Initial Environmental Examination (Updated)

Document Stage: Draft
Project Number: 49107-003
September 2020

IND: Tamil Nadu Urban Flagship Investment Program–Underground Sewerage System for Rajapalayam Municipality in Virudhunagar District Rajapalayam

Prepared by Tamil Nadu Water Supply and Drainage Board on behalf of Rajapalayam Municipality of the Government of Tamil Nadu for Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 20 September 2020)

Currency Unit	–	Indian rupee (₹)
₹1.00	–	$0.0136
$1.00	=	₹73.5348

ABBREVIATIONS

ADB	–	Asian Development Bank
ASI	–	Archaeological Survey of India
BOD	–	biochemical oxygen demand
CMA	–	Commissionerate of Municipal Administration
CMSC	–	contract management and supervision consultant
CPCB	–	Central Pollution Control Board
CTE	–	consent to establish
CTO	–	consent to operate
DWC	–	double wall corrugated
EAC	–	expert appraisal committee
EHS	–	environment, health and safety
EIA	–	environmental impact assessment
EMP	–	environmental management plan
ESS	–	environmental and social safeguard
IEE	–	initial environmental examination
MAWS	–	Municipal Administration and Water Supply
MFF	–	multi-tranche financing facility
MOEFCC	–	Ministry of Environment, Forest and Climate Change
NOC	–	no objection certificate
O&M	–	operation and maintenance
PIU	–	project implementation unit
PMU	–	project management unit
SEMP	–	site environmental management plan
SPS	–	safeguard policy statement
SPSt	–	sewage pumping station
STP	–	sewage treatment plant
TNPCB	–	Tamil Nadu Pollution Control Board
TNUFIP	–	Tamil Nadu Urban Flagship Investment Program
TNUIFSL	–	Tamil Nadu Urban Infrastructure Financial Services Limited
TWADB	–	Tamil Nadu Water and Drainage Board
ULB	–	urban local body
WHO	–	World Health Organization

WEIGHTS and MEASURES

cm	centimeter
dbA	decibel
°C	degree Celsius
ha	hectare
km	kilometer
kW	kilowatt
lpcd	liter per capita per day
m	meter

mbgl	meter below ground level
$\mu g/m^3$	micrograms per cubic meter
mm	millimeter
MLD	million liters per day
km^2	square kilometer

NOTE

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

TABLE OF CONTENTS

List of Tables

List of Figures

EXECUTIVE SUMMARY

1. The Tamil Nadu Urban Flagship Investment Program (TNUFIP) will advance India's national urban flagship programs to develop priority urban and environmental infrastructure in ten cities located within strategic industrial corridors of Tamil Nadu (the State), including those within the East Coast Economic Corridor (ECEC), to enhance environmental sustainability, climate resilience, and livability. It will also strengthen the capacity of state and local institutions and improve urban governance. TNUFIP is aligned with the following impacts: (i) universal access to basic water and sanitation services achieved, (ii) world-class cities and industrial corridors across the State developed, and (iii) water security and reducing vulnerability to climate change in urban areas and enhancing share of renewable energy achieved. TNUFIP will have the following outcomes: livability and climate resilience in at least 10 cities in priority industrial corridors enhanced.

2. The TNUFIP is structured under three outputs: (i) climate-resilient sewage collection and treatment, and drainage systems developed in at least 8 cities; (ii) water supply systems in at least 5 cities improved with smart features; 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.** Rajapalayam is located in the south-western part of Tamil Nadu, in the foothills of Western Ghats. In this subproject to be implemented under the ADB funded TNUFIP, it is proposed to provide underground sewerage system in Rajapalayam municipality area. Subproject includes the following civil works components: (i) sewage collection system (157.174 kilometers (km) length of sewers and 5,865 manholes), (ii) 4 nos. of sewage lift stations, (iii) 3 no. of sewage pump stations, (iv) sewage pumping mains (19.242 km length), (v) sewage treatment plant (STP) of 21.85 million liters per day (MLD) capacity under design-build contract including a 1.4 km length sewer outfall, and (vi) 38,586 house service connections.

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) has been established in TNUIFSL headed by a Project Director and Deputy Project Director (senior official from Commissionerate of Municipal Administration, (CMA), and comprising dedicated full-time staff from TNUIFSL for overall project and financial management. The implementing agencies are project urban local borides (ULBs). Rajapalayam Municipality is the Implementing Agency for this subproject. A project implementation unit (PIU) has been established by Tamil Nadu Water and Drainage Board (TWADB), Government of Tamil Nadu agency, to support the Rajapalayam Municipality, in implementation of the subproject. PIU will be headed by a full-time Project Manager (Executive Engineer or above rank) and comprising dedicated full-time staff of the TWADB for day-to-day implementation of the subproject. A Safeguards Officer (environment, involuntary resettlement, gender) has been placed in PIU from Rajapalayam Municipality to coordinate monitoring and implementation of safeguards at subproject level. Besides, specifically for implementation and monitoring of environmental related tasks, an Environmental Expert from TWADB is mobilized in the PIU. Environmental and Social Safeguards (ESS) Managers in PMU/TNUIFSL will coordinate all the safeguard related activities of the subproject and will ensure the compliance with environmental management plan (EMP) and environmental assessment and review framework (EARF). Environmental Expert will ensure implementation of subproject in compliance with EMP and EARF, and will carry out all necessary tasks at PIU level.

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 The SPS 2009 also requires that ADB-financed sub-projects to comply with host country regulations. As per the Government of India 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 Board[1]. The potential environmental impacts of the subproject have been assessed using ADB Rapid Environmental Assessment Checklist for Sewerage. The potential negative impacts were identified in relation to pre-construction, construction and operation phases.

6. **Categorization.** Based on results of the assessment and ADB SPS 2009, the subproject is classified as environment Category B, i.e., subproject's potential to cause adverse environmental impacts is less adverse than that of category A, and are site-specific, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE) is required.

7. Description of the Environment. The subproject components are located in Rajapalayam, in the southwestern part of Tamil Nadu. The STP and all the lifting and pumping station sites are situated on government owned vacant land parcels, and sewers will be laid on the public roads. Therefore the subproject does not involve any private land acquisition. All the subproject components are located within urban environment. The STP site is located outside the town, surrounded by agricultural and barren lands. There are no ecologically sensitive or protected wildlife or archeological areas in or close to subproject area. Nearest protected area is Srivilliputhur Grizzled Squirrel Wildlife Sanctuary, about 8 km from the Rajapalayam Municipal boundary in the west. Proposed STP site is located on the eastern side of the town, away from the habitation. Site is selected within the existing solid waste disposal facility (compost plant); of the total 20.35 acres area, 5 acres is allotted to STP. There are no streams/rivers flowing through or close to Rajapalayam municipal area. It is proposed to discharge treated wastewater from STP into Kothankulam Irrigation Tank, which is located at about 1.4 km north of STP site.

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

9. Sewerage system performs a crucial function of safely collecting, transporting, treating and disposing domestic wastewater, including, human excreta (designed as a separate system). Subproject is likely to have numerous positive impacts on the environment and public health. In this IEE, negative impacts were identified in relation to pre-construction, construction, and operation phases. Planning principles and design considerations have been reviewed and incorporated into the site planning and design process wherever possible; thus, environmental impacts as being due to the project design or location were not significant. Sewage pumping and

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

lifting stations, which collect sewage to further pump to a higher elevation manhole, pump station or STP, are likely to generate odor.

10. As stated above, it is proposed to discharge treated wastewater from STP into Kothankulam Irrigation Tank, and utilized for irrigation in the tank command area, and if any surplus will flow down via the existing surplus channel to Pudukulam tank, another downstream irrigation tank. At present the water stored inside Kothankulam tank is insufficient and polluted with dissolved oxygen levels of 0.16 mg/l, BOD of 20 mg/l and COD of 100 mg/l. As the lake is dry and polluted, there is no notable aquatic life present. Water from the tank can only be used for irrigation, and not potable for drinking. Water depth is more than 10 m below ground level. Given the current status of the tank (insufficient storage level, polluted, non-potable, no notable aquatic life), no adverse impacts are likely to result from the disposal of STP treated wastewater to meet disposal standards. A sludge management plan will be prepared during the detailed design phase for treatment, disposal and/or safe reuse of sludge. Monitoring of treated wastewater and sludge quality, and safe reuse limits are provided in EMP.

11. The malfunction or decrease in treatment efficiency and sludge handling and disposal in the STP will most likely result in the release of untreated or partially treated wastewater, which will, most likely, pollute the environment and cause public health issues. Industrial waste in sewage also poses risks that could be irreversible. Accumulation of silt in sewers in low areas may overflow, cause blockage, result to power outages, and pose harmful working conditions for the workers cleaning sewers may create nuisance, unhealthy and hazardous conditions.

12. Sewage 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/service areas. These facilities may generate odor and may cause nuisance to nearby households. Site selection is done with utmost care to locate the facilities as far as away from the houses as possible. However, given design considerations and land constraints, most of the sites identified are close to the houses. Various site planning, green buffer and design related measures are included in the project to prevent and control odor generation. These include: appropriately locating sewage wells within site maintaining maximum distance from the nearby houses; developing tree cover; covered facilities; design and operation measures to prevent odor; and, providing gas collection and treatment facilities at sewage pumping stations. Odor monitoring is also proposed during operation.

13. Mitigation measures have been developed to reduce all adverse impacts and incorporated in the infrastructure design. Various measures suggested for odor control include: appropriately locating sewage wells within site as far as away from the houses; developing tree cover; covered facilities; gas collection and treatment facilities, and design and operation measures to prevent odor build up; standard operating procedures for operation and maintenance; imparting necessary training; safety and personal protection equipment for workers, measures to maintain the STP treatment efficiency, and development of green buffer zone around the STP, etc.

14. Potential impacts during construction are considered significant but temporary, and are common impacts of construction in urban areas, and there are well developed methods to mitigate the same. Except sewer works, all other construction activities (lifting/pumping stations and STP) will be confined to the selected sites, and the interference with the general public and community around is minimal. In these works, the temporary negative impacts arise mainly from construction dust and noise, hauling of construction material, waste and equipment on local roads (traffic, dust, safety etc.), mining of construction material from the existing government licensed mining areas having environmental permissions as applicable, occupational health and safety aspects. Sewer

works will be conducted along public roads in an urban area congested with people, activities and traffic. Therefore these works will have significant impacts arising mainly: from the disturbance of residents, businesses and traffic due to construction work; safety risk to workers, public and nearby buildings due to deep trench excavations in the road with some sections involving controlled blasting, especially in narrow roads; access impediment to houses and business, disposal of large quantities of construction waste, etc. These are all general impacts of construction in urban areas, and there are well developed methods of mitigation that are suggested in the EMP.

15. **Environmental Management Plan.** An environmental management plan (EMP) has been developed to provide mitigation measures to reduce all negative impacts, along with the delegation of responsibility to appropriate agency. As stated above, various design related measures are already included in the project design. During construction, the EMP includes mitigation measures such as (i) proper planning of sewer works to minimize the public inconvenience (ii) barricading, dust suppression and control measures (iii) traffic management measures for works along the roads and for hauling activities; (iv) provision of walkways and planks over trenches to ensure access will not be impeded; and (iv) finding beneficial use of excavated materials to extent possible to reduce the disposal quantity. 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 the EMP. The EMP will guide the environmentally-sound construction of the subproject. The EMP also 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.

16. The EMP has already been 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. The contractor will be required to submit to PIU, for review and approval, an updated site environmental management plan (SEMP) also reflecting the associated mitigation and monitoring measures for the controlled blasting activities proposed now in the updated IEE report. No works are allowed to commence prior to approval of SEMP. A copy of the updated EMP/approved SEMP will be kept on site during the construction period at all times.

17. **Consultation, Disclosure and Grievance Redress Mechanism.** The stakeholders were involved in developing the updated IEE through on-site discussions within the limitations imposed by the district authorities during on-going coronavirus disease (COVID-19) pandemic. The views expressed and suggestions made have been incorporated into the updated IEE and the EMP as well as in the revised 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, Rajapalayam Municipality and TNUIFSL websites. The consultation process will be further strengthened after relaxation of present restrictions due to COVID-19 pandemic and also continued thereafter during project implementation. A grievance redress mechanism as described in the IEE has already been made fully functional to ensure quick redressal of public grievances.

18. **Monitoring and Reporting.** The Contractor has been submitting a monthly EMP implementation report to PIU. PIU is monitoring the compliance of Contractor, and submitting a Quarterly Environmental Monitoring Report to PMU. The PMU has been overseeing the implementation and compliance, and submitting semi-annual monitoring reports to ADB. The environmental monitoring reports will be posted on websites of ADB, Rajapalayam Municipality and TNUIFSL.

19. **Conclusions and Recommendations.** Therefore, as per ADB SPS, the project continues to be classified as environmental category B and does not require further environmental impact assessment. However, to conform to government guidelines, consent to establish (CTE) and consent to operate (CTO) from Tamil Nadu Pollution Control Board (TNPCB) is required for the STP. Permission of Public Works Department for disposal of treated wastewater from the STP into Kothankulam Tank has been obtained.. This IEE is prepared based on the preliminary design, and shall be updated by PIU during detailed design phase to reflect final project design and will be reviewed and approved by PMU. The updated IEE will be submitted to ADB for concurrence and disclosure.

I. INTRODUCTION

A. Background

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

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

3. TNUFIP is aligned with the following aspects: (i) universal access to basic water and sanitation services achieved, (ii) world-class cities and industrial corridors across the State developed,[2] and (iii) water security and reducing vulnerability to climate change in urban areas and enhancing share of renewable energy achieved.[3] The investment program will have the following outcome: livability and climate resilience in at least 10 cities in priority industrial corridors enhanced.[4] The TNUFIP is structured under following three outputs:

(i) **Output 1:Climate-resilient sewage collection and treatment, and drainage systems developed in at least 8 cities.** This will include: (i) new (187 million liters per day [MLD]) and rehabilitated (155 MLD) sewage treatment capacity developed with solar power for operations installed on a pilot basis; (ii) reuse of treated wastewater for industrial purposes in selected areas; (iii) new 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:Water supply systems in at least 5 cities improved with smart features.** This will include: (i) smart water supply distribution systems (1,520 km pipelines) established within 110 new district metered areas (DMAs) to reduce NRW and provide regular water supply with 100% household connections (171,000 household connections); (ii) new transmission mains (120 km); (iii) 30 pump stations of 1,530 KW capacity; and (iv) new water storage reservoirs (40 reservoirs totaling 70 million liters).

(iii) **Output 3: Institutional capacity, public awareness, and urban governance strengthened.** This will include: (i) establishing a new state-level Urban Data and Governance Improvement Cell in the CMA; (ii) establishing a new Project Design

[2] World-class cities are defined by Tamil Nadu Vision 2023 as existing towns whose infrastructure is to be upgraded significantly including provision of access to 24x7 water supply, efficient mass transit systems while making them open-defecation free and garbage free. (Government of Tamil Nadu. 2012. *Tamil Nadu Vision 2023*. Chennai).

3Government of Tamil Nadu. 2015. *Tamil Nadu Sustainable Water Security Mission*. Chennai; and Government of Tamil Nadu. 2014. *State Action Plan on Climate Change*. Chennai.

[4] Government of India, Ministry of Urban Development. 2015. *Smart City Mission Statement and Guidelines*. Delhi.

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 revenue, financial management, administration, service delivery, gender mainstreaming, wastewater reuse, and fecal sludge management; and (iv) implementing public awareness campaigns in areas of water conservation, sanitation, and hygiene in project cities. TNUFIP will intensify capacity building of key urban institutions and continue the good practice of incentivizing urban governance improvement. Project design consultants (PDC) will be recruited to prepare new projects in subsequent tranches meeting ADB requirements.

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

(i) **Output 1: Climate-resilient sewage collection and treatment, and drainage systems developed in 6 cities.**[5]This includes: (i) 5 new STPs of 165 MLD treatment capacity including one STP with 2 megawatts (MW) solar photovoltaic (PV) installation for operations; (ii) 1 rehabilitated STP of 37 MLD capacity; (iii) 8,000 cubic meter (m^3) 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 4,473 kW capacity; and (vi) 297,547 new household sewer connections. The breakdown by city is as follows: (i) new sewage collection system and 32 MLD STP in Tirunelveli with treated wastewater supplied for industrial reuse;[6] (ii) new sewage collection system and 30.53 MLD STP with 2 MW solar PV installation in Coimbatore;[7] (iii) new sewage collection system and 30 MLD STP and one rehabilitated 37 MLD STP in Tiruchirappalli; (iv) new sewage collection system and 50 MLD STP in Vellore; (v) new sewage collection system in four areas of Chennai; (vi) new sewage collection and 21.85 MLD STP in Rajapalayam, and (v) 12 community water-sanitation committees formed.

(ii) **Output 2: Water supply systems in 1 city improved with smart features.**[8]This will support 4 areas of Chennai with the following: (i) 275.6 km of distribution pipes in 20 newly established district metered areas to manage and reduce NRW connected to computerized control and data acquisition systems;[9] (ii) 30,800 household metered connections; (iii) 11 km of new transmission pipes; (iv) 9 new storage reservoirs (4 underground and 5 overhead) of 11 million liters capacity; and (v) 5 pump stations of 230 kW capacity.

(iii) **Output 3: Institutional capacity, public awareness, and urban governance strengthened.** This will include: (i) establishing a new state-level Urban Data and Governance Improvement Cell in the CMA; (ii) establishing a new Project Design and Management Center in the CMA; (iii) introducing and implementing a state-wide performance-based urban governance improvement program for all 135 cities under CMA to improve financial management (audited accounts), municipal revenues (taxes, user fees), administration (filling vacancies), and gender

[5] Drainage is taken up under Tranche 2, while appraisal of designs is taken up under Tranche 1.
[6] Tirunelveli city signed a purchase agreement for treated effluent from the STP with an adjoining industrial park.
[7] This innovative pilot will install 2MW of solar power at the STP resulting in: (i) 90% of the STP's energy requirement; (ii) 72% of annual energy charges;and (iii) 3,400 tons of CO_2 equivalent per year avoided.
[8] For Project 1, smart water features (footnote 19) include online automatic pressure sensors and flow meters, 100% household metered connections using DMA-based distribution management, and energy efficient motors for pumps.
[9] NRW in Chennai is 30%. (Source: Government of Tamil Nadu. 29 March 2016. *Chennai District Gazette*. Chennai)

mainstreaming (gender action plan implementation);[10] and (iv) implementing public awareness campaigns in areas of water conservation, sanitation, and hygiene. Output 3 will be supported by governance improvement and awareness consultants.

5. Rajapalayam is located in the south-western part of Tamil Nadu, in the foothills of Western Ghats. In this subproject to be implemented under the ADB funded TNUFIP, it is proposed to provide underground sewerage system in Rajapalayam municipality. Subproject includes the following civil works components: (i) sewage collection system (157.174 kilometer (km) length of sewers and 5,865 manholes), (ii) 4 nos. of sewage lift stations, (iii) 3 no. of sewage pump stations, (iv) sewage pumping mains (19.242 km length), (v) sewage treatment plant (STP) of 21.85 million liters per day (MLD) capacity including a 1.4 km length sewer outfall, and (vi) 38,586 house service connections. STP is proposed under design-build contract, and therefore at present STP is design is preliminary.

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 Checklist for Sewerage (Appendix 1). Then potential negative impacts were identified in relation to pre-construction, construction and operation phases of the improved infrastructure, and results of the assessment show that the subproject is unlikely to cause significant adverse impacts that are irreversible, diverse or unprecedented. Thus, this initial environmental examination (IEE) has been prepared in accordance with ADB SPS's requirements for environment category B projects.

7. This IEE is based on the detailed project report (DPR) prepared by TWADB for Rajapalayam Municipality. The update is to reflect the inclusion of controlled blasting as one of the construction methodologies identified for hard rock removal in some sections of the alignment and sites. However, the STP and disposal system is proposed under design-build type implementation, is under preparation by the contractor and will be updated upon finalization of detailed design. The IEE update 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) required the contractors to establish the baseline environmental conditions prior to commencement of civil works. The results are being reported as part of the environmental monitoring report and would be the basis to ensure no degradation will happen during subproject implementation. Stakeholder consultation was an integral part of the IEE update.

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;

[10] Details of this component are included in the FAM and Technical Assistance Report. (accessible from the list of linked documents in Appendix 2 of the Report and Recommendation of the Presidentto the Board of Directors).

