposal method based on sludge characteristics (if it is hazardous, it shall be handled and disposed as per the Hazardous waste rules of MoEFCC) (iii) Sludge (if not hazardous) shall be transported to solid waste disposal sites in the city, and shall be disposed or used as daily cover for other waste (iv) Clay layer shall also be tested if it appears to be contaminated by visual appearance; in any case, a top layer of 6 inch shall be considered as part of the sludge and disposed accordingly (v) Clay may be used in solid waste disposal site as daily cover on the waste (vi) Devise any suitable reuse method based on the quality of clay Employ proper methods for removal of sludge and clay with safety of workers, environment utmost priority; provide on-site awareness sessions and training for workers on working conditions and safe handling of sludge and provide PPEs to workers (vii) Any other construction waste / debris shall be properly disposed; priority shall be given to reuse, recycle so that disposal is avoided, provided it is suitable and safe for such usage	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation
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Accessibility and traffic disruptions	Traffic problems and conflicts near project locations and haul road	<p>Sewer works</p> <ul style="list-style-type: none"> (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 Appendix6) (ii) Plan the sewer work in coordination with the traffic police; provide temporary diversions, where necessary with clear signage and effectively communicate with general public (iii) Avoiding conducting work in all roads in a colony at one go; it will render all roads unusable due to excavations at the same time, creating large scale inconvenience (iv) Undertake the work section wise: a 500 section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones (v) Confine work areas in the road carriageway to the minimum possible extent; all the activities, including material and waste/surplus soil stocking should be confined to this area. Proper barricading should be provided; avoid material/surplus soil stocking in congested areas – immediately removed from site/ or brought to the as and when required (vi) Limit the width of trench excavation as much as possible by adopting best construction practices; adopt vertical cutting approach with proper shoring and bracing; this is especially to be practiced in narrow roads and deeper sewers; if they deep trenches are excavated with slopes, the roads may render completely unusable during the construction period (vii) Leave spaces for access between mounds of soil to maintain access to the houses / properties; access to any house or property shall not be blocked completely; alternative arrangements, at least to maintain pedestrian access at all times to be provided (viii) Provide pedestrian access in all the locations; provide wooden/metal planks with safety rails over the open trenches at each house to maintain the access 	Contractor
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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
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		<ul style="list-style-type: none"> (ix) Inform the affected local population in advance about the work schedule, a week before, and a day before to start of work (x) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum. (xi) Keep the site free from all unnecessary obstructions. (xii) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints. Provide information to the public through media – newspapers and local cable television (TV) services (xiii) At work site, public information/caution boards shall be provided including contact for public complaints <p>Controlled blasting</p> <ul style="list-style-type: none"> (i) The contractor shall submit a controlled blasting plan to PIU in advance; and implement in accordance with the plan. (ii) Proper prior notice will be issued to the Residents before Commencing UGSS activity works Schedule (iii) Proper information will be Given to Police Officials (iv) Workers (Flagman) shall be stationed on both end of roads to warn people before firing any blasting and not to permit the traffic. (v) Adequate warning shall be given to all persons within the vicinity prior to blasting. Warning signs shall be erected a minimum of 24 hours prior to the blast time. The warning signs will state the time and date of each blast. (vi) For the diversion of traffic in the blasting area, the contractor shall prepare a traffic management plan and obtain permission from Trichy city Corporation and traffic police. <p>Hauling (material, waste/debris and equipment) activities</p> <ul style="list-style-type: none"> (vii) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites (viii) Schedule transport and hauling activities during non-peak hours; (peak hours 7 to 10 AM and 4 to 7 PM) (ix) Locate entry and exit points in areas where there is low potential for traffic congestion; (x) Drive vehicles in a considerate manner (xi) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints. 		
Controlled blasting	Ground vibrations Noise (airblast) Flying debris Dust	<p>Carryout controlled blasting in consultation with PIU so that blasting activities are conducted during periods of the day which will result in least disturbance; especially near schools and other sensitive receptors.</p> <p>The contractor shall submit a blasting plan in advance to PIU for approval; and implement in accordance to the plan once approved.</p> <p>The controlled blasting at identified locations shall be permitted only after the requisite statutory permissions from regulatory authorities are obtained. The contractor shall comply with all terms</p>	Contractor and PIU	Contractor Costs

		<p>and conditions stipulated in such permissions. The controlled blasting would be monitored by following the necessary requirements to prevent safety risk to both public and nearby structures as provisioned in the prevailing Indian regulations and standards. The District Collector of Trichy as accorded permission for carrying out control blasting after observing all safety measures and NOC from ADB is awaited for carrying out the control blasting.</p> <p>Blasting shall be carried out through a licensed Explosive Contractor only.</p> <p>For controlled blasting, explosives including blasting caps, shall be transported to the blasting site only through exclusive vehicle in safe manner in accordance with the requirements of the blasting license. After blasting is over, the balance explosives shall be returned to the licensed storage.</p> <p>Cost for implementation of mitigation measures and liability are the responsibility of contractor.</p> <p>Proper prior notice will be issued to the residents before commencing blasting activity works. Inform the residents likely to be affected by the works in the locality about the upcoming blasting works well in advance so that necessary arrangements are planned by the residents with reduced inconvenience.</p> <p>For sections where the controlled blasting is proposed, the residents shall be provided with the schedule of blasting at least three days in advance and the residents are explained about the preventive, precautionary, mitigation and emergency response measures being taken to address their concerns.</p> <p>Prior information will be given to Police Officials</p> <p>Workers (Flagman) shall be stationed on both end of roads to warn people before firing any blasts and not to permit the traffic. The section proposed for blasting shall be supervised by properly trained staff to ensure no movement of pedestrians, motorized or nonmotorized vehicles, and residents takes place during blasting within the area of influence. For the diversion of traffic in the blasting area, the contractor shall prepare a traffic management plan and obtain permission from Trichy Corporation and traffic police.</p> <p>When blasting, ample warning shall be given to all persons within the vicinity prior to blasting. Warning signs shall be erected a minimum of 24 hours prior to the blast time. The warning signs will state the time and date of each blast.</p> <p>Sites shall be provided with necessary shields all around.</p>		
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		<p>Minimum explosive will be used for Controlled Blasting specifically within residential areas.</p> <p>After a blast has been fired, the Blast Control Specialist shall make a careful inspection to determine that all charges have exploded before employees are allowed to return to the operation, and subsequently the movement of residents /pedestrians and vehicles is permitted.</p> <p>Ensure appropriate measures are taken to maintain maximum ambient noise levels within the limits as permitted by the prevailing Indian regulations and standards. The ambient noise levels would be monitored to ascertain the efficacy of acoustic measures thus implemented and compliance with associated regulatory permissions.</p> <p>Ensure that adequate precautions are taken to avoid flying debris post blasting (such as covering the trench with sturdy metallic sheets with sand filled bags to absorb the blast waves);</p> <p>For sections involving controlled blasting, ensure that dust curtains of adequate height are provided to the trenches to prevent emission of dust during drilling for charge holes and controlled blasting.</p> <p>Ensure that the excavated soil and debris along the section identified for blasting is sprinkled with adequate water prior to blasting to reduce dust emissions upon explosion of charge placed for breaking the hard rock.</p> <p>The project staff from the PIU, consultants and contractors would undertake a post-blasting survey of structures (including videography and/or photography) lying within the area of influence of blasting from the vibrations related impacts (preferably in the presence of the owners of the said structures) to assess and/or ascertain regarding the damages, if any, caused to the structures because of blasting activities.</p> <p>The contractor shall be responsible for any and all damages to property or injury to persons resulting from blasting or accidental or premature explosions that may occur in connection with use of explosives. The log of such events would be properly maintained. The contractor shall provide immediate support and relief measures commensurate with the damages.</p> <p>Training related to controlled blasting activity will be included in the overall safeguards training programme meant for PIUs and Contractors.</p>		
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Socio-Economic Loss of access to houses and business	Loss of income	<ul style="list-style-type: none"> (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. 	Contractor	Contractor cost
Socio-Economic – Employment	Generation of temporary employment and increase in local Revenue	<ul style="list-style-type: none"> (i) Employ local labor force as far as possible (iii) Comply with labor laws 	Contractor	Contractor cost
Occupational Health and Safety	Occupational hazards which can arise during work	<ul style="list-style-type: none"> (i) Follow all national, state and local labor laws (indicative list is in Appendix2); (ii) Develop and implement site-specific occupational health and safety (OH and S) Plan, informed by OHS risk assessment seeking to avoid, minimize and mitigate risk, which shall include measures such as: (a) safe and documented construction procedures to be followed for all site activities; (b) ensuring all workers are provided with and use person all protective equipment; (c) OH, and S Training⁷ 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 Guidelines⁸. (iii) Ensure that qualified first aid is always provided. Equipped first-aid stations shall be easily accessible throughout the sites (iv) For controlled blasting activity, identify the risks involved for the laborer's and public and include measures in the OHS plan. Provide necessary training and PPEs to the laborer's to ensure safety during implementation. 	Contractor	Contractor cost

		(v) Secure all installations from unauthorized intrusion and accident risks (vi) Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;		
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⁷ 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.

⁸<http://www.ifc.org/wps/wcm/connect/a99ab8804365b27aa60fb6d3e9bda932/EHS-Guidelines+101-Webinar.pdf?MOD=AJPERES>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
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		<ul style="list-style-type: none"> (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 visitors do not enter hazard area unescorted. (vii) Ensure the visibility of workers through their use of high visibility vests and other PPE when working in or walking through heavy equipment operating areas. (viii) Ensure moving equipment is outfitted with audible back-up alarms. (ix) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and (x) Disallow worker exposure to noise level greater than 85 dBA for duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively. (xi) Provide supplies of potable drinking water. (xii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances 		
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 100m buffer shall be maintained) or locate the camp site within the existing facilities of City Corporation (iii) Avoid tree cutting for setting up camp facilities. (iv) Provide a proper fencing/compound wall for campsites (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 	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<ul style="list-style-type: none"> (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); firewood 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 biodegradable 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	<ul style="list-style-type: none"> (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 always maintained at the highest standards possible. (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 	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		<p>far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be allowed as accommodation for workers</p> <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; drinking water should be regularly tested to confirm that drinking water standards are met (xii) Prohibit employees from cutting of trees for firewood; contractor should be provided proper facilities including cooking fuel (oil or gas; firewood 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 worksite 		
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 regressed 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

Table 22: Operation Stage Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
STP operation – inadequate treatment	Non-compliance with government regulations; public health, safety and environmental impacts	<p>For operation of the STPs,</p> <ul style="list-style-type: none"> (i) Conduct regular wastewater quality monitoring (at inlet and at outlet of STP) to ensure that the treated effluent quality complies with the standards. (ii) Implement sludge management plan - : sludge management to collect, treat and dispose the accumulated sludge safely; sludge will be tested periodically for heavy metal concentration. (iii) Provide flow measurement devises at inlet and outlet, and maintain flow records (iv) Provision of appropriate training and personal protection equipment to the workers and staff (v) Conduct periodic testing of dried sludge /compost to check presence of heavy metals and confirming the concentration stouseas compost. It shall not be used for food crops. (vi) No wastewater from industrial premises (including domestic wastewater) shall be allowed to dispose into municipal sewers (vii) Monitor regularly and ensure that there is no illegal discharge through manholes or inspection chambers; conduct public awareness programs; in coordination with TNPCB 	DBOT Contractor TCC /	Operating costs
Operation of sewage lifting and pumping Stations	Odor nuisance	<ul style="list-style-type: none"> (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 H₂S monitoring periodically 		Operating costs
Operation and maintenance of Sewerage System	Blocks, overflows, system malfunction, occupational health and Safety	<ul style="list-style-type: none"> (i) Establish regular maintenance program, including: Regular cleaning of grit chambers and sewer lines tor 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 	PIU and TCC	Operating costs

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

Table 23: Pre-Construction and Construction Stage Environmental Monitoring Plan

Monitoring Field	Monitoring Location	Monitoring Parameters	Frequency	Responsibility	Cost and Source of Funds
Preconstruction/Design					
Baseline water quality of receiving water body (Uyyakondan Channel, VallavandhanKottaiPond)	5 points (4 in channel - at discharge point, upstream & downstream, and 1 near Vallavandhavankottai pond/tank 1 in the pond/tank,)	pH, TDS, TSS, DO, BOD, COD, E-coli, Total coli form, Nitrate, Total Phosphates, Oil and grease, Total hardness, Sulphate, Fluoride, Chloride, Ammonia, Aluminum, Manganese, Iron, Zinc, Nickel, Magnesium, Phenolic compounds, Chromium, Arsenic, Mercury, Cadmium, Lead, Pesticides	Twice (Pre-monsoon and post monsoon during design phase)	Contractor	Cost for implementation of monitoring measures responsibility of DB contractor (10 samples x 8000 per sample = 80,000)
Sludge quality from existing STP ponds	5 points (1 composite sample from each pond)	EC, pH, calcium, magnesium, % of total organic matter, Total organic carbon, N, P, K, Aluminum, fecal coliform, As, Cu, Cd, Cr, Pb, Fe, Mn, Hg, Zn, Ni.	Once	Contractor	Cost for implementation of monitoring measures responsibility of DB contractor (5 samples x 10000 per sample = 50,000)

CONSTRUCTION PHASE

Monitoring Field	Monitoring Location	Monitoring Parameters	Frequency	Responsibility	Cost and Source of Funds
Construction disturbances, nuisances, public and worker safety,	All work sites	Implementation of construction stage EMP including safety measures, dust control, noise control, traffic management, and Safety during controlled blasting Site inspection checklist to review implementation is appended at Appendix 7	Weekly during construction	Supervising staff and safeguards specialists of CMSC	Staff and consultant costs are part of incremental administration costs

Ambient air quality	5 locations (locations 50 m downwind direction near sewer and pumping/lifting station work sites in the city);	<ul style="list-style-type: none"> PM10, PM2.5 NO2, SO2, CO 	Once before start of construction Quarterly (yearly 4-times) during construction (3-year construction period)	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (65 samples x 5000 per sample = 325,000)
	1 location at Erubeeshwarar temple	<ul style="list-style-type: none"> PM10, PM2.5 NO2, SO2, CO 	Once prior to start of the works within 300 m of monument fortnightly once during the works within 300 m of monument	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (12 samples x 5000 Per sample = 60,000)
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 construction period)	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (65 samples x 1500 per sample = 97,500)
	1 location at Erubeeshwarar temple	<ul style="list-style-type: none"> Day time and night time noise levels 	Once prior to start of the works within 300 m of monument fortnightly once during the works within 300 m of monument	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (12 samples x 1500 per sample = 18,000)

Surface water quality	4 locations (2 points in river Koraiar u/s and d/s of discharge point, Uyyakondan channel u/s and d/s of project area)	<ul style="list-style-type: none"> pH, Oil and grease, Cl, F, NO3, TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalinity 	Once before start of construction Half yearly during construction (3 year construction period)	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (28 samples x 4000 per sample = 112,000)
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Table 24: Operation Stage Environmental Monitoring Plan

Monitoring Field	Monitoring Location	Monitoring Parameters	Frequency	Responsibility	Cost and Source of Funds
Monitoring of Treated wastewater quality from STP	Inlet and outlet of STPs	Parameters as specified by TNPCB in the consent./disposal standards notified for STPs.	Monthly Once	TCC	TCC Operating Cost
Water quality of receiving channel	3 points in channel (1 at STP discharge location, 1 u/s and 1 d/s) 1 point in VallavandhanKottai Pond/tank	pH, Cl, F, NO3, TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalinity, heavy metals and pesticides	Monthly once during operation Yearly twice (pre-& post monsoon)	TCC	O&M costs (water quality will be tested at the internal laboratory part of STP)
Odor monitoring at pumping stations	3 points (downwind direction) at all pumping stations: near suction well; outside the pumping station and at nearest House	Hydrogen sulphide (H2S)	Periodical (throughout the operation phase)	TCC	Handheld H2S meters to be procured as part of the project and operated by operating staff
Odor monitoring at lifting stations	2 points (downwind direction) at all lifting stations: near suction well and at nearest house	Hydrogen sulphide (H2S)	Periodical (throughout the operation phase)	TCC	Handheld H2S meters to be procured as part of the project and operated by operating staff
Sludge quality and suitability as manure	STP	Analysis for concentration of heavy metals and confirm that value are within the following limits (see Table 4)	Start of operation and Yearly once	TCC	O&M costs (testing to be done at an accredited external laboratory)

B. IMPLEMENTATION ARRANGEMENTS

- 162.** The Municipal and Water Supply Department (MAWS) acting through TNUIFSL is the executing agency. A program steering committee, headed by Principal Secretary, MAWS, GOTN, provide overall guidance and strategic directions to the program. A program management unit (PMU) for TNUFIP, headed by the Managing Director, TNUIFSL acting as Program Director have been established within TNUIFSL for overall management, planning, implementing, monitoring, reporting, and coordinating TNUFIP. The CMA acts as the Deputy Program Director in the PMU. The project ULBs, represented by respective Municipal Commissioners, are the implementing agencies for works in cities/towns and have established program implementing units (PIUs) headed by a municipal engineer as full-time Project Manager. PIUs comprise of dedicated staff responsible for overseeing implementation of projects on a day-to-day basis. The PIUs is supported by a contract management and supervision consultant (CMSC) recruited by TNUIFSL. For the institutional capacity, public awareness, and urban governance component, CMA acting through hits Commissioner, will establish a PIU and appoint a governance improvement and awareness consultant (GIAC) responsible for supporting these activities.
- 163.** The implementing agency for this subproject is TCC. A Project Implementation Unit (PIU) has been established in TCC headed by full-time a Project Manager (a senior official of TCC) and comprising dedicated full-time staff from engineering and other departments of TCC. PIU under the TCC is responsible for planning, implementation, monitoring and supervision and coordination of all activities of subproject. A Construction, Management and Supervision Consultant (CMSC) has been appointed to assist PIU in day-to-day implementation of the subproject.
- 164. Safeguards Compliance Responsibilities.** Environmental and Social Safeguards (ESS) managers in the PMU, TNUIFSL have overall responsibility of safeguard compliance with ADB SPS2009. ESS Managers report to Vice President in the Projects Wing. At PIU level, a Safeguards Officer has been nominated who an Assistant Engineer rank officer and will coordinate safeguard tasks at PIU. As expert support is available to PIU via CMSC, and the role of Safeguard Officer is mainly to coordination, overseeing the implementation of safeguard tasks, grievance redress and reporting.
- PMU Safeguard Responsibilities.** Key tasks and responsibilities of the ESS Manager (Environment), for this subproject include the following

DPR finalization and Bidding stage:

- a. Ensure that all design related measures of the EMP are included designs.
- b. Ensure that EMP is included in bidding documents and civil works contracts including requirement for EHS supervisor with the contractor
- c. Ensure that the bid/contract documents include specific provisions requiring contractors to comply with all applicable labor laws and core labor standards
- d. Ensure that staff required for implementation of EMP (EHS officer) is included in the bid requirements
- e. Ensure that EMP cost is included in the project cost
- f. 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.

CONSTRUCTION STAGE:

- (i) Prior to start of construction:
 - a. Ensure that all necessary clearances/permissions/licenses, including that of

contractor's are in place prior to start of construction.

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

Operation stage.

Ensure that all clearances as required for operation of project are in place prior to operation, such as consent to operate (CTO) for STPs from TNPCB

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

DPR FINALIZATION AND BIDDING STAGE:

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

CONSTRUCTION STAGE:

- (i) Identify regulatory clearance requirements and obtain all necessary clearances prior to start of construction; ensure construction work by contractor is conducted in compliance with all government rules and regulations including pollution control, labour welfare and safety etc.
- (ii) 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 the mon 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
- (v) Guide contractor on updating EMP / preparing Site 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) Submit quarterly environmental monitoring reports to PMU
- (xiii) Conduct continuous public consultation and awareness
- (xiv) Address any grievances brought about through the grievance redress mechanism in a timely manner as per the EMP
- (xv) Monitor Contractor's compliance with the measures set forth in the EMP and any corrective or preventative actions set forth in a safeguard monitoring report that the PMU will prepare from time to time.
- (xvi) Implement corrective or preventative actions in case of non-compliance or new/unanticipated impacts.
- (xvii) 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
- (xviii) 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.
- (xix) Review and approve monthly progress reports submitted by Contractor on EMP compliance,
- (xx) Prepare quarterly environmental monitoring reports and submit to PMU /TNUIFSL
- (xxi) Provide any assistance in environmental safeguard related tasks as required by PMU to ensure compliance and reporting to ADB

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) for STPs from TNPCB
- (i i) Conduct environmental management and monitoring activities as per the EMP

166. Contractor's Responsibilities:

BIDDING STAGE:

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

CONSTRUCTION STAGE:

- (i) Mobilize EHS Supervisor prior to start of work.
- (ii) Prepare SEMP and submit to PIU.
- (iii) Ensure that all regulatory clearances (both projects 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 Appendix3)
 - b. Traffic management (TM) plan (sample is Appendix6)
 - c. OHS Plan, pollution control plan, dust emergency response plan
- (vi) Implement the mitigation measures as per the EMP including CWM and TM Plans
- (vii) Follow the EMP measures/guidelines for establishment of temporary construction camps, construction waste disposal sites, and material borrow areas, etc.

- (viii) Implement EMP and ensure compliance with all the mitigation and enhancement measures.
- (ix) Conduct environmental monitoring (air, noise, water etc.) as per the EMP
- (x) Undertake immediate action as suggested by PIU to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation.
- (xi) Submit monthly progress reports on EMP implementation to PIU.
- (xii) Act promptly on public complaints and grievances related to construction work and redress in a timely manner in coordination with PIU and CMSC.
- (xiii) Comply with applicable government rules and regulations.

C. TRAINING NEEDS

167. The following Table 25 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 safeguard's 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 25: Outline Capacity Building Program on Environmental Management Plan Implementation

Description	Target Participants and Venue	Estimate (₹)	Cost and Source of Funds
<p>1. Introduction and Sensitization to Environmental Issues (1 day)</p> <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 contracts. - Monitoring, reporting and corrective action planning. 	<p>All staff and consultants involved in the project</p> <p>At PMU(combined program for all PIU).</p>	-	Included in the overall program cost
<p>2. EMP implementation (1/2 day)</p> <ul style="list-style-type: none"> - 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 the ASI monuments AC pipe protocol <ul style="list-style-type: none"> - Traffic management plan - Waste management plan - Site clean-up and restoration - Controlled Blasting 	<p>All PIU staff, contractor staff and consultants involved in the subproject.</p> <p>At PIU</p>	-	Conducted by CMSC at the PIU office; part of project implementation cost
<p>3. Contractors Orientation to Workers (1/2 day)</p> <ul style="list-style-type: none"> - Environment, health and safety in project construction - Health & safety measures during coronavirus disease (COVID-19) pandemic 	<p>Once before start of work, and thereafter regular briefing every month once.</p> <p>Daily briefing on safety prior to start of work.</p> <p>All workers (including unskilled laborers)</p> <p>Awareness and on-site training for workers and staff on sludge handling and disposal in existing STP repair work</p>	-	Contractors' EHS officer to conduct program, with guidance of CMSC

D.MONITORING AND REPORTING

- 168.** Immediately after mobilization and prior to commencement of the works, the contractor will submit a compliance report to PIU that all identified pre-construction mitigation measures as detailed in the EMP are undertaken. Contractor should confirm that the staff for EMP implementation (EHS supervisor) is mobilized. PIU will review and approve the report and permit commencement of works.
- 169.** 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. 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 8). During operation, PIU will conduct management and monitoring actions as per the operation stage EMP, and submit to PMU an annual report.
- 170.** Based on PIU Quarterly monitoring reports and oversight visits to subproject work sites, PMU will submit semi-annual Environmental Monitoring Report (EMR). Once concurrence from the ADB is received the report will be disclosed on TNUIFSL, PMU and TCC websites.
- 171.** ADB will review project performance against the TNUFIP commitments as agreed in the legal documents (loan and project agreements etc.). The extent of ADB's monitoring and supervision activities will be commensurate with the project's risks and impacts. Monitoring and supervising of social and environmental safeguards will be integrated into the project performance management system

D. Environmental Management Plan Implementation Cost

- 172.** 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 26: Cost Estimates to Implement the EMP

	Particulars	Stages	Unit	Total Number	Rate (₹)	Cost (₹)	Costs Covered By
A.	Implementation staff						
B.	Mitigation Measures						
2	Providing odor control system sewage pumping & lifting stations (gas capturing & treatment at required stations) and handheld H2S meters for monitoring	Design	Lump sum provision	-	-	5,000,000	Provisional sums of contract (PIU)
3	Measures related to make the STP compliant with TNPCB consent	Design/ construction	-	-	-	-	TCC own funds
4	Provision for tree cutting and compensatory plantation measures (1: 10 ratio re-plantation)	Construction	Per tree	100	1,000	100,000	Project costs (PIU)
5	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
6	Safety barricading	Construction	Lump sum	Lump sum	-	2,000,000	Civil works contract
	Subtotal (B)					7,400,000	
C.	Monitoring Measures						
1	Air quality monitoring	Construction	per sample	77	5,000	385,000	Civil works contract
2	Noise levels monitoring	Construction	Per sample	77	1,500	115,500	Civil work contract
3	Surface water monitoring	Construction	Per sample	28	4,000	112,000	Civil work Contract
4	Baseline water quality of receiving water bodies of STP discharge	Design	Per sample	10	8000	80,000	Civil work contract
5	Sludge quality from existing STP ponds	Design	Per sample	5	10000	50,000	Civil work contract
	Subtotal (C)					742,500	
D.	Capacity Building						
1.	Training on EMP implementation	Pre-construction				-	Part of PIU and PMU , consultant tasks
2.	Contractors Orientation to Workers on EMP implementation	Prior to dispatch to worksite				-	Civil works contractor cost
	Subtotal (D)						
	Particulars	Stages	Unit	Total Number	Rate (₹)	Cost (₹)	Costs Covered By
	Total (A+B+C+D)				₹	9,402,500	

Contractor cost- 4,302,500

PIU Cost - 5,100,000

Total Cost - 9,324,500

IX. CONCLUSION AND RECOMMENDATIONS

- 173.** The process described in this document has assessed the environmental impacts of all elements of the proposed underground sewerage subproject covering municipal area 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: STP treatment process design to meet disposal standards, ensuring efficient treatment, rehabilitation of existing STP to ensure proper treatment and sludge management, odor control at pumping stations, uninterrupted power supply provision; standard operating procedures for operation and maintenance; and imparting necessary training for ULB staff; providing necessary safety, no manual cleaning of sewers, and personal protection equipment for workers (protection against oxygen deficiency, harmful gaseous emissions) and sludge handling, and development of green buffer zone around the STP.
- 174.** Sewage and pumping stations sites, which collect sewage from the sewer network and pump to higher level to convey to sewage to STP for safe treatment and disposal, are located within or near residential areas, which it will serve. These facilities may generate odor and may cause nuisance to nearby households. Site selection is done with utmost care to located as far as away from the houses, however, given design considerations and land constraints, some of the sites identified are close to the houses. New sewage pumping stations (5nos.) are located within or close to residential areas. 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. The sewer network in this area also falls under the 300 m regulated buffer zone of monument. No impacts to the monuments as the work area is not located within the monument, and that works within 300 m area of the monument conducted with the prior permission of competent authority and under the supervision of ASI staff. Various measures are also suggested.
- 175.** New lifting and pumping station sites (24 in all) 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.
- 176.** Except sewer works, all other construction activities are confined to the selected sites, and the interference with the general public and community around is minimal. Major repair and rehabilitation work proposed at the existing STP, which is likely to generate large quantities of construction waste including sludge and used clay from sewage ponds. Proper measures to quality check, disposal and safe handling by workers suggested. 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 are 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. Some section of the proposed alignment may have to opt for controlled blasting as the construction methodology for excavation owing to presence of hard rock. These are all general impacts of construction in urban areas and there are well developed methods of mitigation that are suggested in the EMP.

- 177.** Once the new system is operating, the facilities will operate with routine maintenance, which should not affect the environment. Improved system operation will comply with the O&M manual and standard operating procedures to be developed for all the activities.
- 178.** Mitigation will be assured by a program of environmental monitoring conducted during construction and operation to ensure that all measures are implemented, and to determine whether the environment is protected as intended. This will include observations on- and off-site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported to the PMU. There will also be longer-term surveys to monitor treatment efficiency of STP (raw and treated sewage quality), and sludge Mitigation and monitoring measures, along with the project agency responsible for such actions, form part of the Environmental Management Plan.
- 179.** Stakeholders were involved in developing the IEE through face-to-face discussions, onsite meetings, and acidity level consultation workshop, which was conducted for larger public participation in the project. Views expressed by the stake holders 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, TCC 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.
- 180.** 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.
- 181.** The EMP will assist the project agencies and contractor in mitigating the environmental impacts and guide the environmentally sound execution of the proposed project. A copy of the updated EM/SEP shall be kept on-site during the construction period at all times. The EMP shall be made binding on all contractors operating on the site and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document shall constitute a failure in compliance.
- 182.** 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 for 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 health care and lose fewer working days due to illness, so their economic status should also improve, as well as their overall health.