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

II. DESCRIPTION OF THE PROJECT

A. Project Area

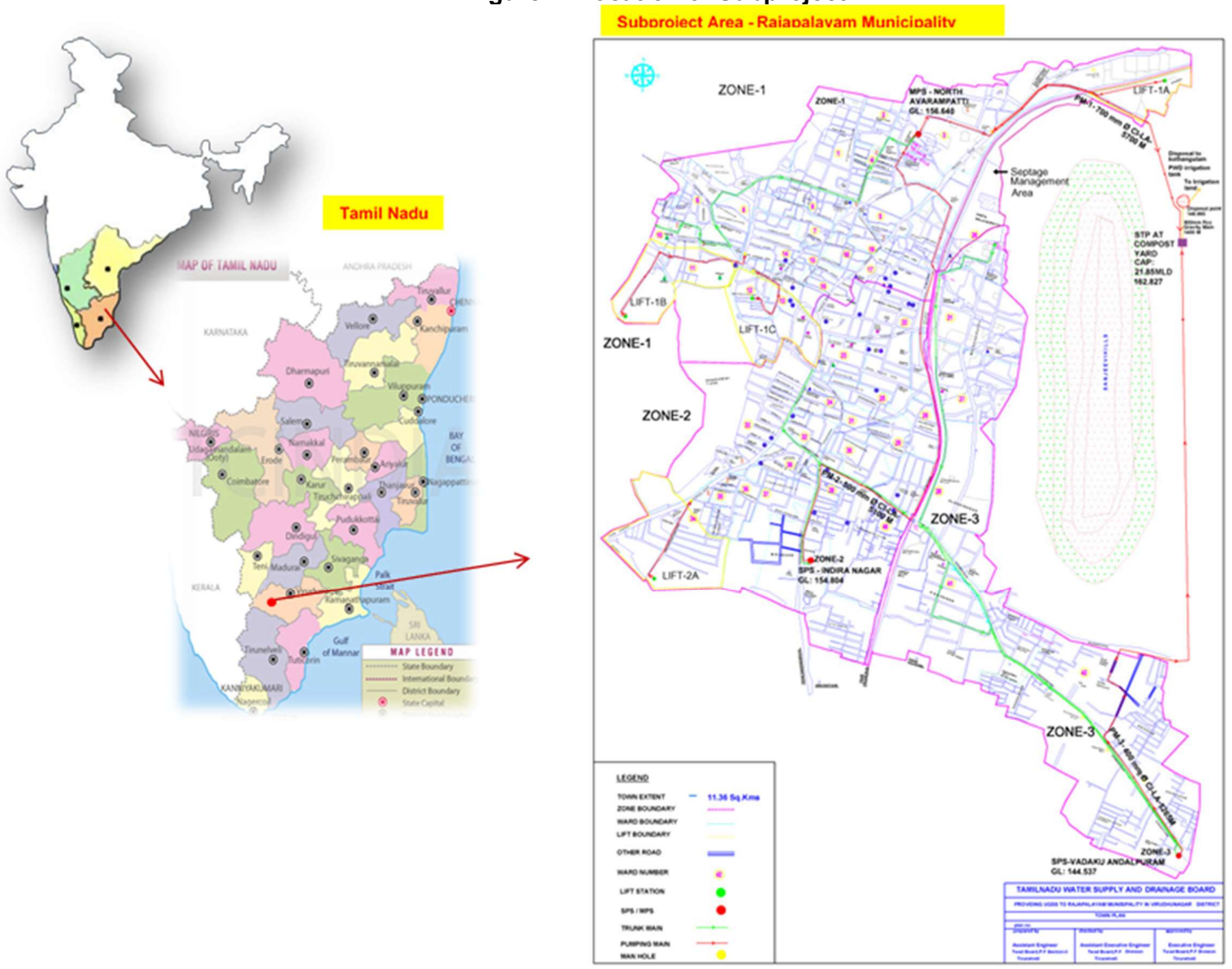
9. Project area comprises municipal area of Rajapalayam Municipality, spread over an area of 11.36 square kilometer(km^2) and population of 130,119 (2011 census).

B. Existing Sewerage System

10. At present there is no sewerage system in the town. Existing system of sanitation comprises septic tanks and soak pits. From the densely populated old town areas, sewage from toilets/septic tanks and sullage is discharged mostly into storm water open drains, which are constructed along the streets in the town. In the houses where soak pits are available, the septic tank effluent and sullage from bath and kitchens is let into soak pits. The wastewater discharged into open drains accumulates in low lying areas of the town, and also flow into the irrigation tanks in the periphery of the town. There are no rivers flowing through the town, and drainage is mainly controlled by irrigation tanks around the town.

11. Rajapalayam Municipality is the responsible agency for providing basic urban services including sewerage in the town. Under the TNUFIP, Rajapalayam Municipality proposed to provide sewerage system to cover entire municipal area comprising 3 zones and 42 municipal wards, and is the implementation agency for this subproject. The DPR for the underground sewage scheme has been prepared by TWADB for the Rajapalayam Municipality. TWADB is supporting the municipality in implementation of the subproject.

Figure 1: Location of Subproject



C. Proposed Project

12. As per the DPR, the population of the town for the year 2020 and 2050 has been projected as 155,000 and 220,000 respectively. The water supply rate of 135 liters per capita per day (lpcd) has been considered in the design for working out the total sewage flow.

13. 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. System is designed as a separate underground system catering only to domestic wastewater; storm runoff generated during rains will be carried by existing open drains and dispose into natural streams/ water bodies. Industrial wastewater will not be disposed into sewers. System is designed for 115 liters per capita per day, based on sewage generation rate of 80% of water supply. System is designed with gravity flow as far as possible, however topography does 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.

D. Implementation Schedule

14. The Underground sewerage scheme to Rajapalayam Municipality is implemented in two packages. Details are as below.
Package 1– 157.174 km collection system, 20.642 km pumping main, 4 nos of Lift stations, 3 nos of Sub-Pumping stations and one Main Pumping station.
Package 2 – STP of 21.85 MLD capacity and 1.4 km outfall sewer for disposal into Kothangulam irrigation tank.
Contract for Package 1 with construction period of 36 months was awarded to M/s.Eco Protection Engineers Private Limited, Chennai on 10 October 2018. Works are in progress and are likely to be completed by September 2021. Package 2 with construction period of 24 months was awarded to M/s.Eco Protection Engineers Private Limited, Chennai on 24 March 2020 and are likely to be completed by March 2022. Currently design works are in progress. This draft updated IEE will be further updated upon completion of detailed design of the STP.

Table 1:Proposed Sewerage Subproject Components

Infrastructure	Function	Description	Location
Sewer network	Collect wastewater from houses and convey by pressure pumping to the sewage treatment plant (STP)	157.174km; sewers of diameter 200-700 mm • 126.935 km- 160 & 200 mm dia PVC pipes • 20.513 km - 200-300 mm dia double wall corrugated (DWC) pipes • 9.726 km - 350-700 mm dia: CI pipes Manholes 4,945 nos. (brickwork) 920 nos. (reinforced cement concrete)	Sewers will be laid underground in the roads and internal streets in the project area comprising Rajapalayam Municipality
Pumping main sewers	Transfer sewage from lift station /sewage pumping station (SPS) to main pumping station (MPS)and to STP	20.642 km, mains of diameter 150-700 mm • 5.1 km – 500 mm dia CI – from SPS @ Indranagar to MPS • 5.265 km – 400 mm dia CI – fromSPS @ North Aandalpuram to STP • 5.92 km 700mm diaCIfrom MPS to STP • 2.872 km 150 mm dia CI from lift wells to SPS • 0.085 km 600mm dia CI for inter Connection • 1.400 km 800mm dia RCC pipe for Effluent Disposal Gravity Main	Pipes will be laid underneath ground level along municipal roads, national and state highways, and rural roads connecting SPS, MPS and STP.
Sewage lift stations (LS)	Collect sewage from low level sewer and pump to higher sewer or to pumping stations	4 No,s Components of LS • Suction well of dia 3 m and depth 3.67 m to 6.45 m (closed) with a vent pipe • Non-clog submersible pump sets • Control panel box	Lift well will be constructed on the road shoulder (and in the road itself when there is no earthen shoulder) where the sewer terminates into the lift well. Pumps will be installed in the well, and a control panel box will be installed near the well. Lift stations are proposed at following locations: 1. Kothankulam Road 2. Samandhapuram 3. Chandhoorani 4. Thiruvananthapuram Street All the above lift stations are located in municipal lands, and along the roads.
Sewage pumping stations (SPS)	Collect sewage and pump to main pumping stations	2Nos. Components of SPS • Screen well -Dia (3.90 and 3.00 m) and depth (4.76 and 4.54 m) • Grit well	Sewage pump stations are proposed at following locations: 1.Indira nagar 2. North Andalpuram

Infrastructure	Function	Description	Location
		-Dia (5.50 and 5.00 m) and depth (6.05 and 5.41 m) • Suction well -Dia (8.00 and 7.00 m) and depth (8.68 and 7.74 m) • Pump rooms (6m x 4 m) Non-clog submersible pump sets	
Main Sewage pumping stations (MPS)	Collect sewage from lift stations and pumping stations and pump to sewage treatment plant	1 no, Components of MPS • Screen well - 2 Nos Dia (5.2 m) and depth (3.19 m) • Grit well Dia (7.2 m) and depth (4.53 m) • Suction well Dia (8.00 m) and depth (8.43 m) • Pump room (6m x4 m) • Non-clog submersible pump sets	Main sewage pump stations are proposed at following locations: 1. North Avarampatti Site is located opposite to community toilet . Site is owned by Hindu Religious and Charitable Endowment Department (HR and CE) department.
Sewage Treatment Plant (STP)	Treatment of collected wastewater to comply with disposal standards	*New* STP of capacity 21.85 MLD Treatment Technology: SBR (Sequential Batch Reactor). Components: • Mechanical screens • Grit removal, • Flow measurement and flow splitter box • Batch reactors with individual inlet flow control and a fully automated process • Sludge management system	Site is located at Pudupalyam village in the eastern outskirts of Rajapalayam Municipality. Site is located within a large campus that is currently housing a solid waste management facility (compost plant). Total area of this campus is 20.35 acres, of which 5 acres allocated to the STP. Selected site is located ideally away from the residential areas (> 1 km)
Outfall sewer	Disposal of treated water from STP into kothankulam irrigation tank.	1.40km length 800 mm dia reinforced cement concrete (RCC) pipe from STP to Kothankulamirrigation tank.	Pipe will be laid underground from STP to Kothankulam irrigation tank along municipal road Treated wastewater from the STP will be discharged into Kothankulam Tank and irrigation tank.
House service connections	Collect sewage from individual houses and convey into network	• 37631 nos. (domestic) • 955 nos. (non-domestic – commercial, institutional, etc.), no connections to industrial establishments	At each household, connected to chamber collecting wastewater drain and outlet from toilet upto the manhole.

Figure 2: Proposed Sewerage Zones

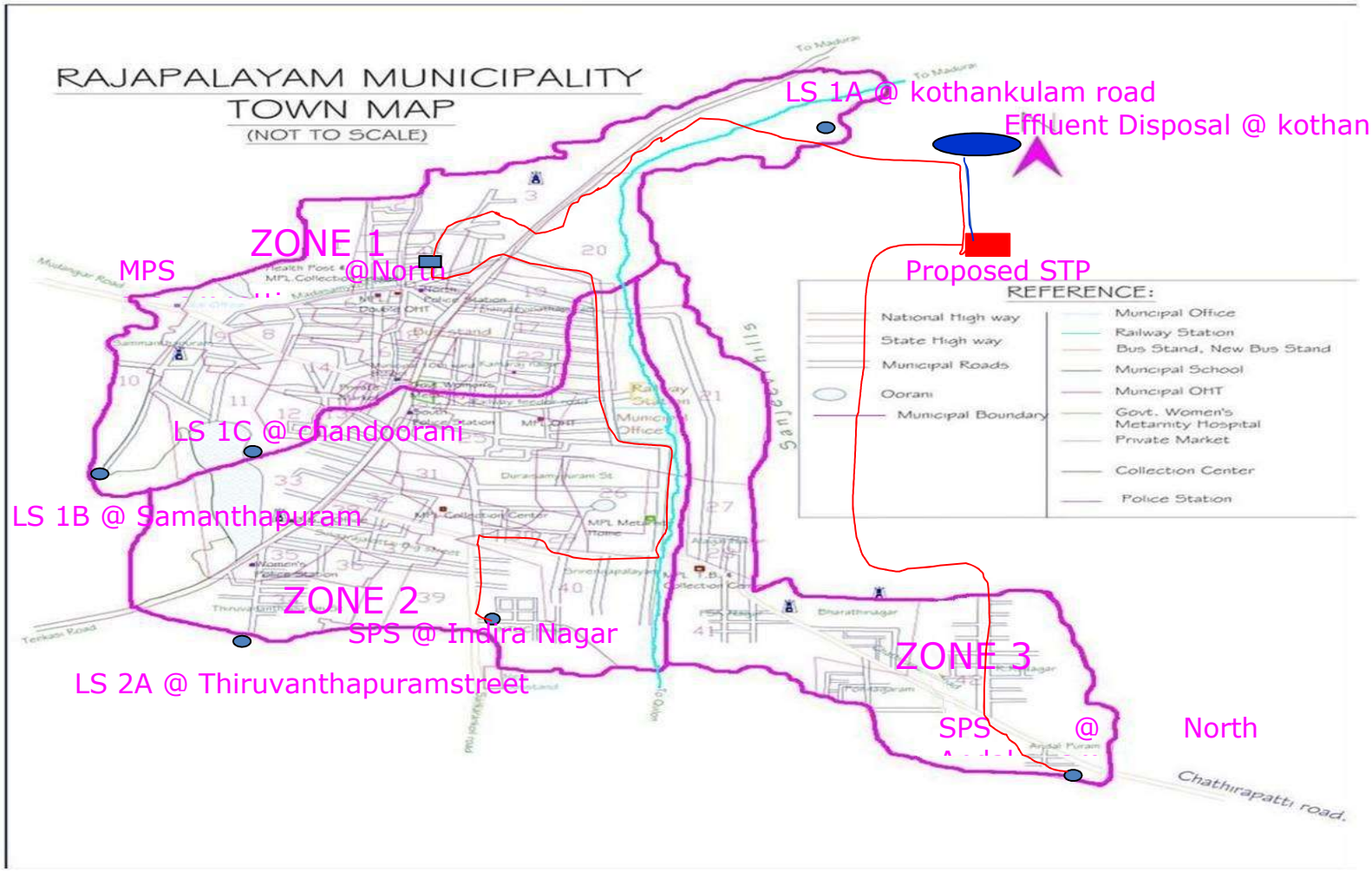

RAJAPALAYAM MUNICIPALITY
TOWN MAP
(NOT TO SCALE)
LS 1A @ kothankulam road
Effluent Disposal @ kothankulam
ZONE 1
MPS
@North
Proposed STP
LS 1C @ chandoorani
LS 1B @ Samanthapuram
ZONE 2
SPS @ Indira Nagar
LS 2A @ Thiruvanthapuramstreet
ZONE 3
SPS @ North
REFERENCE:
National High way
State High way
Municipal Roads
Oorani
Municipal Boundary
Municipal Office
Railway Station
Bus Stand, New Bus Stand
Municipal School
Municipal OHT
Govt. Women's Metarnity Hospital
Private Market
Collection Center
Police Station
Chathirapatti road.

Figure 3: Location of Subproject Components

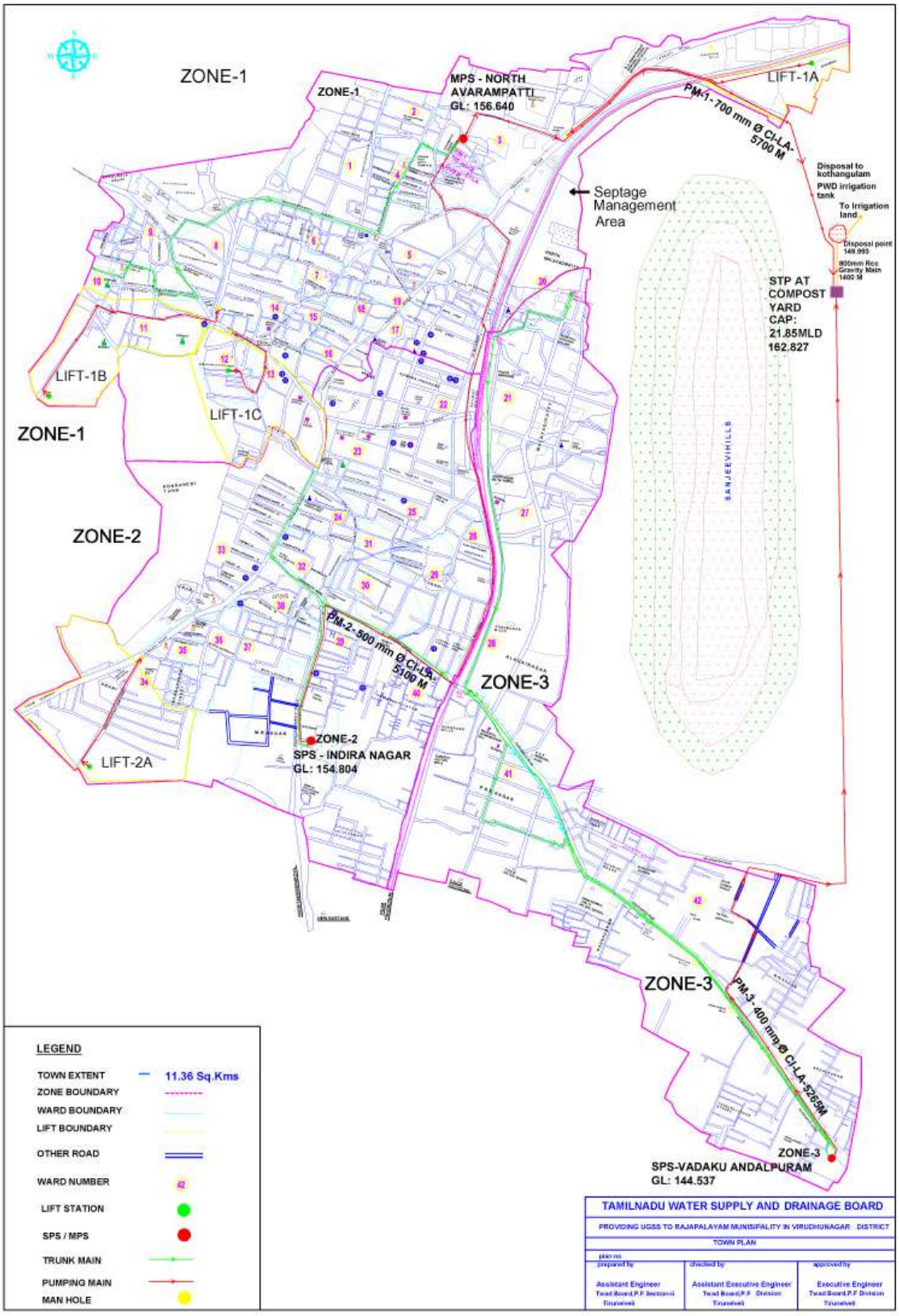
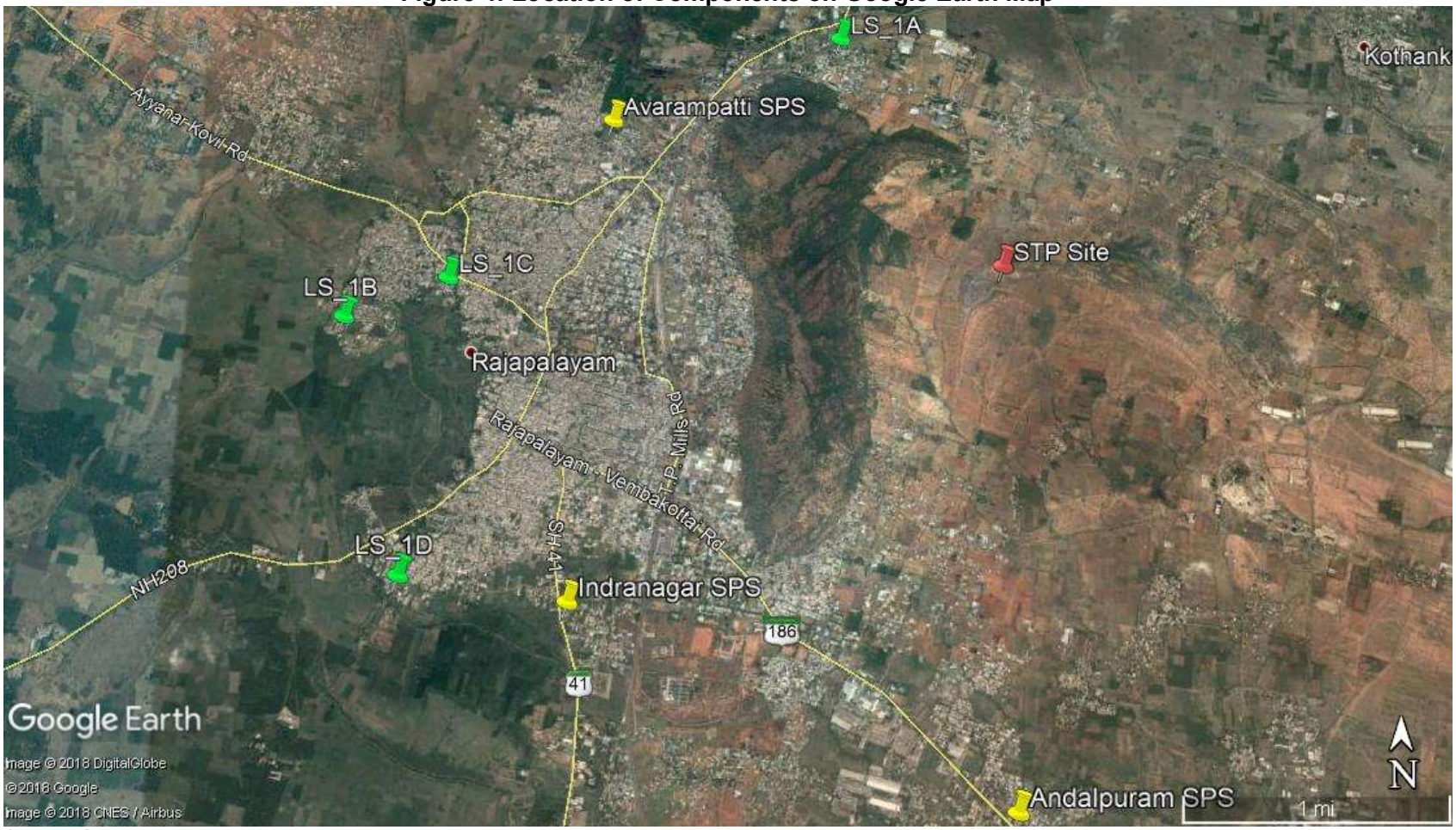


Figure 4: Location of Components on Google Earth Map



Source: Google Earth.

Figure 5: Layout Plan of Sewage Pumping Station at Andalpuram

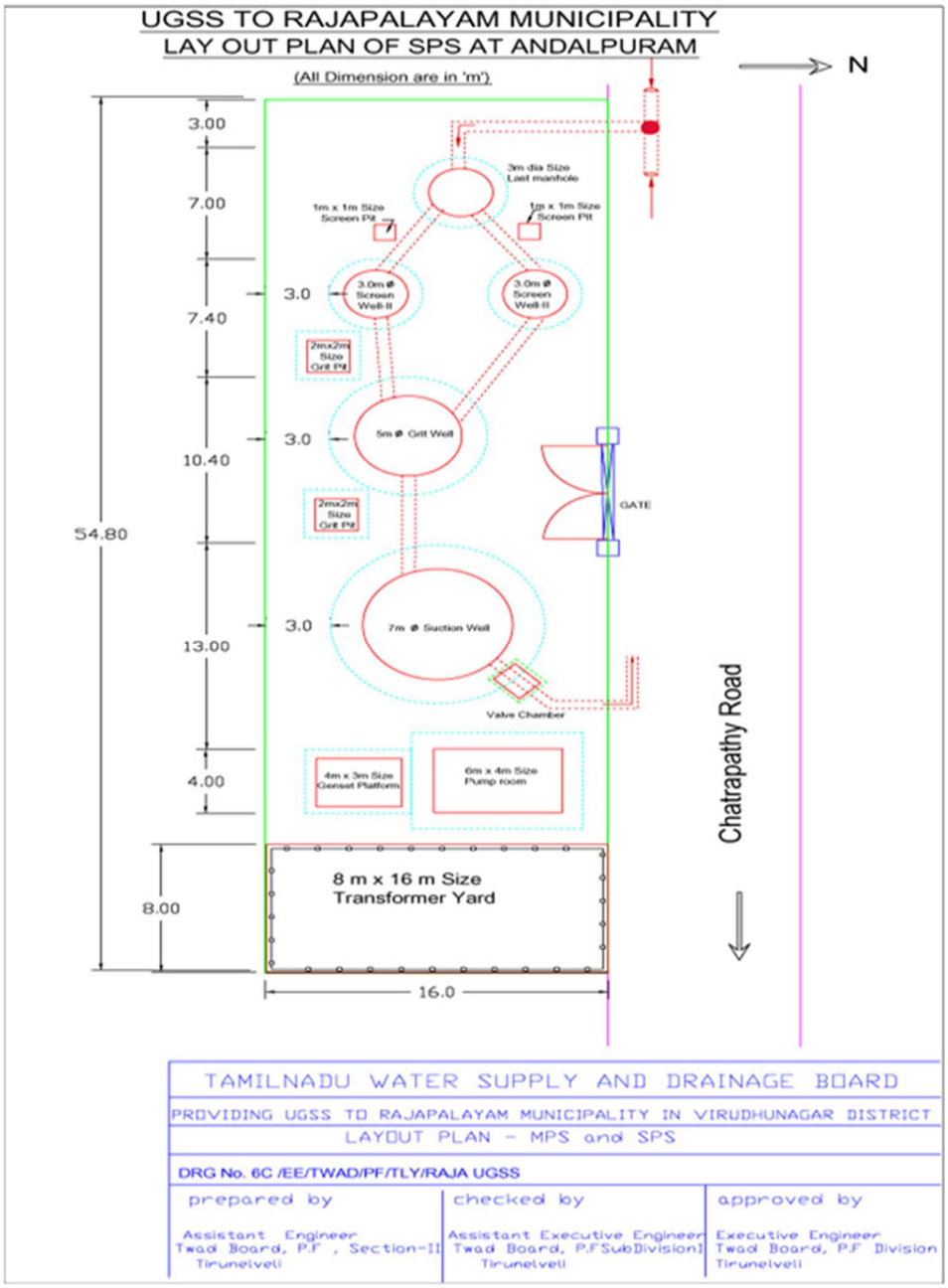


Figure 6: Layout Plan of Sewage Pumping Station at Indlranagar

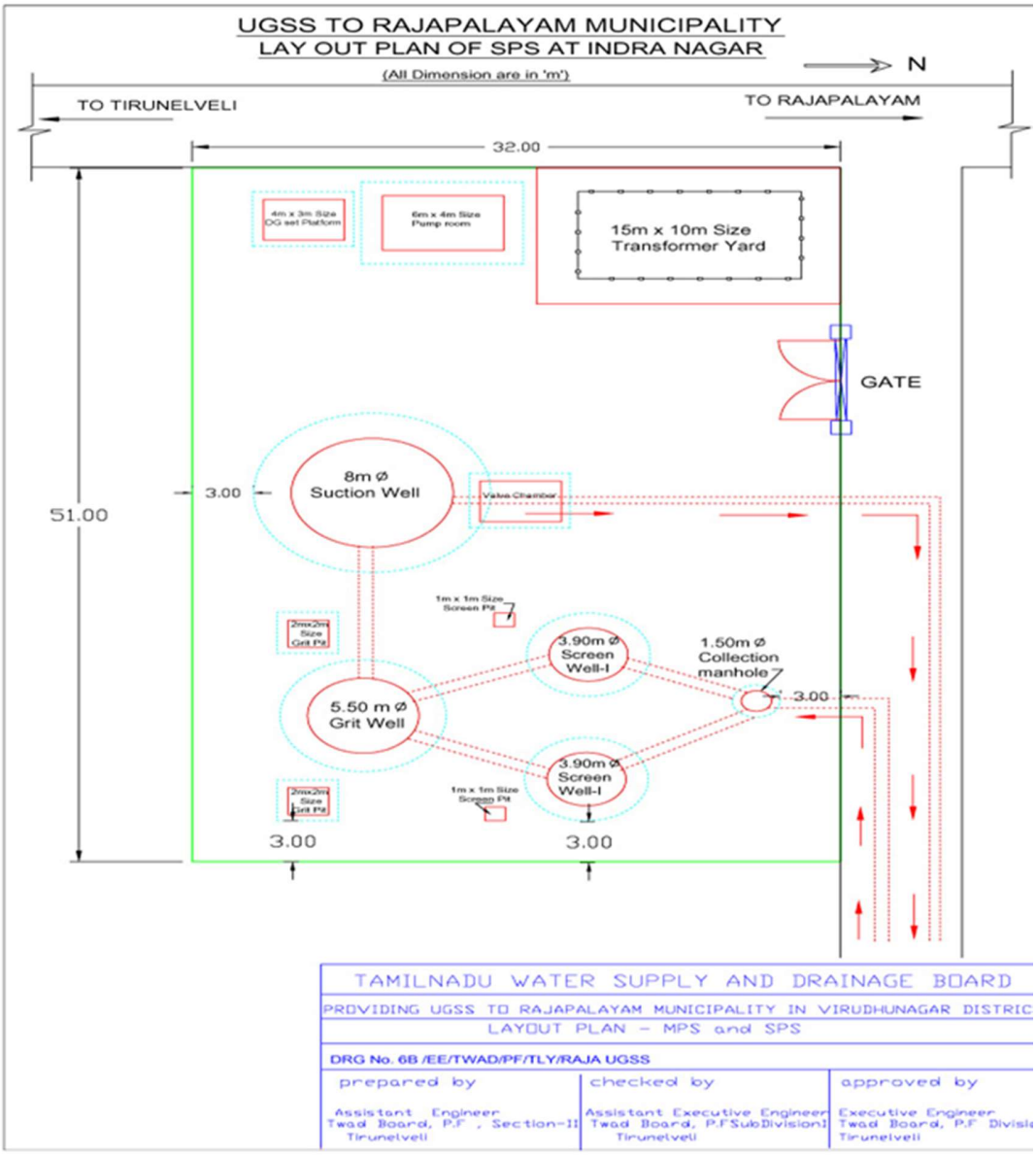


Figure 7: Layout Plan of Sewage Pumping Station at Avarampatti

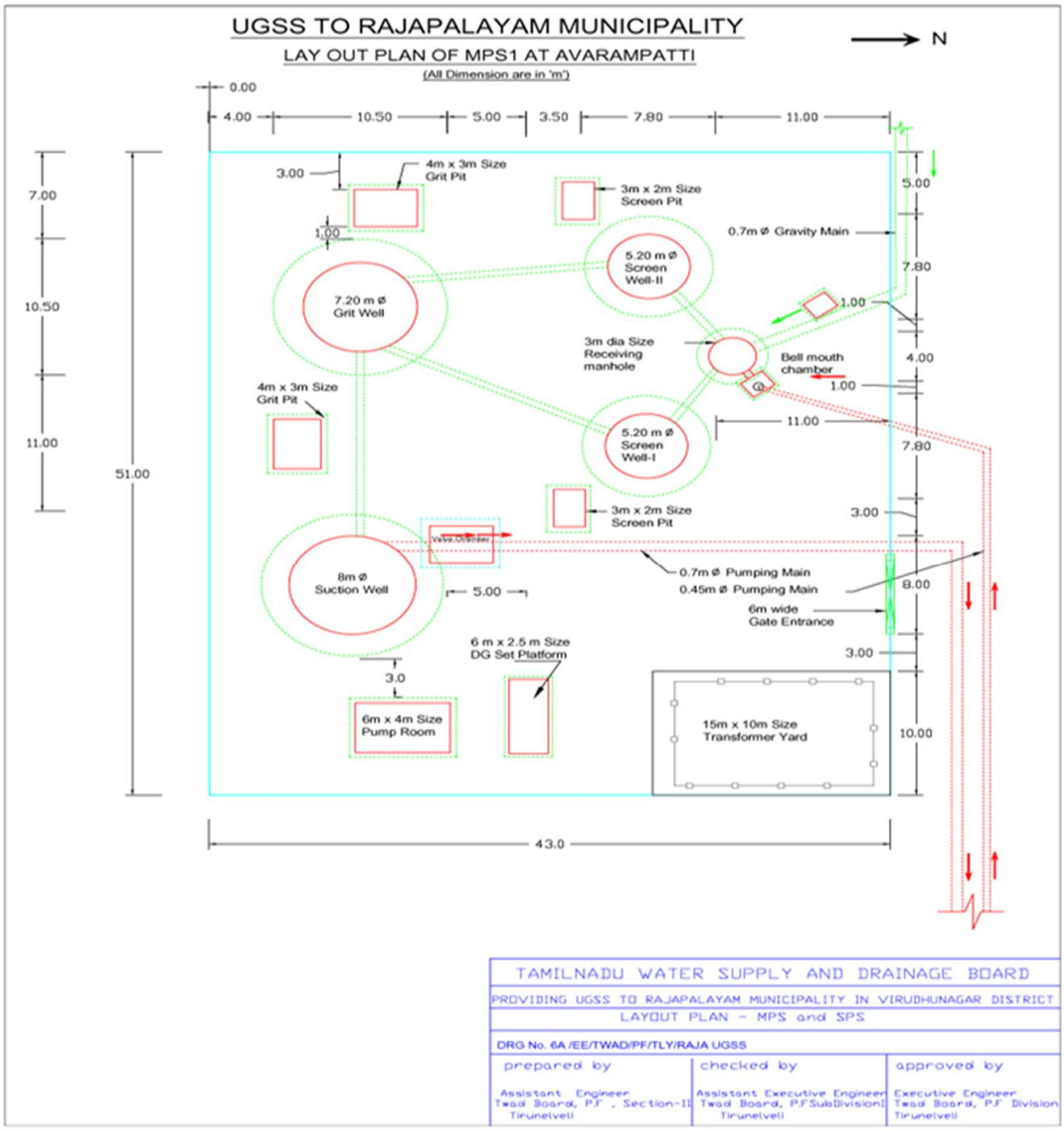


Figure 8: Sewage Treatment Plant Site Map

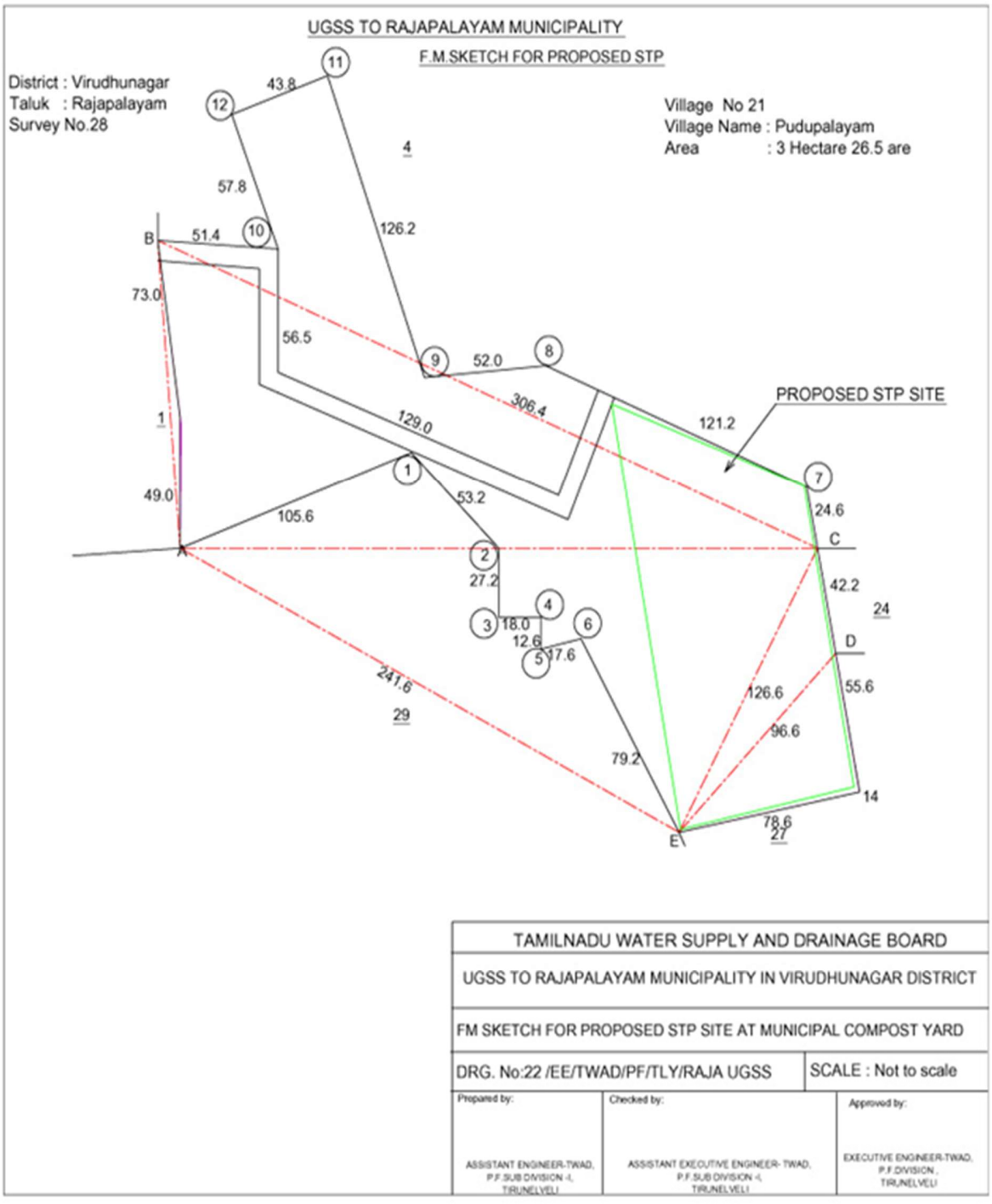
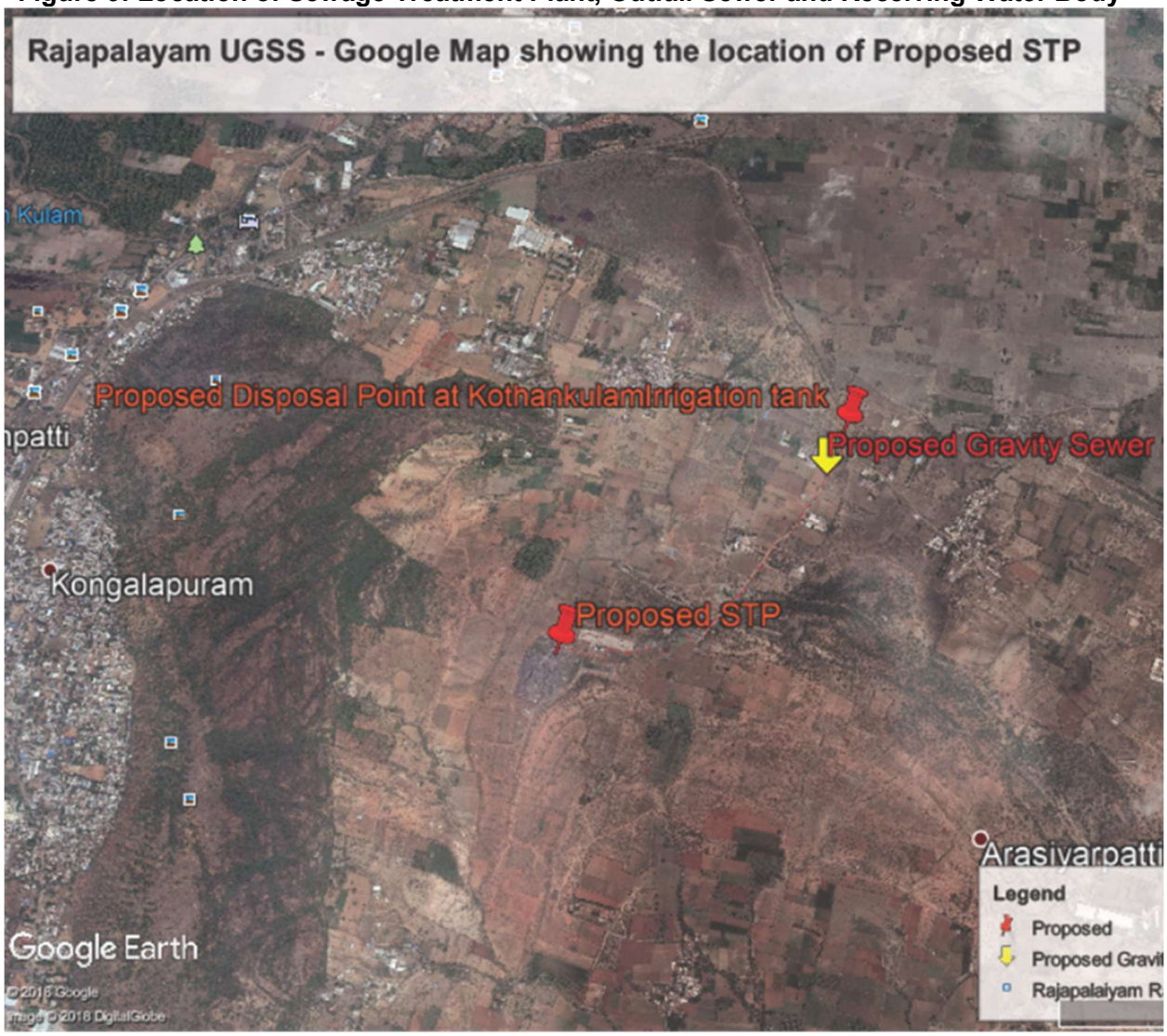


Figure 9: Location of Sewage Treatment Plant, Outfall Sewer and Receiving Water Body



Source: Google Earth.

III. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. ADB Policy

15. 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.

16. **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).

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

18. **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

19. **Environmental assessment.** The Government of India Environmental Impact Assessment (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.

20. Category A projects require Environmental Clearance from the central Ministry of Environment, Forest 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.

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

22. None of the components of this unground 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.

23. **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, health and occupational safety issues that could apply to infrastructure development. Some of the specific regulatory compliance requirements of the subproject are shown in Table 2.

Table 2:Applicable Environmental Regulations

Law	Description	Requirement
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Act was enacted to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water. Control of water pollution is achieved through administering conditions imposed in consent issued under to this Act. All pollution potential activities will require consent to establish (CTE) from Tamil Nadu Pollution Control Board (TNPCB) before starting implementation and consent to operate (CTO) before commissioning.	STP requires CTE and CTO from TNPCB. Application has to be submitted online at http://tnocmms.nic.in/OCMMS/
Ancient Monuments and Archaeological Sites and Remains Acts, 1958, its Rules,1959 and notification, 1992. Ancient Monuments and Archeological Sites and Remains (Amendment and Validation) Act, 2010	This Act provides, inter alia, for the preservation of ancient and historical monuments and archaeological sites and remains of national importance - Notifies 100m around the monument as prohibited area and 100m to 300m as regulated area for construction works; - No excavation/construction work is allowed within 100m of boundary of the protected monument; - Requires prior permission of National Monument Authority (NMA) for taking up works within 300m of the boundary of protected monuments	There are no protected monuments in Rajapalayam

Law	Description	Requirement
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 Refer Table 3 and Table 4 below for 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.
Air (Prevention and Control of Pollution) Act, 1981, amended 1987 and its Rules, 1982.	- Applicable for equipment and machinery's potential to emit air pollution (including but not limited to diesel generators and vehicles); - CTE and CTO from TNPCB; - Compliance to conditions and emissions standards stipulated in the CTE and CTO.	Generators will require CTE and CTO from TNPCB Generators to comply with applicable emission standards.
Solid Wastes Management Rules, 2016	Rules to manage municipal solid waste generated; provides rules for segregation, storage, collection, processing and disposal.	Solid waste generated at proposed facilities shall be managed and disposed in accordance with the SWM Rules
Coastal Zone Regulation (CRZ), 2019	The main objectives of this notification are to ensure livelihood security to the fishing communities and other local communities living in the coastal areas; to conserve and protect coastal stretches and; to promote development in a sustainable manner based on scientific principles, taking into account the dangers of natural hazards in the coastal areas and sea level rise due to global warming. The CRZ Notification, clearly lists out the areas that fall within the categories of I, II, III and IV of CRZ and the permissible and non-permissible activities in each zone.	Projects attracting this notification shall obtain CRZ clearance for implementation from the authority as required.
Construction and Demolition Waste Management Rules, 2016	Rules to manage construction and to waste resulting from construction, remodeling, repair and demolition of any civil structure. Rules define C and D waste as waste comprising of building materials, debris resulting from construction, re-modeling, repair and demolition of any civil structure.	Construction and demolition waste generated from the project construction shall be managed and disposed as per the rules
Labor Laws	The contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The contractor shall base the employment relationship upon equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline. The contractor shall provide equal wages and benefits to	Appendix 2 provides applicable labor laws including amendments issued from time to time applicable to establishments engaged in construction of civil works, which will need to be followed by the project.

Law	Description	Requirement
	men and women for work of equal value or type.	

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

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

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

Note:

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

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

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

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

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

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

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

Table 4:Standards for Sludge Reuse as Manure

S**tandards 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:			
Parameters	**Units**	**Organic Compost (FCO 2009)**	**Phosphate Rich Organic Manure (FCO 2013)**
Arsenic	mg/kg	10	10

S**tandards 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:

Parameters	**Units**	**Organic Compost (FCO 2009)**	**Phosphate Rich Organic Manure (FCO 2013)**
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 P205) percent by weight, minimum	percent by weight	0.4	10.4
Total Potassium (as K20), 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**

FCO = Fertilizer Control Order, g/cm^3 = gram per cubic centimeter, mg/kg = milligram per kilogram, % = percent.
*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.

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

Table 5:Clearances and Permissions Required for Construction

No.	Construction Activity	Statutory Authority	Statute under which Clearance is Required	Implement ation	Supervision
1	Sewage treatment plant (STP)	Tamil Nadu Pollution Control Board (TNPCB)	Consent to establish and consent to operate under Water Act, 1974	Contractor and Project Implementa tion Unit (PIU)	PIU
2	Tree Cutting	Department of Forest and District Collector	Clearances from the authorities as per the Tamil Nadu Timber Transit Rules,1968 or latest.	PIU	PIU
3	Hot mix plants, Crushers and Batching plants	TNPCB	Consent to establish and consent to operate under Air Act, 1981	Contractor	PIU
4	Discharges from construction activities	TNPCB	Consent to establish and consent to operate under Water Act, 1974	Contractor	PIU
5	Storage, handling and transport of hazardous materials	TNPCB	Hazardous Wastes (Management and Handling)Rules. 1989 Manufacturing, Storage and Import of Hazardous Chemicals Rules, 1989	Contractor	PIU
5	Sand mining, quarries and borrow areas	Department of Geology and mining, Government of Tamil Nadu	Not applicable Contractor to obtain material from the existing government licensed mines / quarries; Contractor will require prior approval of PIU for obtaining	Contractor	PIU

No.	Construction Activity	Statutory Authority	Statute under which Clearance is Required	Implement ation	Supervision
			material from a particular source. PIU to review and approve only existing licensed mines that are compliant with prevailing environmental regulations of India.		
6	NOC for Controlled Blasting for excavation	District Collector, Virudhunagar	Explosives Rules, 2008	Contractor	PIU
7	Groundwater extraction	Public Works Department	(Groundwater) Tamil Nadu Groundwater Development and Management Act 2000	Contractor	PIU
8	Disposal of bituminous wastes	TNPCB	Hazardous Wastes (Management and Handling) Rules. 2016 as amended	Contractor	PIU
9	Temporary traffic diversion measures	Traffc Police and Rajapalayam Municipality	MoRTH 112 SP 55of IRC codes	Contractor	PIU

25. **ADB Safeguard Policy Statement Requirements.** During the design, construction, and operation of the project the PMU and PIUs will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines (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. Sewage sludge shall be properly treated prior to its disposal and/reuse.

Table 6:WHO Ambient Air Quality Guidelines

Table 1.1.1: WHO Ambient Air Quality Guidelines[7,8]		
	Averaging Period	Guideline value in µg/m³
Sulfur dioxide (SO_2)	24-hour 10 minute	125 (Interim target-1) 50 (Interim target-2) 20 (guideline) 500 (guideline)
Nitrogen dioxide (NO_2)	1-year 1-hour	40 (guideline) 200 (guideline)
Particulate Matter PM_{10}	1-year 24-hour	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline) 150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $PM_{2.5}$	1-year 24-hour	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline) 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 7:World Bank Group's Environmental, Health and Safety Noise Level Guidelines

Table 1.7.1- Noise Level Guidelines[54]		
	One Hour L_{Aeq} (dBA)	
Receptor	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

26. **Data Collection and Stakeholder Consultations.** Data for this study has been primarily collected through comprehensive literature survey, discussion with stakeholder agencies, and field visits to the proposed subproject sites.

27. The literature survey broadly covered the following:
    (i) Project details, reports, maps, and other documents prepared by TWADB and Rajapalayam Municipality,
    (ii) Discussions with Technical experts of the Project Preparatory Technical Assistance (PPTA) team, TNUIFSL, and other relevant government agencies
    (iii) Secondary data from previous project reports and published articles, and
    (iv) Literature on land use, soil, geology, hydrology, climate, socioeconomic profiles, and other planning documents collected from Government agencies and websites.

B. Physical Resources

1. Location, Area and Connectivity

28. RajapalayamTown is situated southwestern part of Tamil Nadu, in Virudhanagar district, close to Tamil Nadu – Kerala border (15-20 km). Geographically, it is located at latitude of 9° 27'0'' N and longitude of 77°033'0''E at an altitude of 156 m from sea level. It is situated at 85 km southwest of Madurai Cityalong Madurai – Kollam (NH 208). The Municipality covers an area of 11.36 km^2 and the 2011 census population is 130,119. The town was upgraded to a special grade municipality in 2008 with seven revenue villages under its jurisdiction.

29. Rajapalayam has a well-developed transport infrastructure and is well connected by Road, Rail and Air with most cities and towns in India. NH 208 passes through Municipal area. The Nearest railway station to the project area is Rajapalayam Junction which is 2 km far from Municipal Office.

2. Topography, Soils and Geology

35. Rajapalayam municipality forms part of the eastern slopes of the Western Ghats region of the Virudhunagar district. The terrain is mostly flat or with slight slope towards the existing drainage from North-East towards West. The average elevation is around 168m. The town is bound by a small hill on the eastern side, tanks and agricultural lands on the other three sides. Contour of this area varies between +144 m to +183.00m Topography of the Town is sloping from west towards east and north towards south.

30. The soils along the streams are alluvial but the predominant soils in and around the municipality are deep and moderately well drained clayey soils. Gravelly clay soils are seen near the foot of hill. Rajapalayam block is covered with red loam soils that are rich in Phosphorous and micronutrients like Zinc, Boron, Iron and Sulphur. There are no incidences of land subsidence in the project area. Geologically, the entire Virudhunagar district can be broadly classified into hard rock and sedimentary formation of alluvium and tertiary. Limestones associated with gneiss are noticed in Aslapuram and Cholapuram in Rajapalayam taluk.

3. Seismology

31. According to Bureau of Indian Standards (BIS) [IS 1983 (Part I):2002], Rajapalayam town falls under Zone III and on the macro seismic intensity scale the project area falls under MSK VII (Moderate Damage Risk Zone). Structural design of infrastructure elements will be done with due consideration to relevant codes.

4. Climatic Conditions

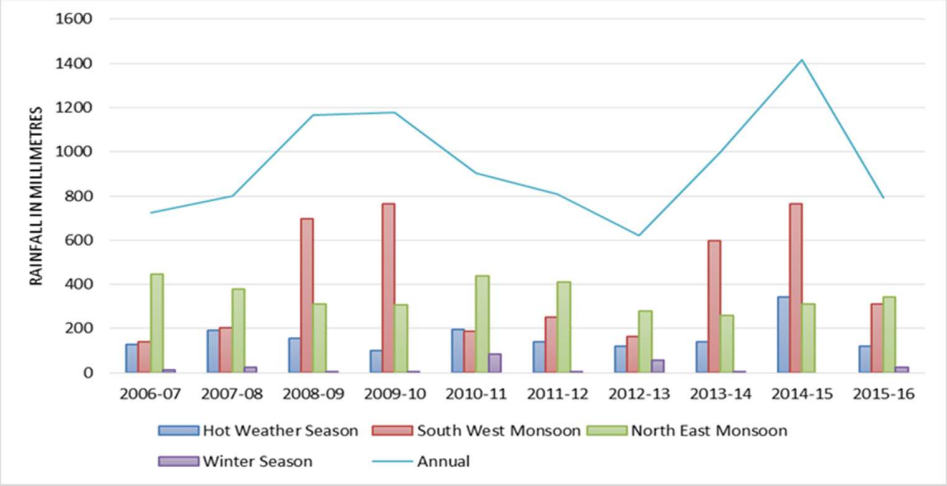
32. The climate of the town is semi-arid tropical monsoon Type. with average monthly rainfall of 69.16 mm, mostly from Northeast monsoon from October to December

33. January and February experience a very pleasant climate. During March, the sky is clear, but the temperature start increasing which continues till the end of May. The highest temperature is recorded early in April/May. Due to the presence of the mountain pass, more elevated parts of the district benefit from the south-west monsoon in the months from June to August. September is the inter monsoon period and the sky is clear. During October and November, the North East

monsoon sets in and provides most of the rains in this district. But after mid-December rain ceases. The temperature which was once set on the downward trend continues its course till the end of January. The climatic condition of Virudhunagar district is most conducive for people and cotton ginning and weaving Industries.

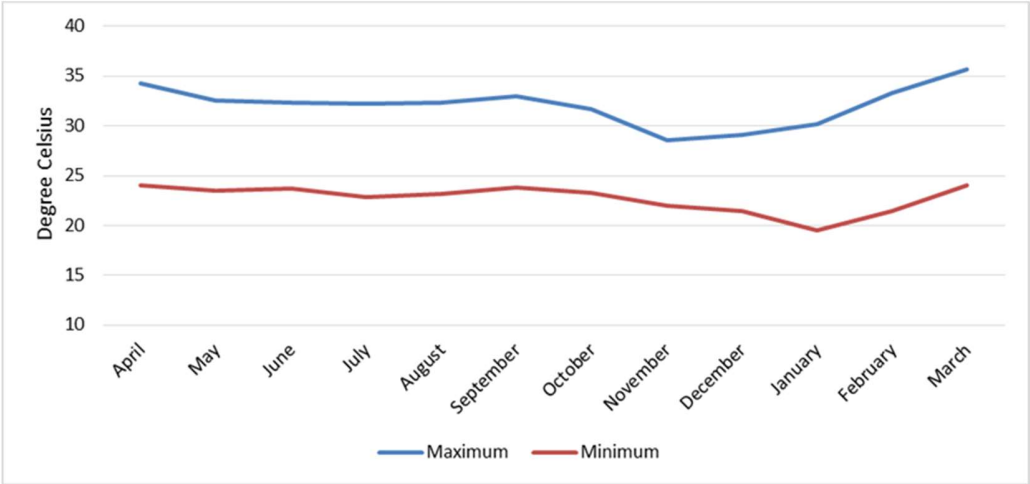
34. The maximum temperature ranges from 36°C to 41°C and the minimum temperature varies from 14°C to 31°C. The mean daily temperature during summer varies from 33°C to 40°C and the mean daily temperature during winter varies from 15°C to 31°C. Rain occurs during Southwest and Northeast monsoons. Northeast monsoon contributes, over 50% of total rainfall from October to December. The average annual rainfall of this district is 647.2 mm.

Figure 10: Annual Seasonal Rainfall in Project Area



Source: Directorate of Economics and Statistics 2015-2016.

Figure 11: Monthly Max and Min Average Temperature in Project Area



Source: Directorate of Economics and Statistics 2015-2016.

5. Surface Water

35. The project area lies within the Sevalaperiyar-Mudangiri sub-basin of the Vaippar river basin. The drainage pattern, in general, is dendritic. All the rivers or streams of the region are

seasonal and carry good flows during monsoon period. However, there are no rivers or stream that flow through or close to municipal area. There are several water tanks in the area, and important of them are: Kothankulam tank, Kondaneri tank and Puliyamkulam tank,etc. These tanks are mainly used for irrigation purposes, however, due to low rain, these tanks rarely gets filled. Water level in the tanks are very low, and due to lack of sewerage system, wastewater from the municipal area enters the tanks, and therefore mostly it is accumulated wastewater in the tanks. As shown in the Table below, water in none of the water bodies in the municipal limit are of potable quality. Biochemical oxygen demand (BOD) ranges from 20-36 mg/l, while chemical oxygen demand (COD) ranges from 100-220 mg/l. Dissolved oxygen content is very low (0.16 – 0.28 mg/l).

Table 8:Water Quality Data of Tanks, 2017-2018

No.	Parameters	Units	Kothankulam Tank	Pudukulam Tank	KondaneriKanmoi	Alavanthankulam	Puthiyathikulam
1	DO	Mg/l	0.16	0.16	0.16	0.28	0.20
2	PH	pH	7.59	7.15	8.00	7.09	6.88
3	EC	MS/cm	138	135	763	747	854
4	BOD	Mg/l	20	22	24	32	36
5	COD	Mg/l	100	120	160	140	220
6	PO_4	Mg/l	0.65	0.35	0.13	0.26	0.29
7	NO_3	Mg/l	15	10	20	25	35
8	SO_4	Mg/l	6	2	12	5	47
9	Cl	Mg/l	10	8	80	120	106
10	Alkalinity	Mg/l	36	48	260	180	220
11	TDS	Mg/l	56	54	300	272	320
12	Turbidity	NTU	4	6	4	14	9

Source: TWADB.

6. Groundwater

36. The district has both porous and fissured formations. Unconsolidated and semi-consolidated formations and weathered, fissured and fractured crystalline rocks constitute the important aquifer systems in the district. The porous formations in the district include sandstones and clays of recent to sub-recent and tertiary age (quaternary).The alluvial formations consist mainly of sand, clay and gravel, and are confined to major drainage courses in the district. The maximum thickness of alluvium is 35 m whereas the average thickness is about 25 m. Ground water occurs under phreatic to semi-confined conditions in these formations. Alluvium, which forms a good aquifer system along the Vaippar and Gundarriver, is one of the major sources of water to the villages. The water-bearing properties of crystalline formations, which lack primary porosity, depend on the extent of development of secondary intergranular porosity. The occurrence and movement of ground water in these rocks are generally confined to such spaces. These aquifers are highly heterogeneous in nature due to variation in lithology, texture and structural features even within short distances. Ground water generally occurs under phreatic conditions in the weathered mantle and under semi confined conditions in the fissured and

fractured zones at deeper levels. The thickness of weathered zone in the district is in the range of 4 to 15 m. The depth of dug wells ranged from 10 to 15 meter below ground level (mbgl). The yield of large diameter wells in the district, tapping the weathered mantle of crystalline rocks ranges from 40 to 110 liters per minute (lpm) and are able to sustain pumping for 2 to 6 hours per day. The Specific capacity of large diameter wells tested in crystalline rocks ranges from 6.26 to 183.8 liters per meter of drawdown.

37. The depth to water level in the district varied between 0.67 and 12.12 mbgl during pre-monsoon (May 2006) and varied between 0.49 and 8.78 mbgl during post monsoon (Jan 2007). The seasonal fluctuation shows a rise in water level which ranges from 0.35 to 2.8 m. The piezometric head varied between 3.49 and 16.23 mbgl during pre-monsoon (May 2006) and 1.29 and 8.06 mbgl during post monsoon. The estimation of groundwater resources for the Virudhunagar district has shown that out of 19 blocks, 11 blocks are over exploited and 4 blocks are under “critical” category.

38. **Groundwater Quality**.Ground water in phreatic aquifers in Rajapalayam Municipality in general is colorless, odorless and slightly alkaline in nature. According to Central Ground Water Board (CGWB) report, the specific electrical conductance of ground water in phreatic zone (µS at 25oC) during May 2006 was in the range of 597 to 4810 in the district. It is between 750 and 2250 µS/cm at 25°C in the major part of the district. Following Table shows the groundwater quality in Rajapalayam along Irrigation channel.