- 183.** Therefore, as per ADB, SPS, the project is classified, as environmental category B and does not require further environmental impact assessment. However, to conform to government guidelines STP requires consent to establish (CTE) and consent to operate (CTO) from TNPCB The CTE has been obtained from TNPCB ON 13.02.2020 and PWD has given clearance to Trichy city corporation for disposal of treated effluent in to Uyyakondan channel. Existing STP will also require CTO and will be obtained on completion of the work. For the project components located within the regulated zone of protected monument; permission from ASI has been obtained and construction will be carried out as per the condition stipulated by ASI. Contract for new STP has been awarded under DBOT modality, the detailed design; treatment and disposal have been finalized. This IEE have been updated during the detailed design of the STP and the measures for controlled blasting during implementation phase and during implementation phase review

Appendix 1: RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

Sewerage

<p>Instructions:</p> <ul style="list-style-type: none"> <input type="checkbox"/> This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional and Sustainable development department. <input type="checkbox"/> This checklist is to be completed with the assistance of an Environment Specialist in a Regional Department. <input type="checkbox"/> This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on 1) involuntary resettlement, 2) indigenous peoples planning, 3) poverty reduction 4) participation 5) gender and development. <input type="checkbox"/> 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. 		
Screening Questions	Yes/No	Remarks
A. Project Siting Is the project area...		
• Densely populated?	Yes	Subproject activities are located in Tiruchirappalli City, a fast-developing urban area in the state of Tamil Nadu. Subproject area includes old town area of Tiruchirappalli, which is very densely populated. Outer areas are comparatively less dense. Old villages areas in the outer city have dense residential pockets, with narrow roads. Newly developing residential areas have low density and well planned layouts. Agriculture is still practiced in the outer areas.
• Heavy with development activities?	Yes	It is a developing area, urban expansion is considerable
• Adjacent to or within any environmentally sensitive areas?	No	-
• Cultural heritage site	Yes	The ASI protected monument Erumbeswarar temple is in close proximity to the nearby proposed network in Zone-3. However, no components are located within the protected monument. Permission from ASI has been Obtained
• Protected	No	-
• Wetland	No	-
• Mangrove	No	-
• Estuarine	No	-
• Buffer zone of protected area	No	-

• Special area for protecting biodiversity	No	-
• Bay	No	-
B. Potential Environmental Impacts Will the Project cause...		
Sewerage		
impairment of historical/cultural monuments/areas and loss/damage to these sites?	Yes	The ASI protected monuments Erumbeswarar temple is in close proximity to the nearby proposed network in Zone-3 but the networks will be laid on existing roads and will not damage to this site. Permission from ASI has been obtained
interference with other utilities and blocking of access to buildings; nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.?	Yes	Few sewage lifting and pump stations are located close to the houses, and odor may create nuisance. Necessary measures are included to prevent and control odor; no net negative impacts Envisaged
dislocation or involuntary resettlement of people?	No	Do not involve land acquisition or resettlement
disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?	No	No such possibilities; sewerage system will cover entire population including urban poor; In fact, it will have positive health impact due to improved sanitation condition.
impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?	Yes	For proposed STP adequate capacity sewage treatment facility is being development under this subproject; It is proposed to rehabilitate the existing STP, which not adequately treating the sewage. Corrective Action plan suggested to improve the compliance.
overflows and flooding of neighboring properties with raw sewage?	Yes	Sewerage system has been designed considering the population growth. It has been designed to accommodate sewage until design year. Design considers standard peak factors and therefore no such impact envisaged.
environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?	Yes	-
noise and vibration due to blasting and other civil works?	No	. Temporary nuisance/disturbance due to construction activities including controlled blasting will be minimized with appropriate mitigation measures as per applicable Indian regulations and standards. Permission has been obtained from the District Collector, Trichy and the conditions laid will be complied with.
risks and vulnerabilities related to occupational health and safety due to physical, chemical, and biological hazards during project construction and operation?	Yes	In appropriate handling of sludge may have occupational health hazard. All necessary safety precautions will be taken to avoid any risk.
discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?	Yes	There are no sources of hazardous material that will find its way into the sewers. Wastewater other than domestic will not be discharged into the sewers.

inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?	Yes	Due to technical constraints and land availability, some lifting and pumping stations are located close to houses, however, necessary measures are included in site planning, design and operation. No net negative impacts envisaged
road blocking and temporary flooding due to land excavation during the rainy season?	Yes	Complete road block are not envisaged; in narrow roads, traffic may be diverted but access will be ensure for pedestrians. All necessary precautions will be taken to prevent flooding during construction; flooding is unlikely as work will be mostly be conducted during dry season.
noise and dust from construction activities?	yes	All the construction activities including controlled blasting in identified sections will be carried out with necessary precautionary measures to mitigate noise and Dust
traffic disturbances due to construction material transport and wastes?	Yes	Proper planning, such as selection of routes and scheduling to avoid peak traffic hours, will be carried out in consultation with concerned authorities
temporary silt runoff due to construction?	No	Earthworks will not be conducted during rains; plain topography and moderate to low rains, so no such impact envisaged
hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?	Yes	A chance of failure of sewerage system is very remote; proper design and standard operating procedures will be followed in O&M; necessary equipment and training to workers will be provided
deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?	Yes	sludge management plan will be implemented
contamination of surface and ground waters due to sludge disposal on land?	No	Sludge will be dried in the ponds, no disposal of wet sludge on the land
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 unsterilized sludge?	Yes	Manual cleaning of sewers and facilities will be avoided. All necessary health and safety training and necessary personal protection equipment will be given to workers and staff during operation of sewerage system
Large population increase during project construction and operation that causes increased burden on social infrastructure (such as sanitation system)?	No	No such impact anticipated; local communities in the vicinity of the project would be employed as much as possible.
Social conflicts between construction workers from other areas and community workers?	No	No such impact anticipated; local communities in the vicinity of the project would be employed as much as possible.
risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?	No	Not applicable. Construction/operation will not involve use of explosives and chemicals.
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	Yes	Operational area will be clearly demarcated and access will be controlled. Only worker and project concerned members will be allowed to visit the construction sites.

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

Appendix 2

SALIENT FEATURES OF MAJOR LABOR LAWS APPLICABLE TO ESTABLISHMENTS ENGAGED IN CONSTRUCTION OF CIVIL WORKS

- (i) Workmen Compensation Act, 1923- The Act provides for compensation in case of injury by accident arising out of and during the course of employment.
- (ii) Payment of Gratuity Act, 1972 - Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years' service or more or on death at the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.
- (iii) Employees' PF and Miscellaneous Provisions Act, 1952 - The Act provides for monthly contributions by the employer plus workers @10 % or 8.33 %. The benefits payable under the Act are: (a) Pension or family pension on retirement or death as the case may be; (b) deposit linked insurance on the death in harness of the worker; (c) payment of PF accumulation on retirement/death, etc.
- (iv) Maternity Benefit (Amendment) Act 2017- The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage, etc.
- (v) Contract Labour (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 as scheduled employment. Construction of Buildings, Roads, Run ways 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 the establishment.

- (xi) Industrial Employment (Standing Orders) Act, 1946 - It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the States and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the employer on matters provided in the Act and get the same certified by the designated Authority.
- (xii) Trade Unions Act, 1926 - The Act lays down the procedure for registration of trade unions of workmen and employees. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities.
- (xiii) Child Labor (Prohibition and Regulation) Act, 1986 - The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of child labor is prohibited in Building and Construction Industry.
- (xiv) Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979 - The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The inter-state migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home up to the establishment and back, etc.
- (xv) The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Cess Act of 1996 - All the establishments who carry on any building or other construction work and employ 10 or more workers are covered under this Act. All such establishments are required to pay Cess at rate not exceeding 2% of the cost of construction as may be notified by the Government. The employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for workers near the workplace, etc. The employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.

Appendix 3
SAMPLE OUTLINE SPOILS
(CONSTRUCTION WASTE) MANAGEMENT PLAN

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

I. SPOILS INFORMATION

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

II. SPOILS MANAGEMENT

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

III. DOCUMENTATION

The volume of spoil generated (site specific, date wise), site disposed, reuse / disposal details should be documented properly.

Appendix 4
PUBLIC INFORMATION NOTICE TEMPLATE

Public Announcement

Providing Underground Sewerage System Tiruchirappalli City
Tiruchirappalli City 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 –

Appendix 5
SAMPLE GRIEVANCE REGISTRATION FORM

(To be available in Tamil and English)

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

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

Thank you.

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

FOR OFFICIAL USE ONLY

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

Appendix 6

SAMPLE OUTLINE TRAFFIC MANAGEMENT PLAN

A. Principles for TMP around the Water Pipes Construction Sites

1. One of the prime objectives of this TMP is to ensure the safety of all the road users along the work zone, and to address the following issues:
 - (i) The safety of pedestrians, bicyclists, and motorists travelling through the construction zone;
 - (ii) protection of work crews from hazards associated with moving traffic;
 - (iii) mitigation of the adverse impact on road capacity and delays to the road users;
 - (iv) maintenance of access to adjoining properties; and
 - (v) addressing issues that may delay the project.

B. Operating Policies for Traffic Management Plan

2. The following principles will help promote safe and efficient movement for all road users (motorists, bicyclists, and pedestrians, including persons with disabilities) through and around work zones while reasonably protecting workers and equipment.
 - (i) Make traffic safety and temporary traffic control an integral and high-priority element of project from planning through design, construction, and maintenance.
 - (ii) Inhibit traffic movement as little as possible.
 - (iii) Provide clear and positive guidance to drivers, bicyclists, and pedestrians as they approach and travel through the temporary traffic control zone.
 - (iv) Inspect traffic control elements routinely, both day and night, and make modifications when necessary.
 - (v) Pay increased attention to roadside safety in the vicinity of temporary traffic control zones.
 - (vi) Train all persons that select, place, and maintain temporary traffic control devices.
 - (vii) Keep the public well informed.
 - (viii) Make appropriate accommodation for abutting property owners, residents, businesses, emergency services, railroads, commercial vehicles, and transit operations.
3. **Figure A2 to Figure A12** illustrates the operating policy for TMP for the construction of water pipes and the sewers along various types of roads.

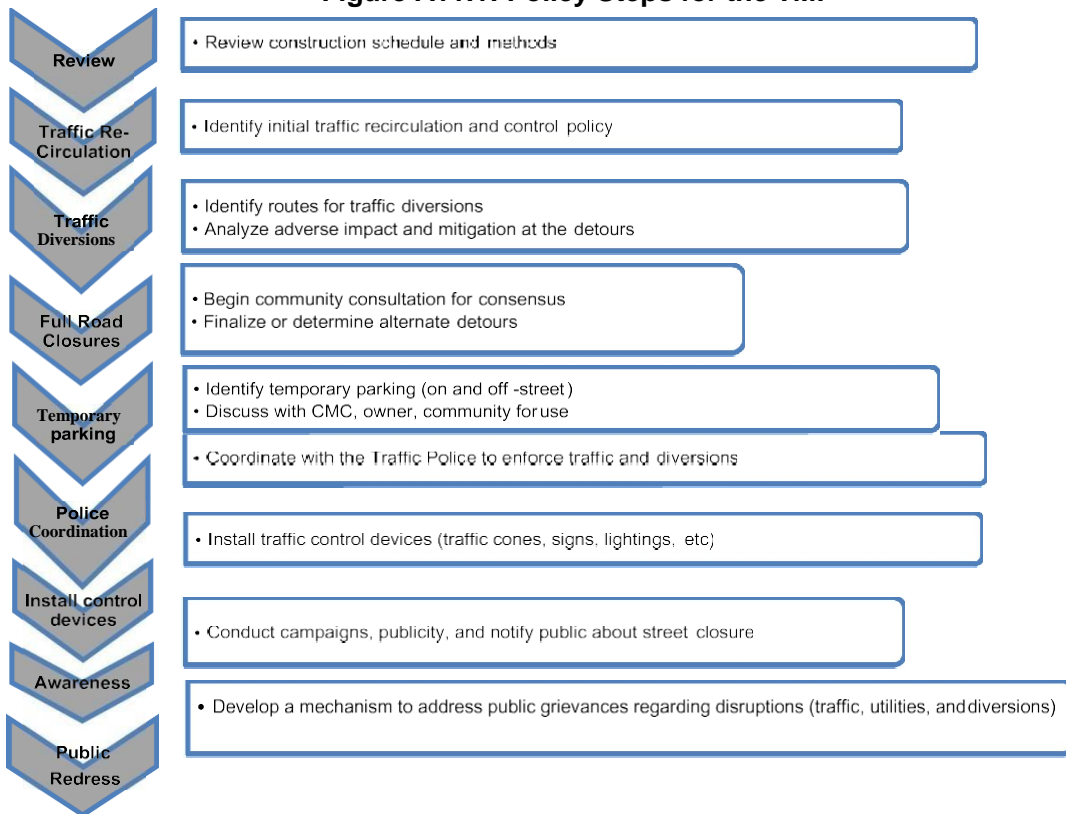
C. Analyze the impact due to street closure

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;
- (i i) 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;
- (i i i) determining of the maximum number of days allowed for road closure, and incorporation of such provisions into the contract documents;
- (i v) 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.
- (viii) If full road-closure of certain streets within the area is not feasible
- (ix) To inadequate capacity of the detour street or public opposition, the full closure can be restricted to weekends with the construction commencing on Saturday night and ending on Monday morning prior to the morning peak period.

Figure A11.1: Policy Steps for the TMP



D. Public awareness and notifications

4. As per discussions in the previous sections, there will be travel delays during the constructions, as is the case with most construction projects, albeit on a reduced scale if utilities and traffic management are properly coordinated. There are additional grounds for travel delays in the area, as most of the streets lack sufficient capacity to accommodate additional traffic from diverted traffic as a result of street closures to accommodate the works.
6. The awareness campaign and the prior notification for the public will be a continuous activity which the project will carry out to compensate for the above delays and minimize public claims as result of these problems. These activities will take place sufficiently in advance of the time when the road blocks or traffic diversions take place at the particular streets. There a son for this is to allow sufficient time for the public and residents to understand the changes to their travel plans. The project will notify the public about the roadblocks and traffic diversion through public notices, ward level meetings and city level meeting with the elected representatives.