.

Table 9: Groundwater Quality in Rajapalayam

Parameters	BIS Standard	Pre-monsoon (mean)	Post-monsoon (mean)
pH	6.5 – 8.5	7.20	7.10
Total dissolved solids, mg/l	500 – 2000	932	900
Total hardness, mg/l	300 – 600	260	240
Calcium, mg/l	75 -200	56	56
Magnesium, mg/l	30 – 100	29	29
Sodium, mg/l	200	210	208
Potassium, mg/l	-	13	13
Chloride, mg/l	250 – 1000	160	140
Bicarbonate, mg/l	300 – 600	180	160
Sulphate, mg/l	200 – 400	219	208
Iron as Fe	0.3	0.21	0.23

BIS = Bureau of Indian Standard, Fe = iron, mg/l = milligram per liter, pH = potential of Hydrogen.
Source: CGWB.

7. Ambient Air Quality

39. The ambient air quality in the project area is being monitored under National Air Quality Monitoring Programme (NAMP) at following locations in Rajapalayam (i) Municipal office (Mixed zone), (ii) Sattrampatti (Residential zone), and (iii) INTUC Nagar (Industrial zone). Following table presents the annual average concentration of air pollutants at the monitoring locations. Oxides of sulfur and nitrogen are well within the national ambient air quality standards, while the particular matter (PM_{10}) levels are exceeding the standards.

Table 10: Ambient Air Quality in Rajapalayam, 2016-2017

No.	Location	Category	Annual Average Concentrations of Air Pollutants ($\mu g/m^3$)								
			SO_x			NO_x			RSPM (<10 µm)		
			Min	Max	Average	Min	Max	Average	Min	Max	Average
1	Chattrapatti Road	Mixed	8.8	11.6	10.2	17.3	26.9	22.4	64	79.1	71.5
2	Municipal office	Residential	7.2	10.4	8.8	16.2	24.2	20.2	58	74	66
3	INTUC Nagar	Industrial	9.2	12.6	10.9	20	28	24	70	80	75
NAAQ Standard											
Industrial, Residential, Rural and Other Areas					50			40			60
Ecologically Sensitive Area					20			30			60

Source: Tamil Nadu Pollution Control Board.

8. Ambient Noise Levels

40. Ambient day time noise level at monitoring locations ranged from 49 dB(A) to 55 dB(A), within the specified noise level standards of 55 dB(A). Both the location where noise level measures are along the main roads, and it is likely that the noise level will be lower than these values in residential areas..

Table 11: Ambient Day-time Noise Levels in Rajapalayam

Area Name	Day-time Noise (dBA)
Chatrampatti Road	49
Tenkasi Road	55
Standards	55

Source: Tamil Nadu Pollution Control Board.

C. Ecological Resources

41. The eastern slopes of Western Ghats lie at about 8-10 km west of Rajapalayam Town. Western Ghats rich in biodiversity, and is house to many rare and endemic varieties of flora and fauna. AyyanarKoil forest area is located in the eastern slopes. Srivilliputhur Grizzled Squirrel Wildlife Sanctuary, which is within the Western Ghats, spread over an 480 km^2 is the nearest protected area. This protected area is at about 8 km west from the Rajapalayam municipal boundary. Situated in a dry area, Rajapalyam town or its immediate surroundings have no environmental sensitive areas. Project area do not have any environmental sensitive areas nor is home to any rare or endangered species. As all the project components are located within the boundary, and the STP site, which is located outside the boundary. is in the east of the town while the Western Ghats and the sanctuary is located towards west.

42. Srivilliputhur Grizzled Squirrel Wildlife Sanctuarywas established in 1989 at Shenbagathopu in the neighboring Srivilliputturtaluk. The sanctuary is home to the endangered, arboreal grizzled giant squirrel (*Rattufamacrora*). This sanctuary is conferred as one of the World Natural Heritage sites by UNESCO in 2012.

43. All the subproject sites are located within the urban area and its immediate surroundings, where there are no notable sensitive environmental or ecological features. These sites are under human use for many years, and therefore there is no natural habitat left. STP site is located outside the town, and surrounded by agricultural/vacant lands. This site is part of a large land parcel earmarked for development of waste (solid and liquid) management facilities of the municipality. Part of the site is used for solid waste disposal. The land earmarked for STP is currently vacant, covered with shrubs and bushes of local species.

D. Economic Development

1. Land Use

44. A land use survey was conducted by the State Town Planning Authority in the year 1997 as part of the preparation of a master plan for Rajapalayam Local Planning Area. The survey showed about 14.69% as developed area and Most of the population live in the aforesaid developed area. The land use analysis for Rajapalayam town is given below. There is no recent data available on the town land use. Considerable land is under industrial use, explaining the industrial character of the town.

Table 12: Land Use Classification in Rajapalayam

No.	Land Use	Area (ha)	Percentage to Total Area (%)
1	Residential	270	23.78
2	Commercial	56	4.93
3	Industrial	105	9.24
4	Educational	54	4.75
5	Public & Semi Public	225	19.80
6	Agricultural (Including water bodies)	426	37.50
	Total	1136	100.00

Source: State Town Planning Authority. 1997.

2. Industry and Agriculture

45. Initially, agriculture was the principal source of living for the people of Rajapalayam. In the mid1900s, Rajapalayam gradually evolved into a thriving business community. "Rajapalayam Mills Limited" was the first cotton spinning mill in this region to start industrial revolution in Rajapalayam. After this initiation was successful, the industrial revolution became very fast. Several years later, Rajapalayam Became 3rd largest Textile industrial hub of Tamil Nadu, after Coimbatore and Dindigul. The city is famous for Bandage cloth, Woven cloth and nightware production, which greatly contributed to export sector. The neighboring town of Chatrapatti (Virudhunagar District) is famous for producing Bandage Cloths (Surgical Cotton cloth-Gauze). Dhalavaipuram and Muhavoor, small towns, are famous for producing nightware with small scale industries. They are the one of the largest producers and exporters of nightware in India.

57. Agriculture in the municipal area is limited to some pockets in the outskirts. Major crops cultivated in the region are sorghum, groundnut, cowpea, rice, cotton and maize.

3. Infrastructure

46. **Water Supply.** Rajapalayam municipality has been provided with protected water supply system. The present water supply schemes were implemented utilizing the water from Mudangiarriver at Ayyanarkovil in the Western Ghats through summer storage tanks. Summer

storage tank is located at a distance of 10 km west of the town. At present daily water supply in the town is 11.30 MLD.

47. **Sanitation and Drainage.** At present due to lack of sewerage system, the existing storm water drains mainly carry the wastewater. Individual households mostly use septic tanks to dispose sewage, and sullage is mostly let into open drains. In the high density areas of the town, where there is no space for soak pits, septic tank effluent is also let into open drains. The total length of roads in the town 132.7, and the length of road side drains is 215 km.

48. **Solid Waste Management**. The Municipality has been divided into 9 sanitary divisions, each division is managed by a sanitary inspector. 320 sanitary workers are engaged in sweeping and drain cleaning, door to door collection, segregation and transportation of solid waste. On an average 55 tons of solid waste is collected from the town. This municipality has established a compost yard at Arasiar Patti Village, on the eastern side of the town. Total area of the site is 20.35acres. A part of this site is now being utilized for the STP.

49. **Transportation.** National Highway (NH) connecting Madurai and Rajapalayam linking major towns like, Thirumangalam, Srivilliputhur. The Rajapalayam municipality covers a total road length of 132.7 km, the length of state and national highways within the municipal limits is 12.03 km.Rajapalayam has two bus stands to cater to the needs of the population. The old bus stand currently serves as the city bus stand. The new bus stand on Sankarankovil Road serves for intercity buses. Buses frequently shuttle between Madurai and Rajapalayam via Srivilliputtur. Rajapalayam has a railway station in the heart of the town, the railway line passing through the town and connecting Madurai and Shencottai divides the town into two parts. Nearest domestic airport is at Madurai, about 80 km from Rajapalayam.

E. Socio Cultural Resources

1. Demography

50. According to 2011 census, Rajapalayam had a population of 130,119 with a sex-ratio of 1,014 females for every 1,000 males, much above the national average of 929. A total of 11,604 were under the age of six, constituting 5,927 males and 5,677 females. Scheduled Castes (SC) and Scheduled Tribes (ST) accounted for 13.51% and 0.09% of the population respectively. The average literacy of the city was 77.87%, compared to the national average of 72.99%. The city had a total of 37,797 households. Workforce participation ratio is 41%, comprising 94% main workers and rest marginal workers. Nearly 90% are engaged in industrial and service sectors, and about 8% are engaged in agricultural activities. As per the religious census of 2011, Rajapalayam had 94.53% Hindus, 3.48% Muslims, 1.75% Christians, 0.02% Sikhs and 0.21% following other religions. Ward-wise population is given in the below table.

Table 13: Ward Wise Population in Rajapayalam, 2011 Census

Ward	Male	Female	Total
Ward No-01	1823	1856	3679
Ward No-02	1513	1554	3067
Ward No-03	1715	1758	3474
Ward No-04	1341	1377	2718
Ward No-05	1165	1205	2370
Ward No-06	992	1052	2044
Ward No-07	1157	1121	2278
Ward No-08	1635	1743	3378
Ward No-09	1455	1458	2913
Ward No-10	1486	1432	2918
Ward No-11	1721	1752	3473
Ward No-12	2138	2135	4273
Ward No-13	1055	1095	2148
Ward No-14	1082	1111	2193
Ward No-15	1253	1289	2542
Ward No-16	1535	1625	3160
Ward No-17	1688	1751	3439
Ward No-18	1035	1089	2124
Ward No-19	1739	1739	3478
Ward No-20	2852	2818	5671
Ward No-21	2821	2785	5606
Ward No-22	797	781	1578
Ward No-23	1166	1209	2375
Ward No-24	1157	1220	2377
Ward No-25	1079	1052	2131
Ward No-26	1536	1555	3091
Ward No-27	2077	2083	4160
Ward No-28	1767	1783	3550
Ward No-29	1142	1200	2342
Ward No-30	1714	1751	3465
Ward No-31	1208	1238	2446
Ward No-32	1060	1136	2196
Ward No-33	1365	1390	2755
Ward No-34	1602	1655	3257
Ward No-35	1534	1553	3087
Ward No-36	1569	1531	3100
Ward No-37	1561	1577	3138
Ward No-38	962	968	1930
Ward No-39	2624	2559	5183
Ward No-40	1849	1828	3677
Ward No-41	1630	1654	3284
Ward No-42	2022	2029	4051
Total	**64622**	**65495**	**130119**

2. History, Culture and Tourism

51. Rajapalayam" the name derived from 'Raja'-The community called Raja (Rajus) and 'Palayam'-in Tamil means a "cantonment on fort". Previously called as 'PALAYA Palayam', then 'RajuPalayam' and finally as 'Rajapalayam'. Rajapalayam is inhabited by people who came from the old Vijayanagaram state. Krishnadevaraya, the Maharaja of Vijayanagara Empire had sent five military commandos to Madurai Nayak kingdom to keep the law and order in the southern part of Nayaka kingdom at Sivagiri region. The Kshatriya Raju team under the leadership of Chinna Raja, a lineage decedent of the king of Vijayanagar belonged to Pasumpatti and other four brothers reached and established good for the Nayaka kingdom of Madurai. After then, they

migrated to the south along with his followers and settled at kilarajakularaman (a nearby village of Rajapalayam) at the first instance and then moved their settlements to Palayapalayam in 1483 AD. When Vijayanagaram rule was established in Madurai, the descendants of the original emigrants were said to have served under the Chokkanathanayak, king of Madurai (1659 -1682) who has recorded his appreciation of the service rendered by Chinna raja and his four sons and has granted 'Sasanam' (King's Free Grant/Charter) to establish a fort there. So the middle of 16th century, they constructed the Palayapalayam fort. Either after the battle of Talaikotta (1565) or on the eve of the same battle more Rajas migrated to the south from the Vijayanagarempire. They settled in Pudupalayam, western portion of Rajapalayam municipality and the town was expanded by purchasing lands from Vijayarengachokkanathanayak (1706 -1732).

52. Rajapalayam was constituted as a united board in the year 1885. It became a panchayat board in the year 1930. Railway line was laid in the year 1927 and the town was electrified in 1937.

53. **Tourism**. AyyanarKoil forest area is located 10 km west of Rajapalayam on the eastern slopes of Western Ghats. The forest area has many of streams, waterfalls, springs and a temple. Hill trekking in this forest area is one of the main recreations for Rajapalayam residents and people from neighboring areas.

54. There are no Archaeological Survey of India or state protected monuments in the project area. The nearest protected monument (TirumalaiNayak Palace, Srivilliputtur) is located at more than 10km distance from the project area.

F. Subproject Site Environmental Features

55. Features of the selected subproject sites are presented inTable 14.

Table 14:Site Environmental Features

Infrastructure	Location and Environmental Features	Site Photograph
Sewage treatment plant (STP)	Proposed site is located within the solid waste compost yard, in Pudupalyam Village, eastern outskirts of Rajapalayam Town. Total land area of this waste management facility is 20.35 acres, of which 5 acres allotted for construction of STP. Site is presently vacant, and covered with scrubs and bushes of local species. Site is not a low lying area. Site is surrounded by vacant/agricultural lands. There are no houses/habitation nearby (>1km). Treated wastewater from STP will be discharged into Kothankuluam irrigation tank, located at about 1.4 km north of STP site. A pipe will be laid from STP to tank along an existing road. Total water storage capacity of the tank is 22.83 million cubic feet (mcft), the depth of water storage is 3.53 m. Irrigated area	**Proposed Sewage Treatment Plant Site**   **Kothankulam Tank**

Infrastructure	Location and Environmental Features	Site Photograph
	under the tank is 89.48 ha. Tank is under the Public Works Department of Government of Tamil Nadu. Water is supplied to fields (when water is available in the tank, normally in monsoon/ post monsoon) via field channels from the tank. These are maintained by Public Works Department (PWD). This irrigation tank is part of Kayalkudiyar sub basin. Kothankulam is part of series of irrigation tanks, inter connected, and have a total water storage capacity of 92.93 mcft and total command area of 350.25 ha. Kothankulam tank has a surplus weir (of 42 m length), and connected to a downstream tank (Pudhukulam tank) by a channel. Pudhukulam tank is in turn connected to network of Citrankulam tank, Pillayarkulam tank, Veppa nkulam tank, and Cennakulamtank. These tanks are rain fed tanks, and due to low rainfall, there is no incidence of tanks filling to their capacity in at least last 5 years. Treated wastewater from the STP will be disposed into Kothakulam irrigation tank. (Latitude - 9.4890837, Longitute - 77.6058169)	 
Sewage pumping stations	**1. Main sewage pumping station at North Avarampatti for Zone - I** This is the main pumping station; sewage from collection sewer network (including lift stations 3 Nos) in zone 1 and pumping main of sewer quantity from zone 2 (including lift station 1 No) will be collected here and conveyed to the STP. Site is owned by Hindu Religious and Charitable Endowments (HR & CE) Department of Government of Tamil Nadu. Site is currently vacant, and located opposite to a community toilet. Site is surrounded by residential areas, and houses are located close to the site (<10 m). A temple is located at about 70 m from the site. Requires proper odor control measures. (Latitude - 9.4630951, Longitute - 77.5580097)	

Infrastructure	Location and Environmental Features	Site Photograph
	2. Sewage pumping station at Andalpuram This is Sub Pumping Station, sewage from Collection Sewer Network in Zone-III will be Collected and Conveyed to STP. Original site was Proposed in a vacant land along a state highway Road of Rajapalayam – Chatrapatty Road belongs to Highway authority. The highway Authority Refused to hand over the above site for the Construction of SPS for Zone-III due to widening of existing road on both sides. Alternate private land site was Identified just nearly away from Original Site Proposed. land owner donated and Registered the above land in the name of the Commissioner, Rajapalayam Municipality on 15.10.19 for the Purpose of Construction of SPS for Zone-III. The site is mostly surrounded by Commercial Buildings and houses are located away from the Site. Site is not low lying or Flood Prone. Nearest Property is at about 30m from the site. (Latitude - 9.4219241, Longitute - 77.5812455).	
	3. Sewage pumping station at Indranagar This is Sub Pumping Station, sewage from Collection Sewer Network in Zone-II will be Collected and Conveyed to MPS. Site is located near burial ground and is owned by municipality. Originally selected along state highway road in the City outskirts that is west side of Burial Ground. Now alternatively east side of the same burial ground site is selected, in consultation with the public. Site is currently vacant and there are no notable tree cover or vegetation. Site is mostly surrounded by vacant land and burial ground and houses are located away from the site. Site is not low-lying or flood prone. (Latitude - 9.4380256, Longitude - 77.5572848)	

Infrastructure	Location and Environmental Features	Site Photograph
Sewer network	Considering the terrain of the town, the entire town area is divided into three zones. Collection system with trunk sewer for each zone has been designed and the waste water generated from each zone has been collected in the Sub Pumping Station and then pumped to Main Pumping Station and then conveyed through the pumping main to the Sewage Treatment. The collection system of 157.174 km length sewer network consists of 200 UPVC pipes for 126.935 km, 200 to 300 mm double wall corrugated (DWC) pipes for 20.513 km and 350 to 700 mm CI pipes for 9.726 km and 5865 manholes. Interceptors for narrow lanes for a length of about 11 km has been proposed within the municipal area. The sewer depth varies between 1.0m to 6.0m and in narrow roads the depth of sewer is between 0.6m to 1.0m. The sewers will be laid in the center of the road, and the maximum width of excavation will be around 1.2m. Sections of the alignment have been identified to involve hard rock requiring controlled blasting for excavation. The procedure followed by TWAD Board in carrying out controlled blasting is provided in Appendix.	