7. The PIU will also conduct an awareness campaign to educate the public about the following issues:
 - (i) Traffic control devices in place at the work zones (signs, traffic cones, barriers, etc.);
 - (ii) defensive driving behavior along the work zones; and
 - (iii) reduced speeds enforced at the work zones and traffic diversions.
8. It may be necessary to conduct the awareness programs/campaigns on road safety during construction.
9. The campaign will cater to all types of target groups i.e. children, adults, and drivers. Therefore, these campaigns will be conducted in schools and community centers. In addition, the project will publish a brochure for public information. These brochures will be widely circulated around the area and will also be available at the PIU, and the contractor's site office. The text of the brochure should be concise to be effective, with a lot of graphics. It will serve the following purpose:
 - (i) Explain why the brochure was prepared, along with a brief description of the project;
 - (ii) advise the public to expect the unexpected;
 - (iii) educate the public about the various traffic control devices and safety measures adopted at the work zones;
 - (iv) educate the public about the safe road user behavior 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 indicate the office hours of relevant offices.

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

10. The purpose of installing traffic control devices at the work zones is to delineate these areas as to warn, inform and direct the road users about a hazard ahead and to protect them as well as the workers. As proper delineation is a key to achieve the above objective, it is important to install good traffic signs at the work zones. The following traffic control devices are used in work zones:
 - (i) Signs
 - (ii) Pavement Markings
 - (iii) Channelizing Devices
 - (iv) Arrow Panels
 - (v) Warning Lights
11. Procedures for installing traffic control devices at any work zone vary, depending on road configuration, location of the work, construction activity, duration, traffic speed and volume, and pedestrian traffic. Work will take place along major roads, and the minor internal roads. As such, the traffic volume and road geometry vary. The main roads carry considerable traffic; internal roads in the new city areas are wide but in old city roads very narrow and carry considerable traffic.

However, regardless of where the construction takes place, all the work zones should be cordoned off, and traffic shifted away at least with traffic cones, barricades, and temporary signs (temporary “STOP” and “GO”).

12. **FigureA11.2toFigureA11.6** 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:
 - (i) Work on shoulder or parking lane
 - (i i) Shoulder or parking lane closed on divided road
 - (i i i) Work in Travel lane
 - (i v) Lane closure on road with low volume
 - (v) Street closure withed tour
13. The work zone should take into consideration the space required for a buffer zone between the workers and the traffic (lateral and longitudinal) and the transition space required for delineation, as applicable. For the works, a 30 cm clearance between the traffic and the temporary STOP and GO signs should be provided. In addition, at least 60cm is necessary to install the temporary traffic signs and cones.
14. Traffic police should regulate traffic away from the work zone and enforce the traffic diversion result from full street closure in certain areas during construction. Flaggers/ personnel should be equipped with reflective jackets at all times and have traffic control batons (preferably the LED type) for regulating the traffic during nighttime.
15. In addition to the delineation devices, all the construction workers should wear fluorescent safety vests and helmets in order to be visible to the motorists at all times. There should be provision for lighting beacons and illumination for night constructions.

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

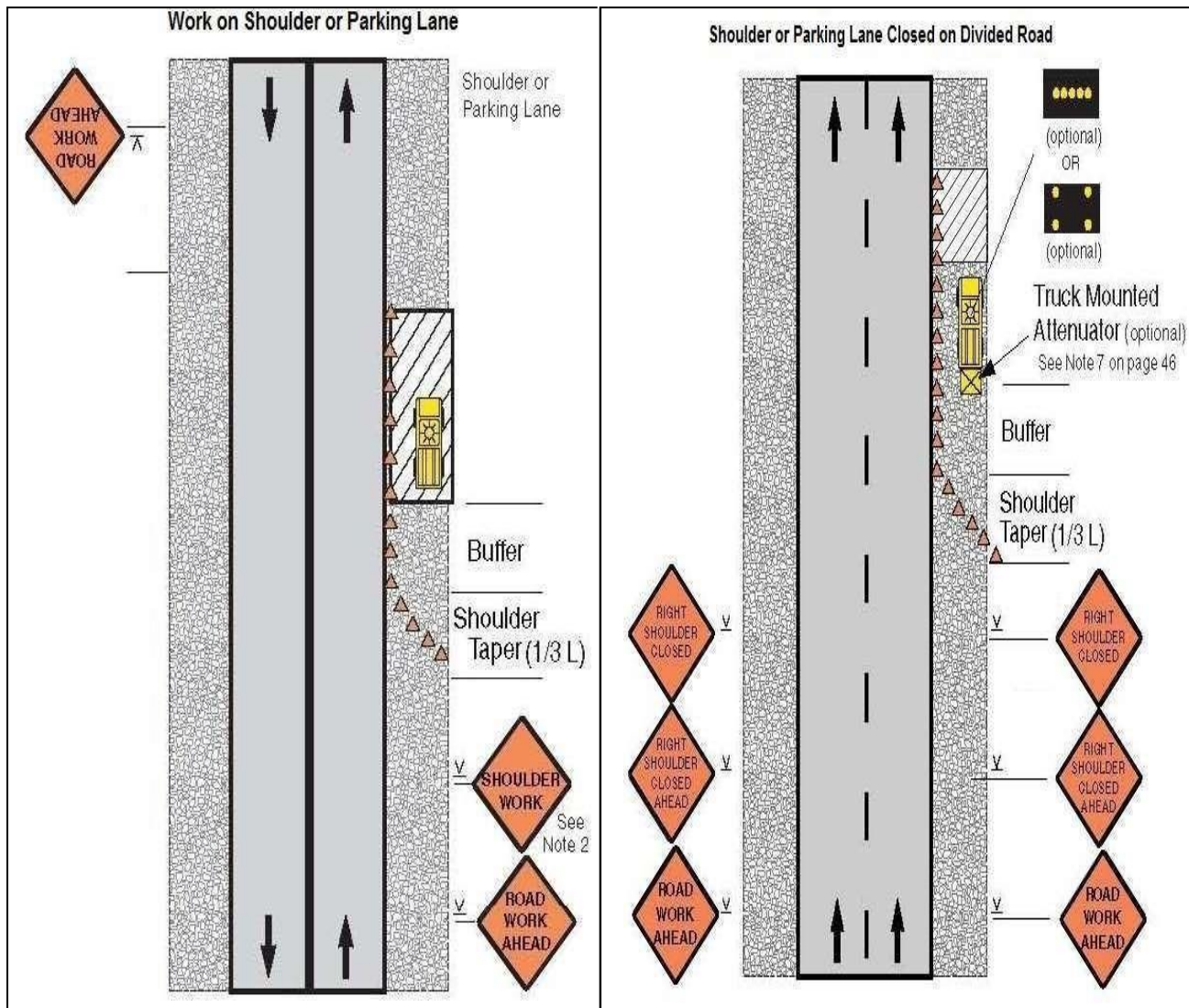
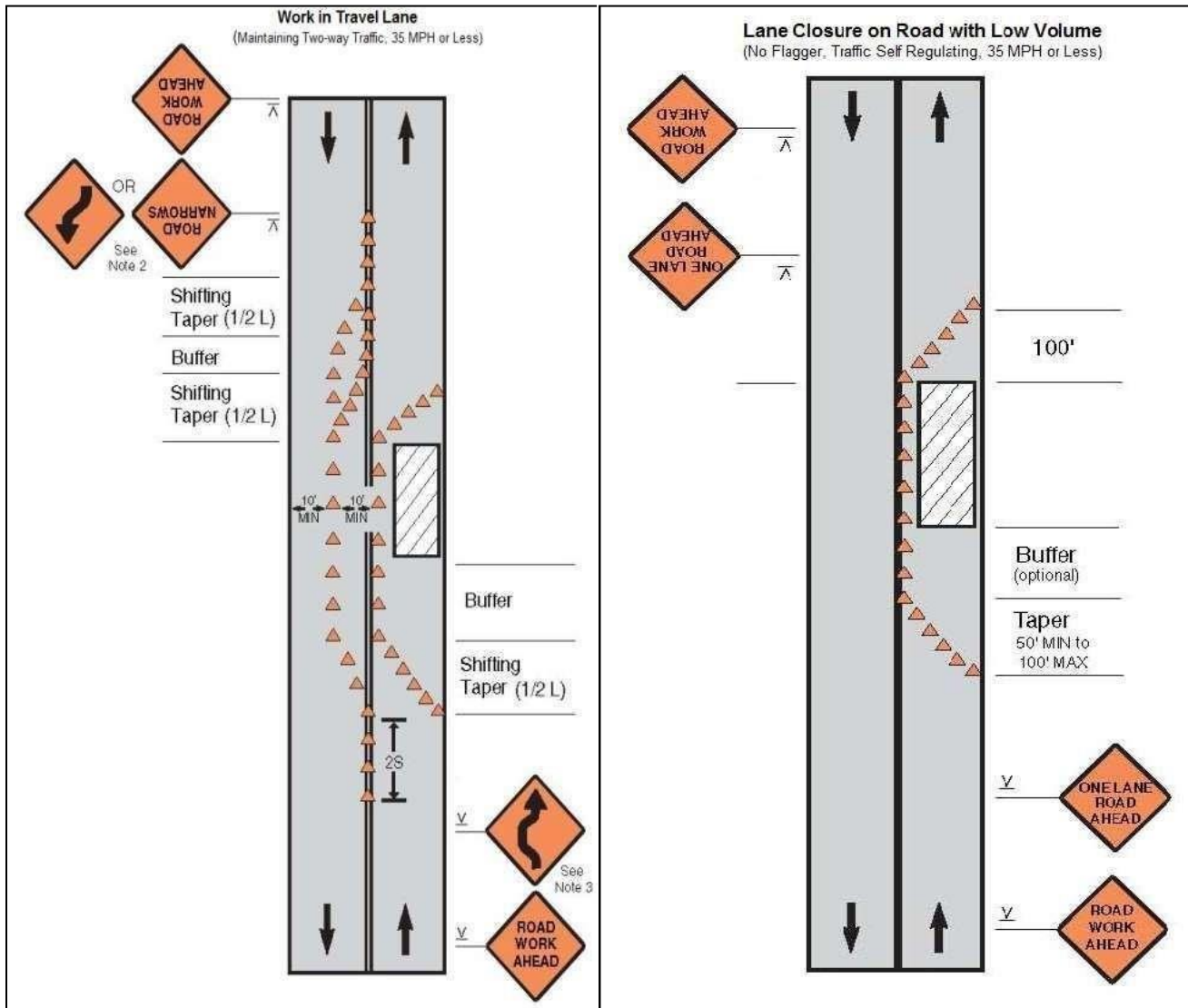


Figure A11.4 and A11.5: Work in Travel lane and Lane closure on road with low volume



road with low volume

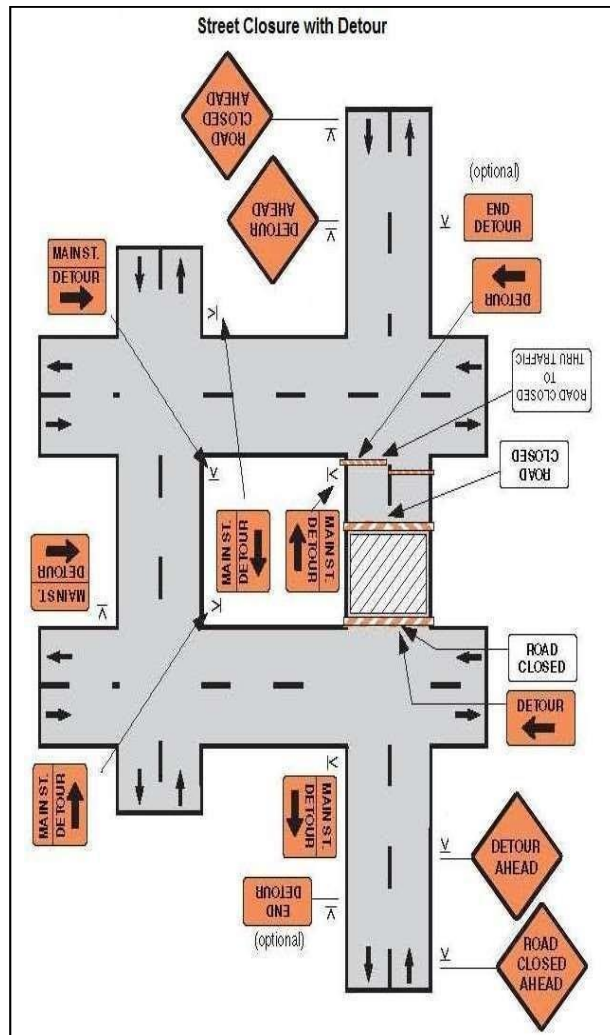


Figure A11.6: Street Closure with Detour

Appendix 7: SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

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 muffsetc)	
Workers conducting or near heavy noise work is provided with ear muffs	
Contractor is following standard and safe construction practices	
Deep excavation is conducted with land slip/protection measures	
First aid facilities are available on site and workers informed	
Drinking water provided at the site	

Toilet facility provided at the site	
--------------------------------------	--

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

Signature

Signoff

Name

Position

Name

Position

**Appendix 8:
SEMI ANNUAL ENVIRONMENTAL MONITORING PLAN TEMPLATE**

1. INTRODUCTION

- Overall project description and objectives
- Environmental category as per ADB Safeguard Policy Statement,2009
- Environmental category of each subproject as per national laws and regulations
- Project Safeguards Team

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

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

Package Number	Components/List of Works	Status of Implementation (Preliminary Design/Detailed Design/On-going Construction/Completed/O&M) ⁹	Contract Status (specify if under bidding or contract awarded)	If On-going Construction	
				%Physical Progress	Expected Completion Date

2. COMPLIANCE STATUS WITH NATIONAL / STATE / LOCAL STATUTORY ENVIRONMENTAL REQUIREMENTS¹⁰

⁹ If on-going construction, include %physical progress and expected date of completion

¹⁰ All statutory clearance/s, no-objection certificates, permit/s, etc. should be obtained prior to award of contract/s.

Package No.	Subproject Name	Statutory Environmental Requirements ¹¹	Status of Compliance ¹²	Validity if obtained	Action Required	Specific Conditions that will require environmental monitoring as per Environment Clearance, Consent/Permit to Establish ¹³

3. COMPLIANCE STATUS WITH ENVIRONMENTAL LOANCOVENANTS

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

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

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

Package-wise Implementation Status

Package Number	Component	Design Status (Preliminary Design Stage/ Detailed Design Completed)	Final IEE based on Detailed Design				Site-specific EMP (or Construct on EMP) approved by Project Director? (Yes/No)	Remarks
			Not yet due (detailed design not yet completed)	Submitted to ADB (Provide Date of Submission on)	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.

Attach as appendix all clearance obtained during the reporting period. If already reported, specify in the "remarks" column.

¹¹ Specify (environmental clearance? Permit/consent to establish? Forest clearance? Etc.)

¹² Specify if obtained, submitted and awaiting approval, application not yet submitted

¹³ Example: Environmental Clearance requires ambient air quality monitoring, Forest Clearance/Tree-cutting Permit requires 2 trees for every tree, etc.

- 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).
 - (i i) **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.
- 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)¹⁴

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						

⁴ Attach Laboratory Results and Sampling Map/Locations

Overall Compliance with CEMP/ EMP

No.	Sub-Project 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

5. APPROACH AND METHODOLOGY FOR ENVIRONMENTAL MONITORING OF THE PROJECT

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

6. MONITORING OF ENVIRONMENTAL IMPACTS ON PROJECT SURROUNDINGS (AMBIENT AIR, WATER QUALITY AND NOISELEVELS)

- 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/m ³	SO ₂ µg/m ³	NO ₂ µg/m ³

Site No.	Date of Testing	Site Location	Parameters (Monitoring Results)		
			PM10 µg/m ³	SO ₂ µg/m ³	NO ₂ µg/m ³

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 µS/cm	BOD mg/L	TSS mg/L	TN mg/L	TP mg/L

Noise Quality Results

Site No.	Date of Testing	Site Location	L _{Aeq} (dBA) (Government Standard)	
			Day Time	Night Time

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

7. SUMMARY OF KEY ISSUES AND REMEDIALACTIONS

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

8. APPENDIXES

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

SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name Contract Number

NAME: _____ DATE: _____

TITLE: _____ DMA: _____

LOCATION: _____ GROUP: _____

WEATHER CONDITION:

INITIAL SITECONDITION: _____

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

Signoff



Name

Name

Position

Position

Appendix 9: DETAILS OF PUBLIC CONSULTATIONS
Details of Stakeholder Consultations was Held on November 3, 2017

Question raised and answers provided during consultations

1. V. Sellappan, Deputy President, Gandhi Salai, KailashNagar

	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. Then they will go next street.
3	scheme to has to be finished within stipulated time	Corporation arranging Project Management Consultancy for this Phase –II scheme. So, Corporation and PMC will closely monitor the works and will complete within period (3Years).

2. M. Thangamuthu, Retd, BHEL, KailashNagar

	Questions	Answers
1	Commercials hotels sewage load has to connect the proposed scheme.	The commercial sewage and institution sewage also considered in the proposed scheme.

3. Sellakannu, V. Sellappan, Kailash Nagar, Kattur

	Questions	Answers
1	Sewage odor has to control	Wherever the sewage pumping station are located in the Resident area, the odor control device like scrapper will installed to control odor.
2	scheme to has to be finished within stipulated time	Corporation arranging Project Management Consultancy for this Phase–II scheme. So, Corporation and PMC will closely monitor the works and will complete within period (3Years).
3	Sewage Treatment Plant has to locate faraway from resident areas.	The STP is located away from the local resident area.

4. V. JHIRUGNANSAMDAM, Lingam Nagar, Melapandamangalam, Kulumani Road

	Questions	Answers
1	Kindly consider the Lingam Nagar also under Phase –II.	The Lingam area will be covered under Phase –III (Next Phase).

5. S.E Rajendren, Welfare Association, Anna Salai, KailashNagar

	Questions	Answers
1	the pipe line connection, from outlet of building to Compound wall (inside premises) has to consider under contractor.	From Phase –II scheme, inside premises pipe line also will be laid under contractor.
2	Future expansion area also has to be considered in this Phase –II.	The overall sewerage master plan including detail design has kept ready. When-ever the population density criteria will match will local population (100 Nos / hectare) , the sewage line will be laid under future phases .

6 A. ArunaGiri, Win Nagar,Kattur

	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 TCC has to mention.	Will do necessary action in this regard.

7 P. Ramachandran, WinNagar

	Questions	Answers
1	Sewage pumping station has to locate for way from resident area.	Most of the cases, the SPS has to proposed at Remote area only. Due to land constraint, SPS-4 only located in the Resident area, the odor control device like scrapper will be installed to control odor issues.

8. R. Ganesan, VigneshNagar

	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. Then they will go next street.
3	scheme to has to be finished within stipulated time	Corporation arranging Project Management Consultancy for this Phase –II scheme. So, Corporation and PMC will closely monitor the works and will complete within period (3Years).
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.

9. R.Rajanobili,Gandhi Nagar, Kattur

	Questions	Answers
1	What is the execution period and operation and maintenance period	3 years execution period and 5 years for O & M
2	The scheme board has to keep in the street. In Board, the contractor Name, phone number and respective wards official number from TCC 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 assured to maintain road level.

10 P. Narayanasamy , Balaji Nagar ,Kattur

	Questions	Answers
1	Montfort school sewage has to consider in this phase.	Considered under Phase –II.

11. V. Ramachandran, Ellaikudi ,Kattur

TIRUCHIRAPPALLI CITY CORPORATION
Providing UGSS Scheme under AMRUT (Phase II)

DATE: 03.11.2017

Venue: Sakthi Mahal, Kattur

Sl.No	Name of the Officials (Thiruvallargal)	Address	Contact No.	Signature
1				
2				
15				
16	R. Chandrasekaran	4/163-c Vasanthanagar	9788758123	R. Chandra
17	M. K. Kumar	Thiruvallargal 3/369	9487359053	M. K. Kumar
18	M. Ramesh Kumar	3/367	9443291551	M. Ramesh
19	K. D. Ramesh Kumar	192	9894285149	K. D. Ramesh

20	V. Devasajulu	1/55E 1/14 ST Cauvery nagar	9803034385	<i>[Signature]</i>
21	P. VENKATACHARI	"	9443592800	<i>[Signature]</i>
22	V. PALANISAMY	Amman nagar south	9442221024	<i>[Signature]</i>
23	A. Mamickam	"	9788072570	<i>[Signature]</i>
24	A. R. SAIFULIS LA	IDA.	9443558516	<i>[Signature]</i>
25	R. Karanaj	5,	9782543238	<i>[Signature]</i>
26	P. Ahmed Nishkan	Plot no 8	9443720018	<i>[Signature]</i>
27	M. Ambalagan	5/137	9489702162	<i>[Signature]</i>
28	S. SIVARAJ	4/139	9790077115	<i>[Signature]</i>
29	L. Manohar	Plot no 20/4	944342290	<i>[Signature]</i>
30	R. G. Chandrashekar	Plot no K. V. Nagar	9443065648	<i>[Signature]</i>
31	V. Sathyaaj	Chinna Malar 20, 21	9487154789	<i>[Signature]</i>
32	B. Pushparaj	V. S. Nagar Meyyur	9443797558	<i>[Signature]</i>
33	P. Perumal	4th St. Pathimani	9187019	<i>[Signature]</i>
34	K. Palanimalai	officers Vigneshwar Presidential	9442134895	<i>[Signature]</i>
35	R. BALABHISHARAN	vigneshwar	9443462442	<i>[Signature]</i>
36	J. C. ROBERT FERVADE	Gandhinagar 8th Street #122 (Coimbatore)	9894558550	<i>[Signature]</i>
37	M. S. S.			
38	M. Chidambaram	Arundhan	9489702162	<i>[Signature]</i>
39	V. VELAYUTHAM	Arundhan	944202894	<i>[Signature]</i>
40	J. THIAGU	Ammanur N. S. Nagar	9442425502	<i>[Signature]</i>
41	K. KARUPPU	Ammanur N. S. Nagar	9442626158	<i>[Signature]</i>
42	A. MANGAZART	Ammanur N. S. Nagar	9894911161	<i>[Signature]</i>



No	Name	Address	Contact no	Signature
43	M. GANESAN	H/164F Valarathnagar Kattur	9894788310	N. Ganesan
44	V. Ramamoorthy	15, Andal Nagar East Ambikapuram	9443312133	V. Ramo
47	R. Ramesh (Rashe Krishnan)	Adarsh Mahal Ammavala Sengudi	9443721940	R. Ramesh
49	M. Narasethi Kikk	Trichy - 620011 21	9442828979	M. N. E
50	K. Belam	79	9600489112	K. Belam
52	A. NATARAJAN	WIN NAGAR	9442531170	A. Natarajan
53	S. DOSS	- do -	985740011	S. Doss
54	A. ARUNAGIRI	- do -	9502594797	A. Arunagiri
55	V. BALAKRISHNAN	KATTUR	9442393863	V. Balakrishnan
56	S. KANNAYAN	3/21 KATTUR	9025394117	S. Kannayan
57	T. KARUPPANNAN	Vasanthanagar katti	971593957	T. Karuppannan
58	M. GOVINDARAJAN	"	9787485955	M. Govindarajan
59	A. Radhakrishnan	Kailashnagar	9786992644	A. Radhakrishnan
60	R. NAVANEETHA KRISHNAN	Kailashnagar Gandhinagar	9443673788	R. Navaneetha
61	M. Thangamathi	Kailashnagar	9345124778	M. Thangamathi
62	E. C. RAJENDRAN	Nos 5/10 Kailash Nagar	9652948069	E. C. Rajendran
63	N. BANDARAJAN	16, KANDY NAGAR II M. K. KOTTA	979077264	N. Bandarajan
64	J. PAREMELALAN	40, main Road Sajeevan Nagar	9443532811	J. Paramelalan
65	V. RAJARAJAN	43 / 915th St, Basini Nager	9708041406	V. Rajarajan
67	T. JOHN SELVARAJ	1/2, V. V. COTTAGE, VIGNESH NAGAR	9865725480	T. John Selvaraj
68	A. JOHN PAUL	RAMANENDRA NAGAR	9842440465	A. John Paul
69	M. Chellakannan	Kailash Nagar	9842463607	M. Chellakannan
70	V. Balaraman	Blowm BSB 3rd 4	98651202993	V. Balaraman
71	C. SUTHANTHIRAN	Prakash Nagar	8838394952	C. Suthanthiran
72	P. Mohi Kalyan	North Kattur, Vayalur	9794652676	P. Mohi Kalyan
73	P. Jeyagan	Quarantine Zone	9790053488	P. Jeyagan
74	M. A. FRANCIS	Quarantine Zone	9942320866	M. A. Francis

Sl no	Name	Address	Contact no	Signature
75	P. Rajendran	12, Thimaltham St	9443590698	
76	V. Palakrishnan	Sengamangal		
77	P. Gomatheswarar	157.5 H Street Ammal Nagar Extra	9487667577	
78	P. Sivakumar	Indragiri Vengal Nagar	9597780406	
79	D. Suresh	Sengamangal	9789333889	
80	M. Srinivasan	Sengamangal	9442408000	
81	S. Balraj	154, Changanallur	9443302621	
82	M. Srinivasan	Sengamangal	9787198839	
83	G. Lakshminarayana	2/143 Changanallur	9585557673	
84	P. Arunachalam	87, Changanallur Extra	94421-36485	
85	A. Subramanian		9688338861	
86	R. Srinivasan	6A Changanallur	9442776757	
87	R. Srinivasan	Changanallur	9442005340	
88				
89	V. Gopalakrishnan	10, NGURU - ST SANJEEV NAGAR WARD - 7 & 8	9443821241	
90				
91	S. Srinivasan	57 Changanallur	9600491363	
92	A. Divakaran	Changanallur	9442539794	
93	V. Rajagopal	- do -	9486122880	
94	K. Balasubramanian	Janaki Amal	9443765678	
95		Arumayapuram		
96		Vengal		
97	V. Ramesh Kumar	No 344 Changanallur	9944530751	
98	S. Thangaraj	4/28 Vignesh Nagar	9524436941	
99	S. Subramanian	Vignesh Nagar	9443688578	
100	T. Devi	6/175, Vengal Nagar, North Kattur TR	8903406180	
101	Rengaraj	Vengal Nagar North Kattur TR - 19	9443766195	
102	K. Venkatesh	No. 7, M. Nagar D. Nagar - (TR-19)	9786639440	

Sl	Name	Address	Contact No	Yr.
	L. Vishwanathan Dharm. Thiruvani	115, Diamond Corridor Lorainu Main Dharm Association	94431-00342	h
	M. Sivasubramanian S. Kalippan	3 MAAR. TR 18 3/826 Venugopalnagar	9790077187 9442502859	guy M
	M. Gopasudhan S. Chandrasekar	3/814 V. Nagar Balaji Nagar	9442168923 944383374	SQ M
	P. Prasad S. S. S. S. S. S.	HOTAS Main T.K. S. Nagar 30th cross street 31st cross street 64th cross street	99652711196 9452842395 960029249	of. cell V 95000 S. S. S. S. S.
	U. Balan M. JAYARAJ	3/814 V. Nagar Balaji Nagar	9914156781 9443764611	LR W
	V. JAYACHANDRAN P. KANDASAMY	Amman Nagar 3/11/11/11/11/11	9442056413 946006359	Vijay K
	S. STALIN S. XAVIER Jayase-	3/10/11/11/11/11/11 4/93 K. Nagar	9290180587 9842526527	S. S. S. S. S.
	M. William Chelladurai K. S. Sivaramkrishnan	Plot 24 A, 1st main Amman Nagar 4/168, V. Nagar Kattur, Trichy-19.	9944186581 9442503127	S. S. S. S. S.
	S. S. Krishnamurti	Plot no 96, 1st cross street Amman Nagar, Kattur Trichy 19.	9443112643	S. S. S. S. S.
	S. Gowthaman	21A, Ganesh Nagar 3rd cross, 5th main Kattur, Trichy 19.	9443153507	S. S. S. S. S.
	S. S. S. S. S. S.	22A, Ganesh Nagar Main - 2nd cross, 7th main	9787555558	S. S. S. S. S.
	C. GURUSAMY	Plot. 6 Amman Nagar 3rd St KATTUR - TRY - A	9974079102	G
	C. DURAIRAJ	Balaji Nagar 8th cross, 8th cross	9600330886	S. S. S. S. S.