Figure 12: Hard Rock Area in Zone I of Rajapalayam Municipality

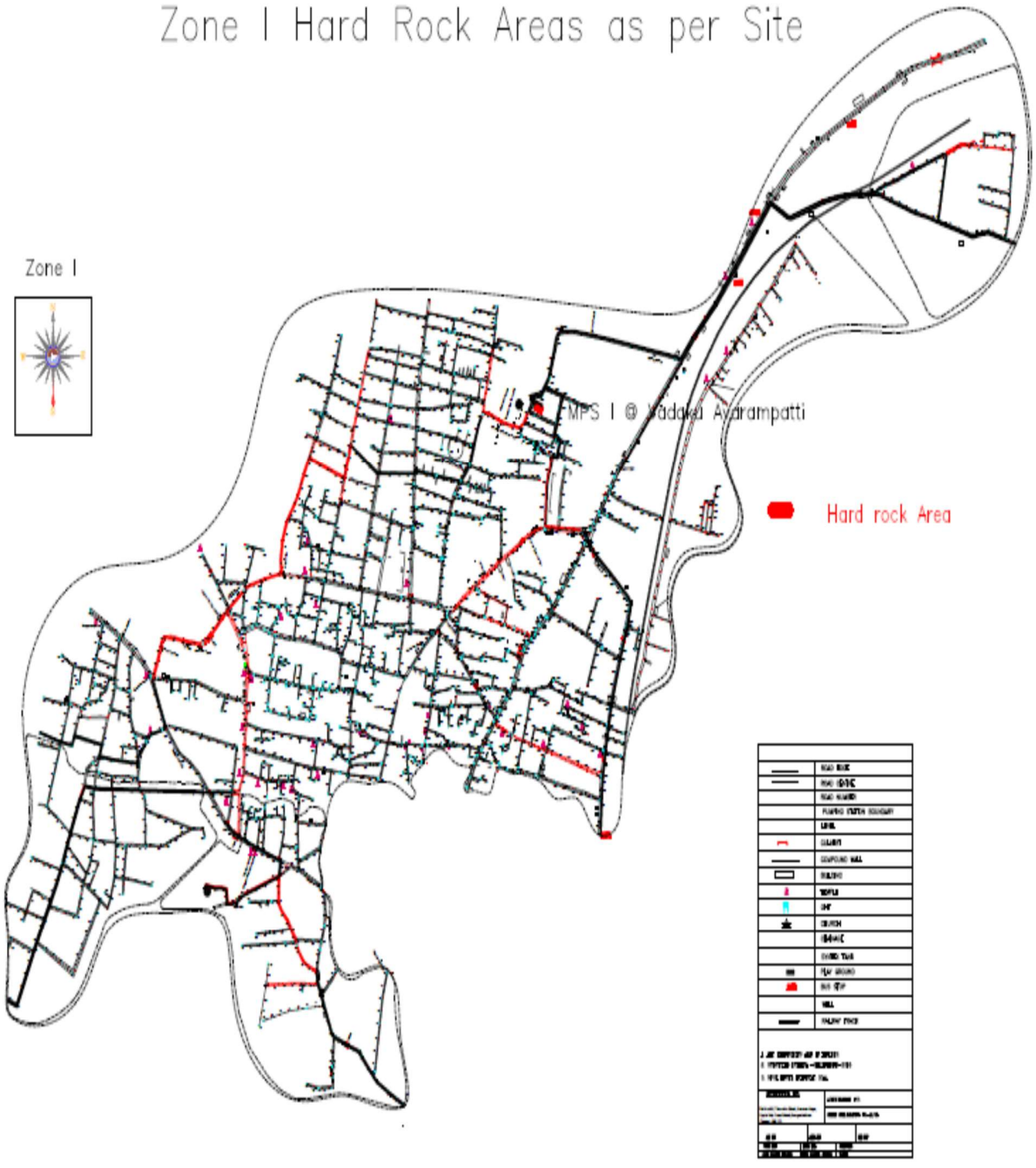


Figure 13: Hard Rock Area in Zone II of Rajapalayam Municipality

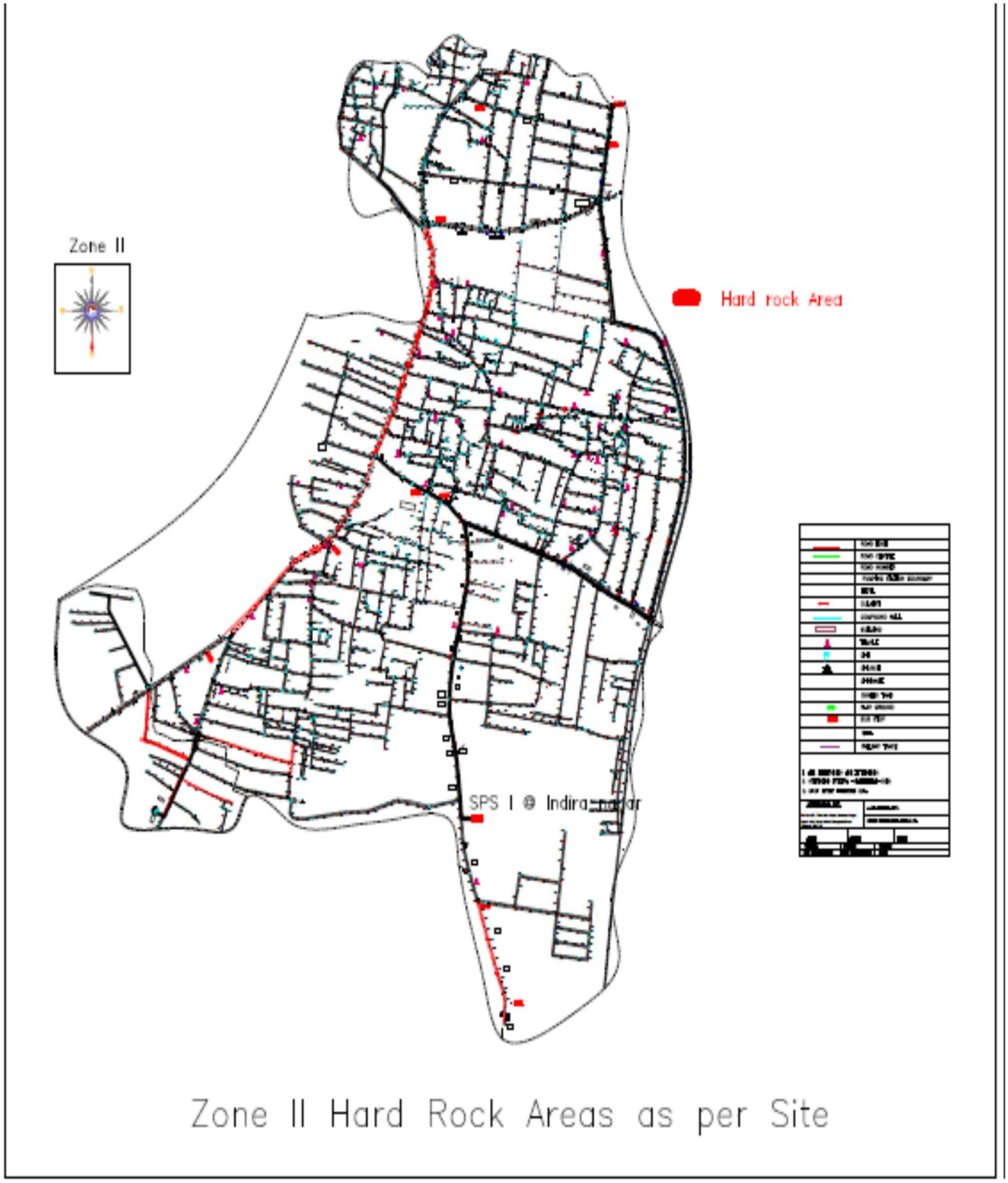


Figure 14: Hard Rock Area in Zone III of Rajapalayam Municipality

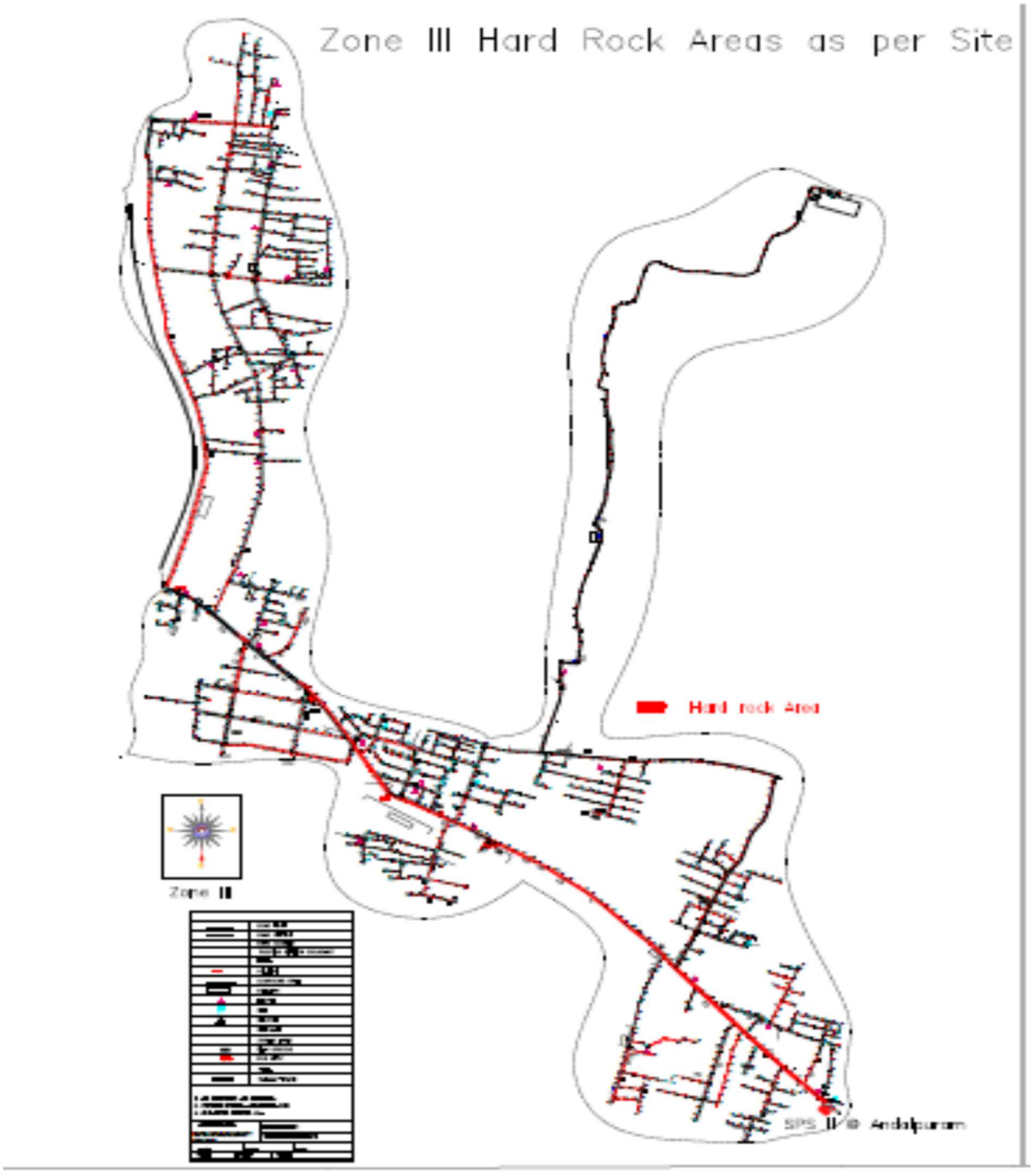
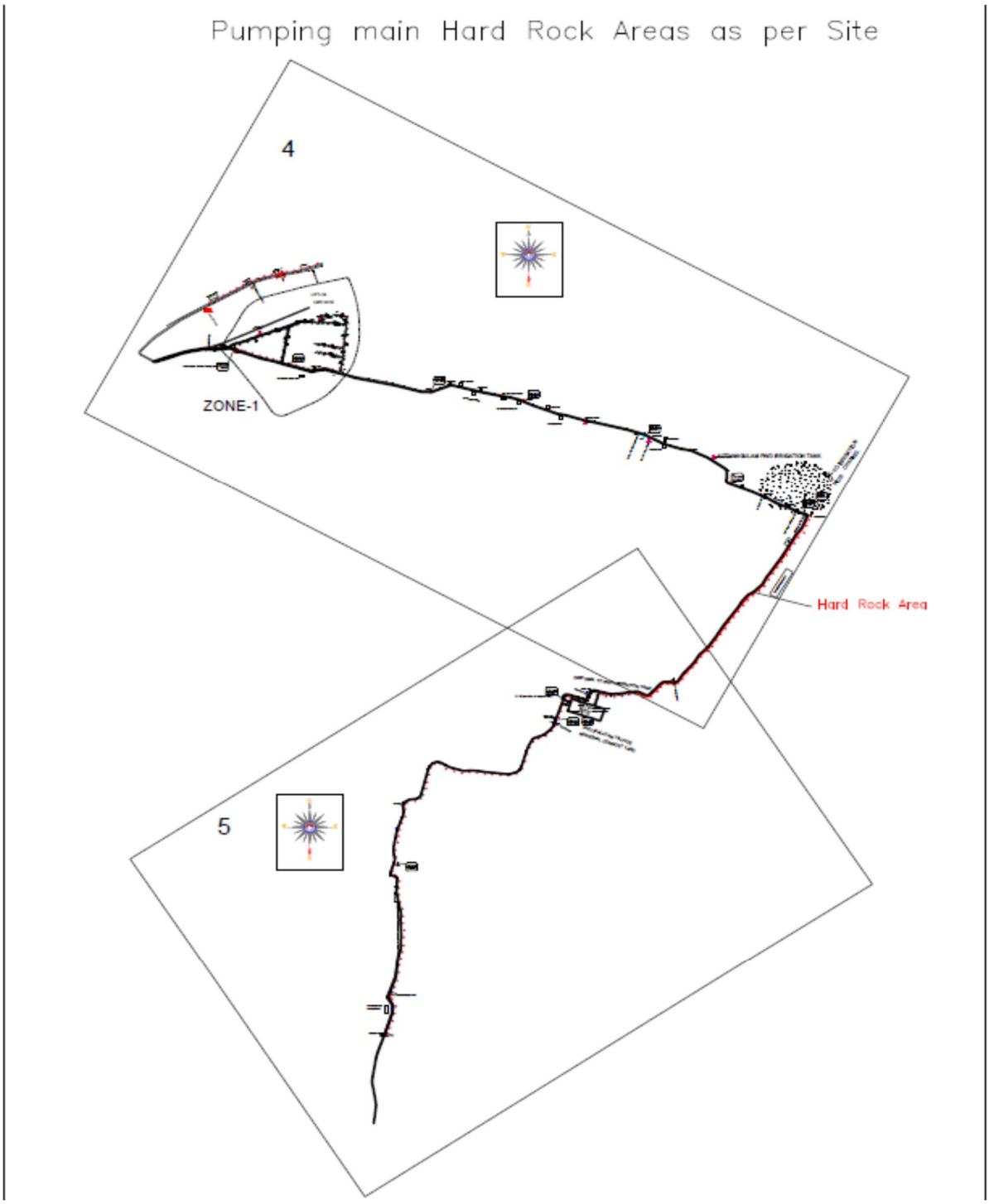


Figure 15: Hard Rock Area in Pumping Main



V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

56. 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.

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

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

58. 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).

59. 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.

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

61. In the case of this project (i) most of the individual elements involve simple construction and operation techniques except for the 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 nearby 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

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

63. **Design of Sewage Treatment Plant**. A 21.85MLD STP is proposed to be constructed at the identified site to treat the sewage generated from the subproject area. It is proposed that the treated wastewater will be disposed into Kothankulam irrigation tank under the control of Public Works Department of Government of Tamil Nadu. This tank is located about 1.4 km north of the STP site. STP is proposed for implementation under design-build mode of contract, and therefore the STP will be designed by the contractor to meet the effluent disposal standards for STPs.

64. Kothankulam tank is rain-fed, and the total water storage capacity is 22.83 mcft (0.62 million cubic meter) with a depth of storage of 3.53 m. Tank has an irrigation command area of 89.44 ha. Tank also has an overflow arrangement to let off the surplus flow once it is filled to its full tank capacity (FTL). Water is supplied to fields (when water is available in the tank, normally in monsoon/ post monsoon) via field channels from the tank. These are maintained by PWD. There is a 42 m length surplus/overflow weir and a channel that takes the overflow to a downstream tank (Pudukulam Tank). The Pudukulam tank overflow is further transferred to another downstream tank. There are in all 6 tanks connected with one another starting from Kothankulam tank, then Pudukulam tank, Chithrankulam tank, Pillayarkulam tank, Veppankulam tank and Chennelkulam tank. These irrigation tanks are part of Kayalkudiyar irrigation sub-basin of PWD. These tank network has a total command area of 350 ha and the total storage capacity is 92.93 mcft. If the water is surplus at the last tank of Chennakulam tank, the surplus will flows into Nathikudi channel and joins Vaippar River near Ethirkottai.

65. **Characteristics of Receiving Water Body**. At present the water storage in Kothankulam tank is negligible. Due to low rainfall tank fills rarely to its capacity. Consequently water is available only during few months during monsoon. Wastewater from Rajapalyam and surrounding areas enter the tank. Water quality data (Table 8) shows the polluted nature of tank water, with dissolved oxygen level of just 0.16 mg/l, BOD of 20 mg/l and COD of 100 mg/l. Due to almost dry nature of lake and polluted water, there is no notable aquatic life in the lake. Water from the tank is used only for irrigation, and there are no drinking water intakes (surface or subsurface) in the tank.

66. Given the current status of tank with negligible storage, polluted nature of water, no dependent potable uses, no notable aquatic life, etc., there are no adverse impacts likely due to disposal of STP treated wastewater meeting the set quality standards. Given the proposed disposal standards that will be utilized, the tank water quality will improve making it feasible to be used for irrigation in the command area. Water is supplied to fields via the existing field channels from the tank maintained by PWD. Proper systems will be put in place at the proposed STP to ensure that treated wastewater at all times meets the stipulated standards prior to its disposal into this tank.

67. The STP will require uninterrupted power supply for operation of all the activities from inlet to treatment, and for sludge dewatering. Disruption in power supply will lead to process upset, may affect the efficiency of treatment, and result in treated effluent quality not meeting the disposal standards. Following measures are integrated into design and contracts to ensure efficient operation:

(i) Ensuring continuous uninterrupted power supply, including a back-up facility (such as generator);
(ii) Providing operating manual with all standard operating procedures (SOPs) for operation and maintenance of the facility;
(iii) Necessary training to municipal staff dealing with STP;
(iv) Extended contractor period for O&M, proper transfer of facility to municipality with adequate technical know-how on O&M and hands-on training to municipal staff; and
(v) Provision for online monitoring of crucial wastewater quality parameters at the inlet and outlet of the plants per the discharge standards.

68. One of the critical aspects in STP operation is, change in raw sewage characteristics at inlet of STP may affect the process and output quality. The system is designed for municipal wastewater, which does not include industrial effluent. Characteristics of industrial effluent widely vary depending on the type of industry, and therefore disposal of effluent into sewers may greatly vary the inlet quality at STP, and will upset process and affect the efficiency. Although proposed system will not serve industrial establishments, and industrial effluent can't be discharged in to municipal sewers, there are industries in subproject area with wastewater discharges, Following measures are suggested to safeguard sewerage system efficiency:

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

69. Proposed STP site is located within the large land parcel that houses solid waste management facility (composting plant) Site is surrounded by agricultural and barren lands, and located away (more than 1 km) from the residential areas / habitations. Site and the town is separated by a big hill (Sajeevi hill). Further, SBR process being an aerobic process and

conducted in a compacted and a closed system with automated operation, odor nuisance will be very minimal. Limited bad odor may be generated from wet well, primary treatment units and sludge treatment. Considering future development, adequate buffer around the plant will be maintained and planted with multiple rows of trees. The following measures are suggested for including in the site planning and design:

(i) Develop a green buffer zone of 15-20 m wide all around the STP with trees in multi-rows and landscaping. This will act as a visual screen around the facility and will improve the aesthetic appearance.

70. **Sewage sludge** generally consists of organic matter, pathogens, metals and micro pollutants. The concentration of parameters such as metals can be influenced by input to the sewers system from industry. Since no industrial wastewater is allowed into sewers, it is unlikely that sludge contains heavy metals. The sludge from reactors will be collected in sludge sump and conveyed to centrifuge for dewatering. Dewatering units will be in enclosed building vented to odor control unit, and health and safety precaution shall be put in place for H_2S build up. The sludge in the form of a wet cake will be further air-dried in the sludge drying beds. The treatment and drying processes kill enteric bacteria and pathogens, and because of its high content of nitrates, phosphates and other plant nutrients the sludge is an excellent organic fertilizer for application to the land. Adequate drying is however necessary to ensure maximum kill of enteric bacteria. To achieve adequate drying minimum drying period (15 days) shall be ensured. The drying period, which will be varying depending on the season will be determined during operation and be followed. A sludge management plan will be developed by the STP facility designer. Sludge shall be periodically tested for presence of heavy metals and to ensure it meets standards for the application to land. Proper sludge handling methods should be employed. Personal Protection Equipment should be provided to the workers.

71. 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, making it unsuitable for food crops. Tests will be conducted to confirm the concentrations are within the following standards. As there are no specific standards notified for sludge reuse, the compost quality standards notified under the Solid Waste Management Rules, 2016 have been adopted here. Rules stipulate that “In order to ensure safe application of compost, the following specifications for compost quality shall be met”:

Table 15:Characteristic of Sludge for Use as Soil Conditioner

In order to ensure safe application of compost, the following specifications for compost quality shall be met, namely			
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/cm3)		<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 P205) percent by weight, minimum	percent by weight	0.4	10.4
Total Potassium (as K20), 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.
Source: Standards for Composting, Schedule II A, Solid Waste Management Rules, 2016
FCO = Fertilizer Control Order, 1985, amendments in 2009 and 2013.

72. **Sewer System – Collection and Conveyance.** The sewerage system is designed as a separate system of sewage collection (i.e. caters only to domestic wastewater). Existing surface road side drains in the project area cater to collection and conveyance of runoff during rains. The underground gravity sewers would carry sewage from households to the nearest lifting or pumping station, from where the sewage would be pumped to the STP. To maximize the benefits as intended, City Corporation would 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.

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

(i) Limit the sewer depth where possible;

(ii) Sewers shall be laid away from water supply lines and drains (at least 1 m) if not possible, sewer lines shall be laid below the water lines;
(iii) In all cases, the sewer line should be laid deeper than the water pipeline (the difference between top of the sewer and bottom of water pipeline should be at least 300 mm);
(iv) In unavoidable cases, where sewers are to be laid close to storm water drains, appropriate pipe material (that has no or least infiltration risk) shall be selected
(v) For shallower sewers and especially in narrow roads, use small inspection chambers in lieu of manholes;
(vi) Controlled blasting would be undertaken in some stretches where hard rock is encountered based on thesite 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.
(i) Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize silt/garbage entry;
(ii) Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulfide generation.

74. **Sewage Pumping Stations and Lift Stations**. It is proposed to construct 4 sewage lift stations, and 3 sewage pumping stations, which will receive sewage from the catchment area via the sewer network and pump to higher level manholes or pumping stations or to STP as per the design. Lift stations are necessitated where in the design the depth of sewer exceeds the downstream interlinking manhole invert levels.

75. 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 of diameter 3m to 3.67m and 6.45 m deep, below the ground, to receive sewage, submersible pumps in the sump to pump out, and an electrical panel board for operation of pumps above the ground. A generator set will also be provided at each lift station of required size. Controlled blasting related activities may have to be undertaken at some locations for the presence of hard rock anticipated.

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

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

77. At these pumping or lifting stations, the operation involves accumulation of incoming sewage in the suction well, and then pumping out as the sewage level reaches the designed pumping depth. The water level in the well rises up before the pumping cycle starts, and as the

pumping is performed the water level goes down, registering its lowest depth at the end of pumping of cycle. This cycle of rising and lowering will continue throughout the day and night, however, the duration between successive pumping cycles will significantly vary depending on the sewage generation. During morning and evening peak hours, sewage will accumulate quickly, and pumping frequency will be high. The sewage retention time in the suction well therefore varies throughout the day, with very high retention periods during the nights and mid-days. Bypass provisions would be incorporated in the design for addressing unlikely overflow conditions.

78. **Odor from Pump Stations.** In the suction wells, the sewage emits gases, which accumulates in the air above water surface. The gas may include odorous compounds like hydrogen sulfide (H_2S), amines, fatty acids, aldehydes, ketones and other volatile organic compounds (VOCs). As the water level rises before the pumping cycle, it physically displaces the air, along with the odorous gas compounds. H_2S is the most dominant odor causing compound, and therefore can cause nuisance to nearby households. When sewage becomes stagnant, H_2S is generated in the anaerobic conditions. The quantum of H_2S generation depend on quantity of accumulated sewage including the organic load and sewage retention time that create anaerobic conditions. Both increase in quantity of sewage accumulation and retention time will increase the H_2S generation. Design considerations are included to minimize the both as much as possible. Pumping stations cater to large area and will have high capacity of suction wells and pump sets, while lift stations are small with lower capacity of suction wells and pumps sets. The retention time is kept to its lowest possible so that there is no stagnation of sewage for long time which could create anaerobic conditions.

79. Given that lifting stations and pumping stations are to be located at technically feasible locations (e.g., lowest point to where sewage can be conveyed from households by gravity) within or close to the residential areas which are being served by respective pumping/lifting station. Given the very limited land availability in urban areas like the project area and even government owned lands, the ideal location of pumping 50-100 m away from the houses becomes impractical. In Rajapalayam, sites for pumping stations were identified based on the technical suitability and availability of government owned land parcels to avoid land acquisition. Given the comparatively higher potential of odor generation, priority has been given to accommodate pumping stations at more suitable locations away from houses and mostly in sparsely populated areas. Sites which are located close have been selected only in cases where there is no other alternative land available.

80. Following design related measures are included in the sewage pumping and lifting station design. As presented in the baseline profile, few lifting stations are located along the roads within the road right-of-way. In such cases there is no buffer space between the houses and the lifting station, and also no layout planning related measures as given below including creating buffer area around the facility may be feasible. Odor potential of lifting stations is very minimal given small scale operation, however, given close location to houses, design related measures as given below are included.

81. **Layout Planning Related Measures**.

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

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

(i) Proposed wells to be closed using reinforced cement concrete (RCC) slabs. Design of RCC slab to consider both superimposed loads (human and equipment loads) and severe corrosion risk from sewer gas from within wells.
(ii) RCC Slab to be designed and fixed in a modular manner such that access to pumps / appurtenances and other equipment can be provided for maintenance / replacement / renewal purposes.
(iii) Since human intervention is involved and safety shall be primary and critical consideration, additional protection by way of a metaled grating / grill work shall be provided over the sections (or full cross section if required) where workers will stand / work for inspection and repair/O&M purposes.
(iv) Provision of passive gas ventilation arrangement by providing a take-off vent from top of well by positioning vent in such a way that cover slab fitment / movement / drawl if required for maintenance purposes is not compromised.
(v) Height of vent to be provided appropriately and a minimum 2 m above the lintel level (top level) of window(s)/passageways/doors in the nearby adjoining buildings.
(vi) 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.
(vii) 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.
(viii) 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.
(ix) Develop standard operating procedures / operational manual for operation and maintenance of lifting and pump stations; this shall include measures for emergency situations.
(x) Provide training to the staff in SOPs and emergency procedures.
(xi) Periodically monitor odor generation.
(xii) Periodic monitoring of H_2S levels at sewage pumping and lifting stations using handheld H_2S meters[11]

[11]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

83. **Provision of Odor Treatment System:** Besides the above measures, which are to be implemented at all sewage pumping and lifting stations, following measures are to be implemented for sewage pumping stations at Avarampatti and Andalnagar located very close to the houses/properties and/or public utilities.

(i) Provide a suitable arrangement so as to capture the gaseous emissions from the wells and treat via scrubber/activated carbon filter before letting out into the ambient air; such system should be designed appropriately to meet the likely emissions/flow rate of respective pumping stations

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

(i) Procure good quality latest technology high pressure pumps that guarantee controlled noise at a level of around 80dB(A) at a distance of 1m[12].
(ii) Use appropriate building materials and construction techniques for sewage pumping stations 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.

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

86. 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:

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

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

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

(i) Minimize removal of trees by adopting to site conditions and with appropriate layout design;
(ii) Obtain prior permission for tree cutting; and
(iii) Plant and maintain 10 trees for each tree that is removed.

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

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

89. **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 100 m away from residential areas, groundwater wells and surface water bodies. However, if it is deemed necessary to locate elsewhere, sites to be considered will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems. Extreme care will be taken to protect the human environment (i.e., to curb accident risks, health risks due to air and water pollution and dust, and noise, and to prevent social conflicts, shortages of amenities,).

90. **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 the Department of Geology and Mining and complying with the environmental regulations of India. Contractor should procure material from existing quarries. Contracts should not create / use any new borrow pits / quarries.

91. **Social and Cultural Resources – Chance Finds**. Any work involving ground disturbance can uncover and damage archaeological and historical remains. For this project, excavation will occur in project sites for foundations, laying pipelines, and for construction of underground structures at pumping/lifting stations and at STP. There are no archeologically or historically recognized sites or places close to subproject sites or within the subproject area. Therefore it is not likely that the project sites contain any archaeological or historical remains, and risk of uncovering them is very low. Nevertheless, PIU will follow chance find protocol to ensure that any chance finds are recognised and measures are taken to ensure they are protected and conserved.

(i) Construction contractors to implement the following measures in conducting any excavation work:
   a) Create awareness among the workers, supervisors and engineers about the chance finds during excavation work;
   b) Stop work immediately to allow further investigation if any finds are suspected;
   c) Inform State Archaeological Department or Archaeological Survey of India if a find is suspected, and taking any action they require to ensure its removal or protection in situ.

B. Construction Impacts

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

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

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

95. Subproject also include linear works (laying of 176.416km sewers along the roads). This covers entire project area of Rajapalayam Municipality and sewers will be laid along almost all the roads. Small sewers (tertiary sewers) that collect sewage from households will be laid in all streets and roads, the larger sewers that collect sewage from tertiary sewers and convey to pumping stations and STP will be laid mostly on wider main roads. Sewers will be laid by open cut method.

96. Open cut trenching method of sewer laying involves trench excavation in the road, placing sewers in the trench, jointing and testing, and refilling with the excavated soil. Proposed pipes for tertiary sewers are double wall corrugated (DWC) pipes and conveying mains (pumping mains) are of cast iron (CI). Diameter of sewer ranges from 150mm to 900 mm, of which nearly 93% of the sewers are of size between 150 mm and 250 mm.. The width of the trench excavation along the roads will vary from 0.8 m to 1.4 m, and the depth varies from a minimum of 1 m to 6 m. Nearly 90% length of sewers will be laid in trench of depth 3 m of less, and there are very few sewers

that will be laid in a trench of more than 6 m deep (0.4% sewers only). The design is optimized to minimize the sewer depth to the extent possible with an optimal combination of sewer depth and pumping requirements. Details of sewer construction are provided in the following table.

Table 16:Sewer Construction

Diameter of Sewer	**Sewer Material**	**Total Length of Sewers to be Laid** (m)	**Percentage of Length (diameter-wise)** (%)	**Width of Trench** (m)	**Depth of Trench and Percentage of Sewer Length** (%)	
150	CI	2845	1.6	0.8	0-2m	83.3%
200	PVC	123866	70.4	0.8	2-2.5m	10.2%
					2.5-3m	6.4%
200	DWC	15773	9	0.8	0-2m	65.7%
					2-2.5m	22.6%
					2.5-3m	11.8%
250	DWC	2560	1.5	0.9	0-2m	85.0%
					2-2.5m	8.2%
					2.5-3m	6.8%
300	DWC	3279	1.4	0.8	3-3.5 m	41.8%
					3.5-4 m	26.3%
					4-6m	30.3%
					6-8m	1.6%
350	CI LA	2766	1.6	0.8	2.5-3m	3.4%
					3-3.5 m	15.8%
					3.5-4 m	17.3%
					4-6m	48.3%
					6-8m	13.4%
					8-10m	1.8%
400	CI LA	7916	4.5	0.9	3-3.5 m	4.0%
					3.5-4 m	11.1%
					4-6m	66.6%
					6-8m	18.3%
450	CI LA	1558	0.9	0.9	0-2m	37.5%
					2-2.5m	18.8%
					2.5-3m	11.2%
					3-3.5 m	4.0%
					3.5-4 m	5.9%
					4-6m	22.1%
					6-8m	0.5%
500	CI LA	6486	3.7	0.9	0-2m	35.0%
					2-2.5m	6.9%
					2.5-3m	3.6%
					3-3.5 m	16.4%
					3.5-4 m	5.3%
					4-6m	29.1%
					6-8m	3.7%
600	CI LA	1198	0.7	0.9	0-2m	31.1%
					2-2.5m	6.5%
					2.5-3m	16.2%
					3-3.5 m	17.1%
					3.5-4 m	8.9%
					4-6m	20.3%
700	CI LA	6390	3.6	1.0	0-2m	48.9%
					2-2.5m	7.9%
					2.5-3m	2.5%
					3-3.5 m	4.3%
					3.5-4 m	4.3%
					4-6m	32.1%
800	RCC	1400	0.8	1.25	0-2m	2.2%
					2-2.5m	9.8%
					2.5-3m	7.6%
					3-3.5 m	8.2%
					3.5-4 m	30.7%
					4-6m	39.5%
					6-8m	2.0%

Diameter of Sewer	Sewer Material	Total Length of Sewers to be Laid (m)	Percentage of Length (diameter-wise) (%)	Width of Trench (m)	Depth of Trench and Percentage of Sewer Length (%)	
		176037	100	0.8 to 1.4	0-2m	73.3%
					2-2.5m	9.6%
					2.5-3m	6.1%
					3-3.5 m	3.8%
					3.5-4 m	2.7%
					4-6m	4.1%
					6-8m	0.4%
					8-10m	0.01%

CI = cast iron, DWC = double wall corrugated, m = meter, % = percent, RCC = reinforced cement concrete.

97. Earth work excavation will be undertaken by machine (backhoe excavator) and include danger lighting and using sight rails and barricades. The work will also be supplemented manually where there is no proper working area (e.g. very narrow streets) for the backhouse excavators. In deeper trenches 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. 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 and debris will be used for refilling the trench after placing the sewer and therefore residual soil after pipe laying and refilling is not significant. Total earthwork excavation will be over 200987 m^3, of which nearly 95% will be reused, and the remaining 10050 m3 of excess soil and debris would be disposed safely to areas approved by the authorities. The bituminous waste would be reused appropriately to the extent possible and the remaining bituminous waste would be disposed as per the regulatory requirements. Some sections of the alignment and the pumping stations are identified to involve hard rock and hence controlled blasting is proposed at such locations for excavation after obtaining statutory permits for undertaking controlled blasting and following necessary precautions to prevent safety risk to both public and nearby structures as provisioned in the prevailing Indian regulations and standards.

98. 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.

99. The project area is predominantly a mix of urban and suburban areas. It includes habitations with narrow streets, and well planned newly developed / developing residential layouts in the lands. Sewers will extend to all residential and developed areas, while large diameter sewers will be laid mostly along the main roads. These main roads include a state and national highways, and other important roads in the town: SH186 (Rajapalayam – Vembakottai), SH41 (Rajapalayam – sankarankovil – Tirunelveli), NH 208 (Thirumangalam to kollam) and MR Nagar, RamasamyKovil street, Sunnadi street etc.

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

101. **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 leveling 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 complying with the prevailing environmental regulations of India and having the requisite environmental permissions, to ensure these controls are in place. Contractor should not create/use any new borrow pits / quarries. The contractor should also make a concerted effort to re-use as much excavated material from this project as possible. The construction contractor will be required to:

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

102. **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 project, spread all over the project area. Over 200,987 m3 of earthwork is anticipated from the project, and 95% of which will be reused for filling the trenches. Also emissions from construction vehicles, equipment, and machinery used for excavation and construction will induce impacts on the air quality. Anticipated impacts include dust and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons. Dust generation from construction work in individual and confined work sites like STP, pumping stations etc., will be mainly during the initial construction phase of earth work, as the site is confined, dust can be effectively controlled with common measures. While pumping and lifting stations are located within residential neighborhoods, STP is located outside the city, away from habitation area. Dust generation will be significant during sewer laying along the roads. Increase in dust/ particulate matter in ambient air is detrimental, and may have adverse impacts on people and environment. To mitigate the impacts, construction contractors will be required to:

103. **For all construction works.**

(i) Provide a dust screen (6 m high) around the construction sites of pumping and lifting stations and STP; provide 2 m high barricades for the sewer works
(ii) Damp down the soil and any stockpiled material on site by water sprinkling;(3-4 times a day - before the start of work, 1-2 times in between, and at the end of the day); when working in the roads there should permanently be one person responsible for directing when water sprinkling needs to take place to stop the dust moving;
(iii) Reduce the need to sprinkle water by stabilizing surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition
(iv) Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process

(v) Cover the soil stocked at the sites with tarpaulins and surround by dust screens.
(vi) Control access to work area, prevent unnecessary movement of vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation
(vii) Use tarpaulins to cover the loose material (soil, sand, aggregate etc.,) when transported by open trucks;
(viii) Control dust generation while unloading the loose material (particularly aggregate, sand, soil) at the site by sprinkling water and unloading inside the barricaded area; minimize the drop height when moving the excavated soil
(ix) Clean wheels and undercarriage of haul trucks prior to leaving construction site
(x) Ensure that all the construction equipment, machinery are fitted with pollution control devises, which are operating correctly, and have a valid pollution under control (PUC) certificate
(xi) No vehicles or plant to be left idling at site and generators to be at placed maximum distance from properties

104. **For sewer works.**

(i) Inform the residents likely to be affected by the works in the locality about the upcoming sewer laying works well in advance so that necessary arrangements are planned by the residents with reduced inconvenience.
(ii) 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 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 area using hard barricades (of 2 m 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 500m 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 dust curtains of adequate height are provided to the trenches to prevent emission of dust during drilling for charge holes and 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.

(xiv) 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.

(xv) 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.

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

(i) Immediately compact 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.

106. **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 .Construction contractor will be required to:

(i) All earthworks be conducted during the dry season to prevent the problem of soil/silt run-off during rains

(ii) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; do not stock earth/material close to edges of the trenches and the at least 100m away from the water bodies

(iii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, only designated disposal areas shall be used;

(iv) Install temporary silt traps, oil traps or sedimentation basins along the drainage leading to the water bodies;

(v) Place storage areas (with impermeable surface) for fuels and lubricants away from any drainage leading to water bodies; these should be at least 100 m away from water bodies and groundwater wells;

(vi) Store fuel, construction chemicals etc., on an impervious floor, also avoid spillage by careful handling; provide spill collection sets for effective spill management

(vii) Dispose any wastes generated by construction activities in designated sites; and

(viii) Conduct surface quality inspection according to the Environmental Management Plan (EMP).

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, scarified bituminous waste, and other similar items. Domestic solid wastes may also be generated from the workers' camp. Improper waste management could cause odor and vermin problems, pollution and flow obstruction of nearby watercourses and could negatively impact the landscape. Total earthwork excavation will be over 200,987 m^3, of which nearly 95% will be reused, and the remaining 10,050 m^3 of excess soil needs to be disposed safely. The following mitigation measures to minimize impacts from waste generation shall be implemented by the contractor:

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

109. **Noise and Vibration Levels**. While pumping and lifting station sites are located predominantly urban and suburban areas, STP is located outside the municipal area. Sewer lines are spread over entire project area. Except STP, all these sites are located close to habitation areas, where there are houses, schools and hospitals, religious places and businesses. The sensitive receptors are the general population in these areas. Increase in noise level may be caused by excavation, particularly breaking of cement concrete or bitumen roads and 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 explosives for controlled blasting and pneumatic drills, will have impact on nearby buildings and utilities. This impact is negative short-term, and manageable 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, hospitals, religious places, courts 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 minimise sound impact to surrounding sensitive receptor; and
(iii) Maintain maximum sound levels within the limits as prescribed 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 the 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.

110. **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 four types of roads/highways in the project area that provide regional connectivity: national highway (NH), state highway (SH), major district roads (MDR) and other district roads (ODR). Sewers are proposed along:

(i) SH186 (Rajapalayam – Vembakottai)
(ii) SH41 (Rajapalayam – Sankarankovil– Tirunelveli)
(iii) NH 208 (Thirumangalam to Kollam)

111. National highway and state highways carry considerable traffic, followed by MDRs and ODRs. Sewers will also be laid along the internal main roads that provide connectivity within the city. These include: INTUC Nagar, PSK Nagar, MR Nagar, Sannathi street etc., These roads also carry considerable flow of traffic and are centers of commercial activities.

112. Internal roads in the project area are narrow, except in the newly developing residential layout which comparatively have wide roads. The areas with narrow roads include: Madukarai, Cattarampatti, Viveganandar street, etc., have wide internal roads, and less traffic.

113. 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

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

115. 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:

116. **Sewer works**.

(i) Prepare a sewer work implementation plan in each zone separately and undertake the work accordingly; ensure that for each road where the work is being undertaken there is an alternative road for the traffic diversion; take up the work in sequential way so that public inconvenience is minimal.

(ii) Plan the sewer work in coordination with the traffic police; provide temporary diversions, where necessary with clear signage and effectively communicate with general public.

(iii) Avoiding conducting work in all roads in a colony at one go; it will render all roads unusable due to excavations at the same time, creating large scale inconvenience

(iv) Undertake the work section wise: a 500 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.

(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) In the roads that connect to SPS sites, which need to accommodate two main sewers (income and outgoing main sewers of SPS), plan work so that access to houses is maintained throughout the construction phase; first lay one sewer and close the trench, restore the road, and lay the second sewer.

(viii) 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.

(ix) 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.

(x) Inform the affected local population in advance about the work schedule, a week before, and a day before start of work
(xi) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum.
(xii) Keep the site free from all unnecessary obstructions.
(xiii) 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.
(xiv) At work site, public information/caution boards shall be provided including contact for public complaints.
(xv) 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 preventive, precautionary, mitigation and emergency response measures being taken to address their concerns.
(xvi) The contractor in coordination with the urban local body officials would conduct pre-blasting physical surveys through videography and photography of the adjacent residential properties and other structures along the sewerage alignment and take adequate measures to minimise such impacts.

117. **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.

118. **Socio-Economic – Income**. Sites for all projects components are carefully selected avoiding 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 is impeded by excavation of trenches, the presence of heavy vehicles and machinery, etc. Access disruption to hospitals, socio cultural places etc., will inconvenience public. Implementation of the following best construction measures will avoid the disturbance reduce the inconvenience and disturbance to the public. Resettlement and social issues are being studied in a parallel resettlement planning study of this subproject.