Name	Address	Contact No	SM
D. HARIKRISHNAN	32/24th Thiru Varku Nagar Puthu - Trichy	9765577091	Shay
S. MAHENDRAN	10-11 Saimanamalapuram Nagar - Adambur mdtc	9442909100	off
P. DHANANAJ	320, 67th St. Annam Nagar (Annam Nagar Assn)	9894989037	P. Dhana
S. MANIMURUGAN	2135A Gramesh Nagar Kattur - TRY - 19	9952800204	S. Mani
T. MOHANADASS	4/155, 1st Varadhu Narik Kattur	9442688917	T. Mohan
M. Balaji	307, 8th St, Kattur 6th St. S. S. Nagar	99469- 47881	M. Balaji
A. MANIKANDAN	PLAT 10th Cross OTOKul Nagar, Kattur	94437 06434	A. Mani
P. Rajaraman	8 Secular Shanmuga Nagar	9894830601	P. Rajaraman
R. Sivakumar	President Shanmuga Nagar	9943879637	R. Sivakumar
V. Goundaraj	#1153 Varadhu Nurt North Kattur	V. Goundaraj 97897509	V. Goundaraj
P. Palanivel	Adurisa Shanmuga Nagar 50A. Shanmuga Nagar	9443760855	P. Palanivel
A. Sheikh Masood	Jauli Serenadi, Shanmuga Nagar Welfare Assn U. T. Malai, Trichy Tamil Nadu	94437 86203	A. Sheikh Masood
S. V. Velayuthan	Shanmuga Nagar Welfare Assn U. T. Malai Trichy	9443994189	S. V. Velayuthan
M. Anbalagan	Vignesh Nagar Vignesh Nagar Welfare Assn	9443894088	M. Anbalagan

Name	Address	Contact no	Signature
(b) சிவசுந்தரன்	116 A, 56/700001, 4 th cross, சிவசுந்தரன் மன்றம்	9944295242	Hrit
M. சிவசுந்தரன்	4/345, 60 th cross, Landmark	990344399	[Signature]
S. சிவசுந்தரன்	4/282 - சிவசுந்தரன்	9442207327	[Signature]
S. சிவசுந்தரன்	4/34, 60 th cross, சிவசுந்தரன் 4/28/1/2/3/4 2/2/8/9/10 2/2/8/9/10	9952465361	S. Arthan
V. சிவசுந்தரன்	சுமார் 20, சிவசுந்தரன் அருள்மொழி சிவசுந்தரன்	9994904661	M.A
M. சிவசுந்தரன்	2/2/8/9/10		[Signature]
R.D. சிவசுந்தரன்	Plot NO 29 III CROSS WEST VIEWAS NEAR T-8	9842169409	R.D. [Signature]
P. SYED MAHABOOB	30/7/5/1/1/3/4 2/2/8/9/10/11/12/13 2/2/8/9/10/11/12/13	9524156695 P. Syed	P. Syed
P. DEENADAYALAN	சிவசுந்தரன் சிவசுந்தரன் மன்றம் சிவசுந்தரன் 30	9600499106	P. Deenadayalan
S. RAJENDRAN	சுமார் 63 சுமார் 63	9655053575	[Signature]
L. Vijay Kumar. PE	Plot No. 3, சிவசுந்தரன் மன்றம் சுமார் 63, சிவசுந்தரன் மன்றம்	944263446	[Signature]
I. AMALRAT	Plot No 29, West அருள்மொழி Kattur Trichy - 19	986548730	[Signature]

Name	Address	Contact No	Sig
P. Arunachalam	18 Green meadows North Kattu Tr. 19	945726698	
M. Nandagopalom	9/824 Kinnigopal Nagar Kattin Tichy, 11	9788068574	
S. JAYAPAL K. Thangaraj	12. KALAIYANAR NAGAR 7115. Periyar Nagar Kattani Tichy.	8778128700	
A. M. Sumanth Kumar	75. Madurai Road, Tichy	9585223929	
A. PANDORA SIVASUBRAMANIAM	NO. 32 NAGANANDI ST EXT K. KATTAN TICHY	9443493659	
P. SETHU	Plot 142 Periyar Nagar Nagor St, Street Maha Thudal Kattu	7094258511	
K. Melindurai	4, 15/2115 Srinagar Saij Prakash Nagar Ext.	9444385927	
S. John Joseph	1/324 Philominal-puram 3rd South Kattu Tr.	9677626635	
S. Anand	4/3 K. K. Nagar Kattani Tichy	9345798711	
S. Arangan	3/276 21/2 Melindurai K. K. Nagar	9790053457	
P. S. Srinivasan	4/92 K. K. Nagar Tichy	9791218600	
A. S. Srinivasan	Tichy - 11	9442659545	
S. Ramakrishna	21/21/11/11 St	9994314271	
A. Srinivasan	15/39 K. K. Nagar K. K. Nagar	99521548801	
R. K. P. Srinivasan			
S. Srinivasan	"Srinivasan St" 4767A Srinivasan K. K. Nagar	9442502907	

Name	Address	Contact No	Sig
Pankaj Murali	76 Railnagar East Ambikogan Trichy 4.	81489410 -19	Pankaj
M. Anmol	76, Anmol Vishal Illam, Sanjeevi Nagar, South Extn, Trichy-620002	9003376652	Anmol
K. Munugasam	87, Sanjeevi Nagar South Extn, Trichy-620002	9894287213	K. Munugasam
J. PARIMELUNGAN	40 minnimal. Sanjeevi Nagar	9443532811	J. Parimelungan
J. S. Manoj	A. A. S. Manoj Trichy	9488610365	J. S. Manoj
Jeeva Prasanna	3/1-10A Gandhi Street TRICHY-4	9443592955	Jeeva
J. S. Srinivasan	79, Railnagar	9442181403	J. S. Srinivasan
J. Mohanlal Shrin	79, Railnagar	9790222955	J. Mohanlal Shrin
K. Meenakshi.		9942720204	K. Meenakshi
K. Srinivasan	1/25 Gandhi Nagar Tali	9003375282	K. Srinivasan
A. Fathima Alphon	3/20 B.S. Srinivasan Bhaskara	9482769963	A. Fathima Alphon
S. Udayan			S. Udayan
Dr. Chandrayan	100, Amest, Malayappa TRICHY-10	7708483539	Dr. Chandrayan
M. GURUSAMY	3rd cross Bhaskara	9486390669	M. Gurusamy
S. CHANDRASEKARAN MALAYAPPA NAGAR WELFARE ASSOCIATION.		7904070600	S. Chandrasekaran
D. J. HAYAKUMAR	8A. Anmol Street Malayappa Nagar Trichy	9944773333	D. J. Hayakumar

(X) 1. பரமசிவன் - 99 44530751
 No/3 4th mg
 B.Banay Man
 அந்த: 63

M. சோனி (வழிநோக்கியலாளர்)
 அலுவலகம், அமைச்சர் அலுவலகம், அமைச்சர் அலுவலகம்
 அமைச்சர் அலுவலகம், அமைச்சர் அலுவலகம்
 தொலை: 9542551376

Photographs of Stakeholder Consultations held on November 3, 2017



Notice issued to house owners regarding work.

STP Awareness program

Public Consultation during Construction Time



Environmental Onsite Training by CMSC



Public consultation on sewerage network connection



HH level awareness on sewerage line connection



HH level awareness on sewerage line connection- interaction with participant



Awareness on Project documentation on Environment and Social –Team Leader addressing the participants



Awareness on Project documentation on Environment and Social –City Engineer, Trichy City Corporation addressing the participants

Consultation at STP site and Vin Ngar and Raja Rajeswari Nagar




PUBLIC GREVANCE ADDRESSED BY Trichy Corporation AT KEELAKALKANDAR KOTTAI



CMSC Team Leader giving clarification to Public AT KEELAKALKANDAR KOTTAI



<p>Vin Nagar , Zone-3, SPS Team visting for public consultation</p>	<p>Vin Nagar , Zone-3, SPS interaction with people</p>
	
<p>Vin Nagar , Zone-3, interaction session</p>	<p>Vin Nagar , Zone-3, CMSC Team Leader explaining about SPS</p>
	
<p>Raja Rajeswari Nagar, Zone-4, SPS, Public gathering for meeting</p>	<p>Raja Rajeswari Nagar, Zone-4, SPS, Municipality staff and Local people interaction</p>
	
<p>Raja Rajeswari Nagar, Zone-4, SPS, Municipality staff and Local people interaction</p>	<p>Raja Rajeswari Nagar, Zone-4, SPS, Municipality staff and Local people interaction</p>

Appendix-10 - Procedure proposed for Controlled Blasting and permission from District collector

PROCEDURES INVOLVED IN CONTROLLED BLASTING

UGSS to Trichy Municipality Package I Collection System Works are under Progress. During execution, at some of the places in all the zones, hard rock strata is identified. For laying sewer pipeline in these areas, the hard rocks must be removed to the required depth. In these Identified areas the excavation of hard rocks can be done by controlled blasting mechanism. Zones 1, 2, 3, 4 and 6 have been identified as hard rock areas. The quantum of rock to be removed by Control blasting has been tentative estimated for a length of 65.6 km in all the 5 Zones of Package 1. Already we have received permission from District collector to execute the control blasting only awaiting NOC from ADB. The Step by Step procedure of carrying out Control Blasting operations is enumerated below

❖ Drilling Holes:

For carrying out the control blasting, the first step is to remove the topsoil and to drill holes on the hard rock for placing the explosive charges. The holes are drilled with the help of air compressors with 3ft rods for drilling operations. The holes driven with a depth of 2ft and 20mm dia. The distance between each hole driven is 1.5ft and maximum 10 holes will be driven for one round of controlled blasting. The holes are driven only by competent licensed explosive contractors.

❖ Placing Charge at each hole:

After the drilling operations on the hard rock surface, the explosive charges are placed inside the drilled holes. In these step two components are mainly used, they are Electric Detonator and the Explosive charge. The explosive charge used for the controlled blasting activity is Nitrate Mixture and each nitrate mixture charge is about 125g. The amount of Nitrate mixture used in the controlled blasting activity is about 40gms i.e. one third of the total Nitrate Mixture charge. After loading the holes with the nitrate mixture, the Non electric detonator is attached to each hole i.e. one Non electric detonator for one nitrate mixture charge/hole.(In other cases where blasting is carried out like quarries the amount of nitrate mixture used is triple the times i.e. 375g). After the Nonelectric detonators are fixed to the nitrate mixtures, the wiring is done and the charges are interconnected using Nonel method of technology. The Licensed Explosive contractor has the proper license for the storage and transport of the explosive charges. The explosive contractor has a separate vehicle for the transport of the explosives. The explosives are bought and brought to the site for the required quantity only.

❖ **Detonating the charge:**

During controlled Blasting the following safety and precautionary arrangements are followed.

- Proper prior notice will be issued to the residents in the vicinity of the blasting area before commencing the blasting activity duly apprise them about how the interests of the residents is safeguarded during the operation.
- Advance information will be given to the police officials before the blasting activity.
- During Controlled Blasting, flagman will be placed at both ends of the road under operation to block the road and to give caution to Public
- Minimum Explosive quantity will be used for the Controlled blasting in the residential area by the qualified licensed Explosive personnels.
- Trenches are properly covered with sandbags and the top of the trench will be covered with MS steel plate of adequate thickness.
- Above the MS plate, a layer of shade net is covered to prevent the movement of debries from the blasting area and over which sandbags are placed.
- Before Commencing of controlled blasting Works, it will be informed to the residents about the activity of works through public addressing system.
- Adequate Signages will be placed around the site with visible warning boards and indicating the start and completion of the blasting.

After following all the necessary safety and precautionary measures the controlled blasting activity will be carried out. The wiring from the Nonelectric detonators are connected to a battery box using Nonel technology which will be operated from a safe distance. When the button is pressed in the battery box it initiates an electric charge which passes through the Non electric detonators and ends up in firing the explosive charge, thereby it leads to the cracks and breakage of rocks which will be removed by earth moving equipment.

❖ **Minimum Explosive usage:**

Based on the past experiences of the licensed blasters and that of the Package I Contractor with those blasters, Controlled blasting will be carried out in Tiruchirappalli UGSS Project using advanced Non-Electric Detonators (NONEL) technologies with minimum explosive usage.

PROCEEDING OF THE DISTRICT COLLECTOR, TIRUCHIRAPPALLI

PRESENT : THIRU.S. SIVARASU, I.A.S.,

Roc.D2/25251/2019

Dt : 22.10.2020

Sub : Explosive Act and Rules – Tiruchirappalli District – Tiruchirappalli City Corporation – UGSS – work of "Providing Under Ground Sewerage Scheme to Tiruchirappalli Corporation (Phase II – Package I) – Permission to conduct blasting operation for foundation excavation work at Tiruchirappalli Town - requested – Order issued.

- Ref : 1) Commissioner, Tiruchirappalli City Municipal Corporation letter Roc.No.1228/2015/E7(Main) Dt: 05.03.2020.
2) Revenue Divisional Officer, Tiruchirappalli, letter No. Roc.No.A1/1702/2020 Dt : 22.09.2020.

--XX--

ORDER :

In the reference 1st cited, the Commissioner, Tiruchirappalli City Municipal Corporation has informed that the work of "Providing Under Ground Sewerage Scheme (Collection System) to Tiruchirappalli Corporation (Phase II – Package I) awarded to the Contractor M/s. Subbaya Construction Company Limited, Chennai.

The works, as per the project such as construction of Manhole, Sewage pumping stations, Lifting Stations and laying of sewer pipeline are in progress in the designed areas.

M/s SCCL, has submitted that during the earth work excavation in the following locations, hard rock is met with at 2m below the ground level and this hard rock has to be removed by controlled blasting method only. The contractor had requested permission for conducting controlled blasting wherever hard rocks are encountered.

The area covering under Package of work are as follows.

Sl.No.	ZONE	WARD NO
01.	ZONE-1	7(p), 28(p), 29(p) & 61(p)
02.	ZONE-2	7(p), 27(p), 29(p), 30(p) & 32(p)
03.	ZONE-3	7(p), 28(p), 29(p), 30(p), 32(p), 61(p), 62(p), 63(p), 64(p) & 65(p)
04.	ZONE-4	29(p), 30(p), 32(p), 61(p), 62(p) & 63(p)
05.	ZONE-6	30(p), 31(p) & 63(p)

The Contractor M/s. Subbaya Construction Company Limited, Chennai has informed to the Municipal Corporation, Tiruchirappalli City that the blasting operation have to be conducted through following licensed holders.

- License No.E/SC/TN/30/1060 (E56261) (Licence Valid upto : 31.03.2021)
2. Thiru.S. Pandiyan, S/o. Shanmuganaikar, Tirupur.
Licence No.E/SC/TN/30/1974(E98391)
(Licence Valid upto : 06.04.2022)

The above contractor has proposed to conduct controlled blasting with the use of Jellatin sticks alone Necessary rubber strips and sand bags will be utilized for precautionary measures. The contractor has assured to take care of all necessary precautions for traffic and public safety during the blasting operation.

Further, the Corporation Commissioner has requested to grant permission for conducting controlled blasting operations through the License holders for the above requested areas with certain condition. The Revenue Divisional Officer, Tiruchirappalli and the Assistant Director(Mines), Tiruchirappalli have jointly inspected and recommended to grant permission with certain conditions.

Accordingly, on the request of the Commissioner, City Corporation, Tiruchirappalli and the recommendation of the Revenue Divisional Officer, Tiruchirappalli, Permission is hereby accorded to Tvl. Subbaya Constructions Company Limited for controlled blasting of hard rock through valid licence holder for the above area covered in Phase II – Package I subject to the following conditions.

1. The details of purchase and usage of Gelatin sticks to the project work is to be reported with in time every week to the inspection authorities.
2. If any accident and incident may occur, the contractor is whole responsible for it.
3. The contractor has to have comprehensive insurance coverage for all those engaged for this task.
4. Blasting materials should be purchased from the valid Licensed Seller.
5. All safety measures have to be taken and the operation have to be undertaken during the day hours.
6. Rock particles has to be handed over to the Assistant Director(Mines), Tiruchirappalli.
7. All precautionary measures have to be taken and protocols to be followed regarding Covid-19.

Sd/-S. Sivasasu,
District Collector,
Tiruchirappalli.

//By Order//

For District Collector

To :-
The Commissioner, 7
Tiruchirappalli City Corporation,
Tiruchirappalli.

Copy to the Revenue Divisional Officer, Tiruchirappalli for necessary action.

Copy to the Assistant Director Mines and Minerals, Tiruchirappalli for necessary action.

Copy to the Tv.Subbaya Constructions Company Limited, New No.21 (Old No.26), Soundrapandian Street, Ashok Nagar, Chennai – 600 083.

**Appendix 11:
Clearances Obtained.
Consent to establish Permission from PCB for water and air:**



TAMIL NADU POLLUTION CONTROL BOARD

Category of the Industry :

RED

CONSENT ORDER NO. 2001228988767 DATED: 13/02/2020.

PROCEEDINGS NO.T1/TNPCB/F.1311TRY/RL/TRY/A/2020 DATED: 13/02/2020

SUB: TNPC Board-Consent for Establishment-M/s. TRICHY CITY CORPORATION SEWAGE TREATMENT PLANT - KEELAKALKANDARKOTTAI , S.F. No. 81, KEELAKALKANDARKOTTAI village, Thiruverumbur Taluk and Thiruchirapalli District - for the establishment or take steps to establish the industry under Section 21 of the Air(Prevention and control of Pollution)Act,1981, as amended in 1987(Central Act. 14 of 1981)-Issued -Reg.

REF: 1. OCMMS application No:28988767 dated 27/11/2019
2.IR.No : F.1311TRY/RL/AE (M)/TRY/2020 dated 29/01/2020
3.Minutes of CCC vide Item No:266-12 dated 06/02/2020

Consent to establish or take steps to establish is hereby granted under Section 21 of the Air (Prevention and control of Pollution) Act,1981, as amended in 1987 and the Rules and Orders made there under to

THE COMMISSIONER,
M/s . TRICHY CITY CORPORATION SEWAGE TREATMENT PLANT - KEELAKALKANDARKOTTAI
S.F No.81,
KEELAKALKANDARKOTTAI Village,
Thiruverumbur Taluk,
Thiruchirapalli District.

Authorizing occupier to establish or take steps to establish the industry in the site mentioned below:

S.F No. 81,
KEELAKALKANDARKOTTAI Village,
Thiruverumbur Taluk,
Thiruchirapalli District.

This Consent to establish is valid upto **March 31, 2024**, or till the industry obtains consent to operate under Section 21 of the Air (Prevention and control of Pollution) Act, 1981, as amended in 1987 whichever is earlier subject to special and general conditions enclosed.

**For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai**

To
THE COMMISSIONER,
M/s.TRICHY CITY CORPORATION SEWAGE TREATMENT PLANT - KEELAKALKANDARKOTTAI,
TRICHY CITY CORPORATION ,
BHARATHIDSAN SALAI, TIRUCHIRAPPALLI TALUK
TIRUCHIRAPPALLI DISTRICT,Thiruchirapalli District
Pin: 620001

This is computer generated order. Signature is not required. □

Copy to:

1. The Commissioner, TIRUCHIRAPPALLI-Corporation, Thiruverumbur Taluk, Thiruchirappalli District .
2. The District Environmental Engineer, Tamil Nadu Pollution Control Board, THIRUCHIRAPALLI.
3. The JCEE-Monitoring, Tamil Nadu Pollution Control Board, Tiruchirappalli.
4. File

This is computer generated order. Signature is not required. 12

SPECIAL CONDITIONS

1. This consent to establish is valid for establishing the facility for the manufacture of products/byproducts (Col. 2) at the rate (Col 3) mentioned below. Any change in the product/byproduct and its quantity has to be brought to the notice of the Board and fresh consent has to be obtained.

Sl. No.	Description	Quantity	Unit
Product Details			
1.	Treatment and disposal of 37 MLD of sewage generated from 12 wards of Trichy city corporation and STP employees	37.0	MLD

2. This consent to establish is valid for establishing the facility with the below mentioned emission/noise sources along with the control measures and/or stack .Any change in the emission source/control measures/change in stack height has to be brought to the notice of the Board and fresh consent has to be obtained if necessary.

I Point source emission with stack :				
Stack No.	Point Emission Source	Air pollution Control measures	Stack height from Ground Level in m	Gaseous Discharge in Nm ³ /hr
1	DG500 KVA	Acoustic enclosures with stack	6	1368
2	DG500 KVA	Acoustic enclosures with stack	6	1368
II Fugitive/Noise emission :				
Sl. No.	Fugitive or Noise Emission sources	Type of emission	Control measures	

3. **Additional Conditions:**

1. The unit shall provide Air Pollution control /Acoustic measures as proposed and shall satisfy the ANL/AAQ/emission standards prescribed by the Board.
2. The unit shall construct compound wall of sufficient height around the STP site.
3. The unit shall provide water sprinkling arrangement in the site to avoid dust emission during construction.
4. The construction materials shall be covered during transport and the necessary water sprinkling arrangements shall be provided for hauling roads.
5. The unit shall take necessary precautionary measures so that the agricultural field around the site shall not get affected by any means during construction and operation of the sewage treatment plant.
6. The unit shall develop green belt in and around the unit premises and shall furnish exact greenbelt area earmarked/developed as per norms in the unit premises
7. In case of revision of consent fee by the government, the unit shall remit the difference in amount within one month from the date of notification. Failing to remit the consent fee, this consent order will be withdrawn without any notice and further action will be initiated against the unit as per law.
8. The unit shall not use 'use and throwaway plastics' such as plastic sheets used for food wrapping, spreading on dining table etc., plastic plates, plastic coated tea cups, plastic tumbler, water pouches and packets, plastic straw, plastic carry bag and plastic flags irrespective of thickness, within the industry premises. Instead it shall encourage use of eco friendly alternative such as banana leaf, arecanut palm plate, stainless steel, glass, porcelain plates/cups, cloth bag, Jute bag etc.,
9. The unit shall comply with the E- waste management Rules 2016. E- Waste as listed in Schedule-I, generated by them shall be channelized through collection centre or dealer of the authorised producer or dismantler or recycler or through designated take back service provider of the producer to authorised dismantler or recycler. The unit shall maintain records of e- waste generated by them in Form and make such records available for scrutiny by the TNPCB. The unit shall file annual returns in Form-3, to the TNPCB on or before the 30th day of the June following financial years.

For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai

GENERAL CONDITIONS

1. This consent to establish cannot be construed as consent to operate and the unit shall not commence the operation without obtaining the Consent to operate.
2. The applicant shall make a request for grant of consent to operate at least thirty days, before the commissioning of trial production.
3. Any Change in the details furnished in the conditions has to be brought to the notice of the Board and got approved by the Board, before obtaining consent to operate under the said Act.
4. The unit has to comply with the provisions of Public Liability Insurance Act, 1991 to provide immediate relief in the event of any hazard to human beings, other living creatures/plants and properties while handling and storage of hazardous substances (wherever applicable).
5. Consent to operate will not be issued unless the unit complies with the conditions of consent to establish.
6. The unit shall provide adequate water sprinklers for the control of dust emission during the loading and unloading of construction material so as to minimize the dust emission.
7. The unit shall provide water sprinklers along the temporary roads inside the premises to avoid fugitive dust emission during the vehicle movements.
8. The unit shall develop green belt of adequate width around the premises.
9. In case there is any change in the management, the unit shall inform the change with relevant documents immediately.

**For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai**

** This consent order is computer generated by OCMMS of TNPCB and no signature is needed**



TAMIL NADU POLLUTION CONTROL BOARD

Category of the Industry :

RED

CONSENT ORDER NO. 2001128988767 DATED: 13/02/2020.

PROCEEDINGS NO.T1/TNPCB/F.1311TRY/RL//TRY/W/2020 DATED: 13/02/2020

SUB: TNPC Board-Consent for Establishment-M/S TRICHY CITY CORPORATION SEWAGE TREATMENT PLANT - KEELAKALKANDARKOTTAI S.F No. 81, KEELAKALKANDARKOTTAI Village, Thiruverumbur Taluk, Thiruchirappalli District - for the establishment or take steps to establish the industry under Section 25 of the Water (Prevention and control of Pollution) Act, 1974, as amended in 1988 (Central Act 6 of 1974)- Issued- Reg.

REF: 1. OCMMS application No:28988767 dated 27/11/2019
2. IR.No : F.1311TRY/RL/AE (M)/TRY/2020 dated 29/01/2020
3. Minutes of CCC vide Item No:266-12 dated 06/02/2020

Consent to establish or take steps to establish is hereby granted under Section 25 of the Water (Prevention and control of Pollution) Act, 1974, as amended in 1988 (Central Act 6 of 1974) (hereinafter referred to as 'The Act') and the Rules and Orders made there under to

THE COMMISSIONER,

TRICHY CITY CORPORATION SEWAGE TREATMENT PLANT - KEELAKALKANDARKOTTAI

Authorizing occupier to establish or take steps to establish the industry in the site mentioned below:

S.F. No.81,

KEELAKALKANDARKOTTAI Village,

Thiruverumbur Taluk,

Thiruchirappalli District.

This Consent to establish is valid upto **March 31, 2024**, or till the industry obtains consent to operate under Section 25 of the Water (Prevention and control of Pollution) Act, 1974, as amended in 1988 whichever is earlier subject to special and general conditions enclosed.

**For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai**

To

THE COMMISSIONER,

M/s. TRICHY CITY CORPORATION SEWAGE TREATMENT PLANT - KEELAKALKANDARKOTTAI,

TRICHY CITY CORPORATION ,

BHARATHIDASAN SALAI, TIRUCHIRAPPALLI TALUK

TIRUCHIRAPPALLI DISTRICT,

Pin: 620001

Copy to:

1. The Commissioner, TIRUCHIRAPPALLI-Corporation, Thiruverumbur Taluk, Thiruchirappalli District .

2. The District Environmental Engineer, Tamil Nadu Pollution Control Board, THIRUCHIRAPPALLI.

3. The JCEE-Monitoring, Tamil Nadu Pollution Control Board, Tiruchirappalli.

4. File

This is computer generated order. Signature is not required. 1

SPECIAL CONDITIONS

1. This consent to establish is valid for establishing the facility for the manufacture of products/byproducts (Col. 2) at the rate (Col 3) mentioned below. Any change in the product/byproduct and its quantity has to be brought to the notice of the Board and fresh consent has to be obtained.

Sl. No.	Description	Quantity	Unit
Product Details			
1.	Treatment and disposal of 37 MLD of sewage generated from 12 wards of Trichy city corporation and STP employees	37.0	MLD

2. The unit shall provide Sewage Treatment Plant and /or Effluent Treatment Plant as indicated below.

a Sewage Treatment Plant:			
Treatment status: Individual STP			
SL. No.	Name of the Treatment Unit	No. of Units	Dimensions in metres
1.	Receiving Chamber	1	4.3M x 4.5M X 3.5M
2.	Coarse Bar Screen Mechanical	1	3.8 Mx1.35 M x1.5 M
3.	Coarse Bar Screen Manual	1	3.8Mx1.3Mx1.5M
4.	Fine Bar Screen Mechanical	1	3.8Mx1.3Mx1.5M
5.	Fine Bar Screen Manual	1	3.8Mx1.3Mx1.5M
6.	Detritor	2	8.5Mx8.5Mx1.3M each
7.	Sequential Batch Reactor (SBR)	4	36Mx30Mx5.8M each
8.	Air Blower	1	24Mx7Mx5M
9.	Thickener feed sump	1	5Mx4Mx3.5M
10.	Gravity Sludge Thickener	1	Dia 16 M x 4.0 M H
11.	Centrifuge feed sump/Thickened Sludge sump	1	3.2Mx3.2Mx3.5M
12.	Centrifuge unit	1	7.5Mx5Mx4.5M
13.	Chlorine Contact Tank	1	27Mx10Mx3.5M
14.	Chlorine Dosing system unit	1	12Mx7.5Mx5M
15.	Treated sewage water sump	1	10Mx8.5Mx3.3M
b Effluent Treatment Plant:			
Treatment status: No trade effluent and hence does not arise			
SL. No.	Name of the Treatment Unit	No. of Units	Dimensions in metres
1.			
2.			

3. This consent to establish is valid for establishing the facility with the below mentioned outlets for the discharge of sewage/trade effluent. Any change in the outlets and the quantity has to be brought to the notice of the Board and fresh consent has to be obtained.

Outlet No.	Description of Outlet	Maximum daily discharge in KLD	Point of disposal
Effluent Type : Sewage			
1.	Treated Sewage	37000.0	Uyyankondan canal at Alathur village
Effluent Type : Trade Effluent			

4. **Additional Conditions:**

1. The unit shall provide sewage treatment plant as proposed and shall provide RO system with Reject management System.
 2. The unit shall submit proposal for RO system with Reject management system and for the utilization of RO permeate for beneficial purpose instead of discharging in to Uyyankondan Canal within three months.
 3. The unit shall explore the possibility of providing alternate treatment system instead of Chlorination.
 4. The STP plant shall be designed to achieve the STP standards prescribed by the Hon'ble NGT(PB) in order dt. 30.04.2019 in O.A. No.1069/2018 which are as follows:
S.No. Parameter Standards
(Applicable to all mode of disposal)
 1. pH 5.5 – 9
 2. BOD 10
 3. TSS 20
 4. COD 50
 5. Nitrogen – Total 10
 6. Phosphorus-Total(for discharge into ponds, lakes) 1
 7. Fecal Coliform (FC)(Most probable Number per 100 milli litre, MPN/100 ml) Desirable – 100
Permissible - 230
- Note :
- i. All value in mg/l except for pH and Fecal Coliform
 - ii. These standards will be applicable for discharge into water bodies as well as for land disposal/applications.
 - iii. Reuse/Recycling of treated effluent shall be encouraged.
5. The unit shall provide electro magnetic flow meter at the inlet and outlet of the STP and connect the same to the WQW centre, TNPCB, Chennai.
 6. The unit shall provide online continuous effluent monitoring system for the parameters pH, TSS and BOD at the inlet and outlet of the STP and connect the same to the WQW, TNPCB, Chennai.
 7. The unit shall provide 4 Nos of CCTV camera focusing the primary, secondary and tertiary treatment and connect the same to the WQW, TNPCB, Chennai.
 8. The unit shall not invite complaints from the near by public and farmers
 9. The unit shall not dispose the untreated/ partially treated/ treated sewage into the irrigation drains, nearby land and water sources nearby.
 10. The unit shall analyze quality of ground water in and around the STP site before commissioning of the STP as baseline data to assess the ground water quality in that area.
 11. The unit shall provide monitoring wells to assess the ground water quality before and after commissioning of the project in the area.
 12. The unit shall closely monitor the conveyance system of raw sewage to avoid leakages.
 13. The unit shall submit stability certificate for the sewage treatment plant structures.

**For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai**

Appendix- 12 Permission from ASI and PWD

Page 1 of 2

வினாவு விஞ்சல்
021856601
15/6/2020

F. No. T-19034/26/2019-M
Government of India
Archaeological Survey of India

Speed Post

"Dharmar Bhawan"
24, Tilak Marg, New Delhi
Dated:.....

10 JUN 2020

To,
The Superintending Archaeologist,
Archaeological Survey of India,
Chennai Circle, Chennai

Subject:- The proposal in respect of the Commissioner, Tiruchirapalli City Corporation, Tiruchirapalli for providing Sewerage collection system in the extended area of Corporation for UGSS in Tiruchirapalli under AMASR Act- regarding

Sir,

With reference to your letter no. 1/37/Tech/NMA/2018-19-749 dated 26.03.2019 on the subject cited above, I am to communicate the approval of the Competent Authority for providing underground Sewerage system in the protected area of Shiva Temple (Erumbisvara temple) subject to following condition:-

1. The work should be executed under the close supervision of SA Chennai Circle or any official from the circle to ensure that no archaeological remain, over the ground or under the ground is damaged.
2. The excavation/digging for laying the drain pipeline shall be undertaken by traditional method without use of heavy machinery.
3. No machine shall be used for carrying out the work in protected area.
4. If any ancient structure comes across during the excavation, the work shall be stopped immediately and the proper documentation shall be done.
5. If any statue or antiquity is recovered from the construction site, the same shall be kept in safe custody of SA, Chennai Circle.
6. The execution of the work of manholes should be constructed such a manner so as to gel with the overall ambience of the monument by resorting to selection of material, texture and colour.
7. While constructing the drain adequate measures must be taken to ensure that the area immediately beyond the drain on either sides does not get any effect of dampness.
8. It should be ensured that no damage is caused to monument or ancient structure under and above the ground.
9. No blasting operation shall be carried out in the protected area.

Further, it is stated that some encroachments have been noticed in the protected area of the said monument. Therefore you are requested to initiate urgent action against the offenders/encroachers for removal of encroachments.

https://asi.eoffice.gov.in/eFile/?x=*Lx7sjLY1d80a40OpRrUBVOKGsx0eBjy

6/10/2020

Yours faithfully,

(Arvin Manjul)

Director (Monuments-II)

✓ Copy to:- The Commissioner, Tiruchirapalli City Corporation, D.No. 58, Bharathidasan Salai,
Tiruchirapalli- 620001 for information and necessary action and also with the request to
remove the encroachment from protected area of the monument before take up the work.

F. No. 2-8/1106/2018-NOC/NMA
Government of India
Ministry of Culture
National Monuments Authority

24, Tilak Marg, New Delhi-110001
Dated: 12.05.2020

(3)

To

The Competent Authority (Southern Region)
Archaeological Survey of India
Chennai Circle, Fort St. George,
Chennai-600009.

Encl

Sub.: NOC to The Commissioner, Tiruchirappalli City Corporation, The Commissioner, Tiruchirappalli City Corporation, D. no. 58, Bharathidasan Salai, Tiruchirappalli- 620001, for Providing Sewerage Collection for Underground Sewerage scheme in Tiruchirappalli Corporation.- reg.

Madam,

This is in response to your letter F. No: 1235/NMA/CA (TN) 2018/1092 dated 25.02.2020 on the subject cited above.

In this context, I am directed to enclose herewith the recommendation of the National Monuments Authority given in its 267th meeting held on 18th March, 2020, for grant of permission, in the regulated area of the "Siva Temple", Tamilnadu declared as monument of national importance under Ancient Monuments and Archaeological Sites and Remains Act, 1958. The NOC is recommended to be granted with the terms and conditions mentioned in the report of CA, Chennai.

The recommendation of the authority and grant of permission by the C.A. is subject to the applicant obtaining other required clearances/NOCs from relevant agencies.

A copy of the approved building plan with the approved area marked in Red and certified by NMA is also enclosed herewith.

Encl.: As above.

Yours faithfully,

Amara Mudi

(AMAR MUDI)
Director (Consultant)
Tel No.- 011-23004694

Copy to:

1. The Director General, Archaeological Survey of India, 24, Tilak Marg, New Delhi-110001.
2. The Superintending Archaeologist, ASI, Chennai Circle, Chennai, Fort St. George, Chennai - 600009 (Tamilnadu) ; with the request to monitor the proposed construction work on the basis of the authenticated architectural drawing as approved by NMA.
3. The Commissioner, Tiruchirappalli City Corporation, D. no. 58, Bharathidasan Salai, Tiruchirappalli- 620001, This is for information only. The sanction copy will be issued by Competent Authority.

Permission for PWD

FROM
R.Baskar,
Executive Engineer,PWD,
R.C.Division,
Trichy-01.

PWD/WRD

TO
The Commissioner,
Trichy City Corporation,
Trichy.

Lr.No. 12.44/2019 / F.16074 Date. 21.12.2019

Sir,

Sub: UGSS - Tiruchirappalli City Corporation - Phase - II Package-3 Effluent discharge to Uyyakondan river - Permission from PWD Report submitted - Regarding.

Ref:

1. The Commissioner, Trichirappalli City Corporation, Trichy Roc.No.1228/2015/E7/(Main)/dated.28.8.19.
2. The Assistant Executive Engineer, PWD, R.C.Sub Division,Trichy Lr.No.F24/ 2019/AEE(Trichy)/Dt.21.10.19.
3. This office Lr.no:782M/2019/F.160C/D1/Dated. 04.11.2019
4. The Commissioner, Trichirappalli City Corporation, Trichy Roc.No.1228/2015/E7/(Main)/dated. 27.11.19.
5. The Assistant Executive Engineer, PWD, R.C.Sub Division,Trichy Lr.No.F24/ 2019/AEE(Trichy)/Dt.26.12.19.

With reference to the above subject the Commissioner, Trichy City Corporation has assured in the reference 4th cited that on completion of the sewage treatment plant project all the sewage entry points will be plugged and no raw sewage will be let into the Uyyakondan Channel in the City limit and from Palpannai to Alathur Village.

Based on the assurance of the Commissioner and the recommendation of the AEE, R.C.Sub Division, Trichy permission is granted under the following conditions for the proposed treated sewage let into the Uyyakondan channel on the LB @ LS 27/1 mile in Alathur Village of Trichy East Taluk at the rate of 37 MLD (15.10 cusecs) with the permissible parameters of the TNPCB after considering that the treated water may be utilized for irrigation.

Scanned with CamScanner

- 1) Cross masonry structures with necessary shutter arrangements should be constructed at the inlet point of the treated sewage in to the Uyyakondan Channel. All such constructions should be, got approved by the Executive Engineer, PWD, WRD, River Conservancy Division, Tiruchirappalli well in advance and constructed to the fully satisfaction of P.W.D. Officers.
- 2) The arrangements for drainage and the construction on the Canal Uyyakondan margin shall be got approved by the Executive Engineer, PWD, WRD, River Conservancy Division, Trichirappalli-01.
- 3) No damages should be caused to the bank of canal Uyyakondan (or) its distributaries jeep track during the process of laying pipe lines. If any damages are caused, it should be rectified by the Trichy City Corporation
- 4) Any law and order issues if arrises due to entering of treated effluent in to the canal should be solved by Trichy City Corporation only.
- 5) The Trichy City Corporation/Agency shall agree that they will, allow the Executive Engineer, PWD, WRD, River Conservancy Division, Tiruchirappalli-1 or his authorized representatives to inspect the said S.T.P at any time.
- 6) The report containing the amount of treated sewage effluent discharged in to the channel, and its physical, chemical and Biological properties should be furnished monthly and the samples may be collected monthly and it should be tested and certified from the Government approved laboratory. The lab reports also to be submitted monthly.
- 7) The Trichy City Corporation / Agency shall comply with the decisions and instructions of the Executive Engineer, Water Resource Department, River Conservancy Division, Trichirappalli who has jurisdiction over the Canal Uyyakondan in this matter.
- 8) PWD/WRD department officials will inspect the sewage treatment plant and if found that the treated sewage effluent discharging is not within permissible limits, then the discharging treated effluent should be stopped immediately.
- 9) The City Corporation should co-operate in removal of growth of unwanted weeds and vegetation inside the channel grown due to sewage water.

- 10) The permission is liable to be withdrawn by the PWD.WRD at any time without any previous notice to the City Corporation, without assigning any reasons there for.
- 11) The Laying of discharge pipe lines from the sewage treatment plant to the Inlet point of Uyyakondan channel should not be laid in any channel or any water bodies. The City Corporation officials should ensure the path of pipe carrying treated sewer line in this regard.
- 12) Responsibility of Operation and Maintenance of all units of Sewage Treatment plant should be given to one agency after completion of the maintenance period of present agency.
- 13) The City Corporation of Trichy may analyze the potential of the dried sludge generated from STP's as Manure and should encourage its use in agricultural land as soil conditioner.
- 14) The City Corporation of Trichy should maintained the drain leads to the Uyyakondan canal in their presence and to be kept clean and it should only allow the treated water from the STP without any obstruction.
- 15) The City Corporation would be responsible for proper operation and maintenance of this new STP. The new STP being constructed now shall ensure that they are capable of treating fecal Coliform Bacteria and also suitable for irrigation purpose.
- 16) Drains carrying sewage in any of the wards/towns forming part or segment of Phase-II would not be permitted to join the Uyyakondan channel and its tributaries. All the drains shall be tapped and the sewage from these drains should connect to this STP. The PWD/WRD concerned will block the discharge of any sewage or any untreated effluent into the channel. If any problem arises in Public due to blocking of sewage entry the City Corporation should solve the issues.
- 17) Every Officer / Engineer for this STP in the Trichy City Corporation responsible of maintaining and operating the STP would be individually responsible for any discrepancy, if the released sewage treated effluent is found to be beyond the limit of Permissible factors.
- 18) The team comprises of District Administration, PWD/WRD, TNPCB, Trichy City Corporation shall inspect the sewage treatment plant periodically (monthly) and collect the treated effluent samples at

frequent intervals and analysis may be done. The TNPCB may furnish the Parameters are found within the permissible limits.

- 19) The Trichy City Corporation will enter into the Mou (Memorandum of understanding) with the Government before proceeding with the construction of drainage treated sewage let into the Canal Uyyakondan.
- 20) INSPECTION OF RECORDS: The officers of the Public Works Department and Revenue Department not lower in rank of Assistant Engineer / Junior Engineer and Revenue Inspector respectively shall have the right to inspect the meter, pipes and accounts at any time to see whether the conditions of the Mou are kept up.
- 21) In case of any further continued violation by the City Corporation/Agency in the matter of drainage treated sewage and effective treatment and disposal of effluent, the authorities shall have the final option of instructing to cut off supply to the Canal Uyyakondan.

The Trichy City Corporation/Agency shall obtain the permission of the Water Resources Department, Revenue Department or any other concerned Government Departments for the occupation of Government lands to the extent that becomes inevitable and pay the lease amounts, rack rent etc., fixed by the authorities/department concerned.

Ince 2/1/2020
**Executive Engineer, PWD,
R.C. division, Trichy.1.**

*Prady
2/1/2020*

Appendix- 13 Permission for tree removal & cutting

Municipal Administration and Water Supply Department

From

S. Sivasubramanian., B.Sc., B.L,
Commissioner & Special Officer,
Tiruchirappalli City Corporation
Tiruchirappalli – 620 001



To

Eco Protection Engineers Pvt. Ltd.
Plot No.943, 54th Street, TVS colony,
Anna Nagar west Extn,
Chennai – 600101.

Roc No : 1517/ 2018/ E7 (Main) Dt. 06.06.2020

Sir,

Sub : Tiruchirappalli City Corporation - UGSS – Phase II – Package 3 –
Tree Cutting Permission – reg.

Ref : 1. Agreement No: 03 / 2018-19/ dt 30.01.2019 .
2. EPEPL Lr No : EPEPL/ TCC -37 MLDSTP/ 340/ 20-21/
Dated: 06.06.2020

* * * * *

With reference to the letter 2nd cited above, your request for permission to cut and remove following 8 neem trees is

S.No	Type of Trees	Age of Trees	Phase
1	Neem – 1	5	South Direction
2	Neem – 2	2	South Direction
3	Neem – 3 to 6	2	East Direction
4	Neem – 7 & 8	2	South Direction

In this connection it is to be stated that, as per Section 8 particular condition of the contract, the mitigation measures to be taken for tree cutting by removing and replanting the trees nearby and to maintain 10 trees for each Trees that is removed. Hence, it is permitted to remove and replant 8 trees by following the above said condition.

S. Sivasubramanian
8/6/2020
For Commissioner,

Tiruchirappalli City Corporation