(i) Inform all businesses and residents about the nature and duration of any work well in advance so that they can make necessary preparations;

(ii) Do not block any access; leave spaces for access between barricades/mounds of excavated soil and other stored materials and machinery, and providing footbridges so that people can crossover open trenches
(iii) Barricade the construction area and regulate movement of people and vehicles in the vicinity, and maintain the surroundings safely with proper direction boards, lighting and security personnel – people should feel safe to move around
(iv) Control dust generation
(v) Immediately compact 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.

119. **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 labor force as far as possible.

120. **Occupational Health and Safety**[13]. 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:

(i) Follow all national, state and local environmental and labour laws (indicative list is in Appendix 2);
(ii) Develop and implement site-specific occupational health and safety (OHS) Plan, informed by OHS risk assessment seeking to avoid, minimise and mitigate risk, including controlled blasting actviity, which shall include measures such as: (a) safe and documented construction procedures to be followed for all site activities; (b) ensuring all workers are provided with and use personal protective equipment; (c) OHS Training for all site personnel, (d) excluding public from the work sites; and (e) documentation of work-related accidents.[14]Follow International Standards such as the World Bank Group's Environmental, Health and Safety Guidelines.[15]
(iii) Ensure that first-aid is available at all times. Equipped first-aid stations shall be easily accessible throughout the sites;

[13] A separate health and safety plan has been prepared to respond to ongoing coronavirus disease (COVID-19) pandemic, which would be implemented by the contractor in addition to the provisions outlined here.

[14] 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.

[15] IFC World Bank Group. Environmental, Health & Safety Guidelines101.

(iv) Secure all installations from unauthorized intrusion and accident risks
(v) Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;
(vi) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;
(vii) Ensure the visibility of workers through their use of high visibility vests and other PPE when working in or walking through heavy equipment operating areas;
(viii) Ensure moving equipment is outfitted with audible back-up alarms and blinkers;
(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 (especially explosives) and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate;
(x) Disallow worker exposure to noise level greater than 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; and
(xii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances.

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

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

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

Safety Measures for Controlled blasting during excavation: Presence of sub-surface rock (at a depth of 2 m whereas the sewer depth is in the range of 2-3.50 m) in the alignment has been identified in few locations in Rajapalayam Municipality. During excavation, alternatives like drilling and chiselling, controlled blasting etc have been examined and the 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. For the initial stretches proposed totalling to about 3.2 km permission is obtained from The District Collector of Virudhunagar.
(iv) Blasting shall be done through an 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 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, 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..
(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, Virudhunagar.
(xv) For the diversion of traffic in the blasting area, the contractor shall prepare a traffic management plan and obtain permission from Rajapalayam Municipality and traffic police.

122. **Construction Camps.** Contractor may require to set up construction camps – for temporary storage of construction material (sewer, cement, steel, fixtures, fuel, lubricants,

explosives, etc.,), and stocking of surplus soil, and may also include separate living areas for migrant workers. The contractor will however be encouraged to engage local workers as much as possible. Operation of work camps can cause temporary air, noise and water pollution, and may become a source of conflicts, and unhealthy environment if not operated properly. Potential impacts are negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

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

C. Operation and Maintenance Impacts

123. O&M of the sewerage system will be carried out by Rajapalayam Municipality. Operation will involve collection and conveyance of wastewater from houses to nearest lifting/pumping stations; operation of lifting/pumping stations to pump accumulated sewage main pumping stations; operation of main pumping stations to pump accumulated sewage to STP; treatment of sewage at STP to meet the disposal standards; and final disposal of treated wastewater into

Kothankulam, and treatment and disposal of sludge. STP is proposed under design-build modality, and the contract will prepare detailed designs for STP including the outfall sewer and disposal arrangements. At present, treatment and disposal system is designed in outline only (preliminary design); detailed design will be conducted by the design-build contractor during detailed design phase, and the assessment will be updated accordingly.

124. **Treated wastewater disposal from STP**. During its operation phase, STP will treat 21.85 million liters of wastewater every day. It is proposed to dispose treated wastewater from the STP into Kothankulam tank, which is located about 1.4 km north of the STP site. This is a rain-fed tank, and the total water storage capacity is 22.83 mcft (0.62 million cubic meter) with a depth of storage of 3.53 m. Tank has an irrigation command area of 89.44 ha. Water is supplied to fields via field channels from the tank maintained by PWD. Tank also has an overflow arrangement to let off the surplus flow once it is filled to its full tank capacity (FTL). There is a 42 m length surplus/overflow weir and a channel that takes the overflow to a downstream tank (Pudukulamtank). The Pudikulam tank overflow is further transferred to another downstream tank. There are in all 6 tanks connected with one another starting from Kothankulam tank, then Pudukulam tank, Chithrankulam tank, Pillayarkulam tank, Veppankulam tank and Chennelkulam tank. These irrigation tanks are part of Kayalkudiyar irrigation sub-basin of PWD. These tank network has a total command area of 350 ha and the total storage capacity is 92.93 mcft. If the water is surplus at the last tank of Chennakulam tank, the surplus will flows into Nathikudi channel and joins Vaippar River near Ethirkottai. At present, the water storage in Kothankulam tank is negligible. Due to low rainfall, tank fills rarely to its capacity. Consequently water is available only during few months during monsoon. Wastewater from Rajapalayam and surrounding areas enter the tank. Water quality data (Table 8) shows the polluted nature of tank water, with dissolved oxygen level of just 0.16 mg/l, BOD of 20 mg/l and COD of 100 mg/l. Due to almost dry nature of tank and polluted water, there is no notable aquatic life in the tank. Water from the tank is used only for irrigation, and there are no drinking water intakes (surface or subsurface) in the tank. Depth of water level is more than 10 m below groundwater level.

125. Given the current status of tank with negligible storage, polluted nature of water, no dependent potable uses, no notable aquatic life, etc., there are no adverse impacts likely due to disposal of STP treated wastewater meeting the set quality standards. Given the proposed disposal standards , the disposal will improve the existing water quality, and will raise the water level, and can be utilized for irrigation in the command area. Proper systems should be put in place at the proposed STP to ensure that treated wastewater at all times meets the stipulated standards prior to its disposal into this tank. Any disposal action will require permission/consent of TNCPB, which will be obtained during the detailed design phase. Following measures will be implemented during the detailed design phase:

(i) Review the feasibility studies and finalize detailed design of treatment and disposal system, including reuse and/or safe disposal into downstream water tanks; review the tank stability of bunds to continuously hold water and along with its overflow arrangement and interconnection with other lakes shall be checked for safety and proper disposal of surplus water without any inundation
(ii) Obtain PWD and TNPCB consent for disposal of treated wastewater into Kothankulam Tank
(iii) Conduct detailed water quality assessment of Kothankulam tank, pre and post monsoon seasons.

126. **Treatment efficiency and Compliance with Disposal Standards**. Sewage treatment facility will be designed to meet the STP disposal standards notified by MoEFCC. As discussed

above, the treated wastewater will be disposed into Kothankulam tank, from where water will be used for irrigation. It is critical that STP treats the sewage as designed to meet the disposal standards. Operation and maintenance of STP and change in incoming sewage quality will have impact on the treatment efficiency.

127. **STP operation**. The operation procedures will be firmed up during the detailed design phase, including the amount of automated or manual operation. It must be ensured that the facility is operated with standard operating procedures and only by trained staff. Ensuring uninterrupted power supply with back-up facility is a must. Standard operating procedures and operation manual will be prepared by the design-build contractor. Besides routine operation, this should cover all necessary items such as preventive maintenance, periodic maintenance and emergency maintenance, replacement of pumps, motors, and other electro-mechanical parts as per the design life to optimize energy use and system efficiency etc., Adequate resources – technical and financial, have been taken into consideration in the project design. Manual will also include safety awareness and mock drills for worker safety.

128. **Quality of Raw Sewage**. One of the critical aspects in STP operation is, change in raw sewage characteristics at inlet of STP may affect the process and output quality. The system is designed for municipal wastewater, which does not include industrial effluent. Characteristics of industrial effluent widely vary depending on the type of industry, and therefore disposal of effluent into sewers may greatly vary the inlet quality at STP, and will upset process and affect the efficiency. It is critical that no wastewater from industries is allowed into the sewer network with strict monitoring and enforcement, and public awareness programs.

129. **Use of treated wastewater for irrigation**. The treated wastewater disposed into Kothankulam tank will be used for irrigation in its command area. This will benefit farmers with much needed and scarce water resource round the year. Use of wastewater for irrigation is associated with some health risks – from bacteria in wastewater, which may contaminate food and spread disease, health risk to farm workers from worms (helminths) and nematodes and chemical risk is associated if industrial wastewater enter the sewers. In Rajapalayam, the sewer system will collect only domestic sewage, and it will not cater to industrial wastewater. STP will treat wastewater to disposal standards. The mixing with lake water and retention period in lake will further improve the quality of water, and will also reduce the bacteriological contamination greatly.[16] If the wastewater with bacteriological contaminants are used for food crops like lettuce, tomato, which are eaten without peeling or cooking, it will present a greater health risk if precaution such as such washing with chlorinated water or storing for adequate time in normal temperature before use (at least 10 days). According to the WHO, effluent which is used to irrigate trees, industrial/commercial (not food, like cotton) and fodder crops, fruit trees, and pasture should have less than one viable nematode egg per liter. Effluent used for the irrigation of food crops, sports fields, public parks, should have less than one viable nematode egg per liter and less than 1000 fecal coliforms per 100 milliliters. In the areas around Rajapalayam, crops cultivated mainly include groundnut, sorghum, rice, cotton etc., No vegetable cultivation reported. However, in future due to availability of water, vegetable may be cultivated, and therefore proper monitoring of water is required for use in irrigation, and is proposed in the environmental monitoring plan.

130. **Sewage Sludge**. No estimate of sludge generation from STP is available at this stage. 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. Sludge regularly accumulates in the treatment units during the process.

[16] According to WHO, a retention time of 11 days in a lagoon will adequately remove helminths from sewage.

STP will have proper facilities for handling, treatment and disposal of sludge safely with implementation of sludge management plan. Therefore no adverse impacts envisaged. This sludge from basins will be collected into sludge sump and conveyed to centrifuge unit for dewatering and thickening. 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. 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 in the Solid Waste Management Rules, 2016.

131. STP is proposed under design-build contract modality, following measures needs to be considered and included in the detailed design of the STP:

(i) Process design to meet the discharge standards;
(ii) Regular monitoring to ensure that treated wastewater always meets the design disposal standards;
(iii) Review the feasibility studies and finalize detailed design of treatment and disposal system
(iv) Sludge management to collect, treat and dispose the accumulated sludge safely; sludge will be treated in a mechanical centrifuge which will thicken the sludge by separating the liquid, thicken sludge will be further dried, and dried sludge will be used as a soil conditioner in fields; Sludge will be tested periodically for heavy metal concentration;
(v) Designing the entire system to maintain optimal flow and terminal pressure, and optimising the overall energy usage in sewer system, including STP;
(vi) Using low-noise and energy efficient pumping systems;
(vii) Installing the noise-producing pumps and motors etc., in enclosed buildings with noise reducing walls, and also maintaining adequate buffer to the nearby inhabited areas;
(viii) Provision of appropriate personal protection equipment to the workers and staff.

132. Following measures are to be implemented during the operation phase, and should be appropriately included in the project design:

(i) Ensure proper knowledge transfer, hands-on training to municipal staff engaged in STP operation has been provided by contractor prior to handover of facility;
(ii) Ensure continuous uninterrupted power supply;
(iii) Operate and maintain the facility following standard operating procedures of operational manual;
(iv) Undertake preventive and periodic maintenance activities as required;
(v) Maintain the mechanical/electrical parts as per the maintenance plan to avoid any hazards;
(vi) Conduct periodic training to workers;
(vii) Ensure that all safety apparatus at STP including personal protection equipment are in good condition all times; and are at easily accessible and identifiable place; periodically check the equipment, and conduct mock drills to deal with emergency situations;
(viii) Implement sludge management plan at the STP;
(ix) No wastewater from industrial premises (including domestic wastewater) shall be allowed to dispose into municipal sewers;

(x) Monitor regularly and ensure that there is no illegal discharge through manholes or inspection chambers; conduct public awareness programs; in coordination with TNPCB:
Conduct regular wastewater quality monitoring (at inlet and at outlet of STP) to ensure that the treated effluent quality complies with design standards;Fecal

(xi) Conduct periodic testing of dried sludge/compost to check presence of heavy metals and confirming the concentrations to use as compost as specified in the Standards for Composting, Schedule II A, Solid Waste Management Rules, 2016, FCO = Fertilizer Control Order, 1985, amendments in 2009 and 2013. It shall not be used for food crops.

133. **Odor and Noise from Sewage Lifting and Pumping Stations**. Various measures are included in the design of these facilities giving utmost importance to odor and noise. Therefore it is anticipated there will not be any significant generation of odor or noise that will impact the surrounding households. Following measures are to be implemented during the operation:

(i) Strictly follow standard operating procedures/operational manual for operation and maintenance of lifting and pump stations;
(ii) Ensure that operating staff is properly trained, and have clear understanding of odor issues vis-à-vis its related with operational practices;
(iii) Ensure that pumping cycles are properly followed; and there is no buildup of sewage beyond design volume in the wells;
(iv) Conduct H_2S monitoring (periodically at pumping stations and lifting stations);

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

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

(i) Establish regular maintenance program, including:
  a) Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas;
  b) Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration; and
  c) Monitoring of sewer flow to identify potential inflows and outflows;
  d) Conduct repairs on priority based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is

currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failuresor sewer line blockages).

(ii) Maintain records; review previous sewer maintenance records to help identify "hot spots" or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed;

(iii) When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system;

(iv) Prohibit/prevent disposal of wastewater/effluent from industrial units in the sewers; ensure regular checking to ensure no illegal entry of industrial wastewater into sewers;

(v) Develop an Emergency Response System for the sewerage system leaks, burst and overflows, etc.;

(vi) Provide necessary health and safety training to the staff in sewer cleaning and maintenance;

(vii) Provide all necessary personnel protection equipment;

(viii) Do not conduct manual cleaning of sewers; for personnel engaged sewer maintenance work, there is a risk due to oxygen deficiency and harmful gaseous emissions (hydrogen sulfide, methane, etc.); provide for adequate equipment (including oxygen masks) for emergency use.

VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Overview

136. 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.

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

B. Public Consultation

138. 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

139. The subproject proposal is formulated by Rajapalayam Municipality (through TWADB) and in consultation with the public representatives in the project area to suit their requirements.

140. Focused 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 Rajapalayam on 2 February 2018, with the public representatives, prominent citizens, NGOs, etc. Details of consultation is provided in Appendix 9.

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

2. Consultation during construction

142. Prior to start of construction, PIU conducts information dissemination sessions at various places and solicit the help of the local community, leaders/prominent for the project work as and when necessary. Focus group meetings will be conducted to discuss and plan construction work (mainly pipeline work) with local communities to reduce disturbance and other impacts and also regarding the project grievance redress mechanism. Project information and construction schedule will be provided to the public via mass media (newspapers, ULB websites etc.,). A constant communication will be established with the affected communities to redress the environmental issues likely to surface during construction phase. Contractor will provide prior public information (in Tamil and English) about the construction work in the area 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, information boards are being provided to disseminate project related information. During construction stage of the project, dissemination programs were conducted at various locations of the Rajapalayam municipalty to create awareness among the public about the proposed controlled blasting activity for hard rock removal in excavation. The dissemination included the need for the controlled blasting, regulatory requirements & compliance to conditions, safety measures followed, etc. The details of the dissemination programs conducted are provided in the appendix 9.

C. Information Disclosure

143. Executive summary of the IEE will be translated in Tamil and made available at the offices of PMU, PIU, and Rajapalayam Municipality 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 Rajapalayam Municipality after clearance of this draft updated IEE by ADB. Stakeholders will also be made aware of grievance register and redress mechanism.

144. 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.

145. Local communities will be continuously consulted regarding location of construction camps, access and hauling routes and other likely disturbances during construction as required while complying with the guidelines issued by the government for the current COVID-19 pandemic conditions. The road closure together with the proposed detours will be communicated via advertising, pamphlets, radio broadcasts, road signage, etc.

VII. GRIEVANCE REDRESS MECHANISM

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

147. 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 email, by post, or by writing in a complaints register in PIU or Rajapalayam Municipality 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.

148. GRM provides an accessible, inclusive, gender-sensitive and culturally appropriate platform for receiving and facilitating resolution of affected persons' grievances related to the project. A two-tier grievance redress mechanism is conceived, one, at project level and another, beyond project level. For the project level GRM, a grievance redress committee (GRC) will be established in PIUs; Safeguards officer, supported by the Environmental Expert of PIU 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.

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

150. In case of grievances that are immediate and urgent in the perception of the complainant, the contractor, and supervision personnel of the 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 Rajapalayam Municipality level. In the event that certain grievances cannot be resolved even at Rajapalayam Municipality 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.

151. 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.

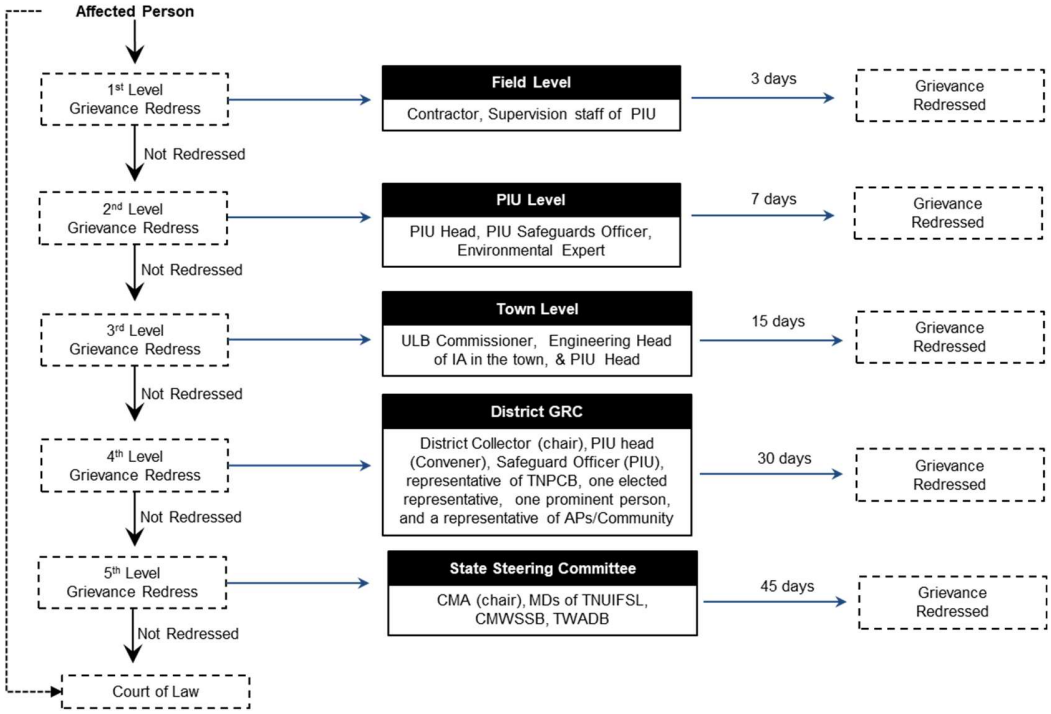
152. **Composition of Grievance Redress Committee**. GRC will be headed by the District Collector, and members include: PIU head, Safeguards Officer of PIU, representative of TNPCB, one elected representative/prominent citizen from the area, and a representative of affected community. GRC must have a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

153. **State Level Steering Committee** will include Commissioner of Municipal Administration as chair, member include managing directors of TNUIFSL, CMWSSB, TWADB and others as necessary.

154. **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).

155. The multi-tier GRM for the project is outlined below (Figure 18), 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 12: Proposed TNUFIP Grievance Redress Mechanism



AP = affected person, CMA = Commissionerate of Municipal Administration, CMWSSB = Chennai Metropolitan Water Supply and Sewerage Board, GRC = grievance redress committee, IA = implementing agency, PIU = Project Implementation Unit, TNUIFSL = Tamil Nadu Urban Infrastructure Financial Services Limited, TWADB = Tamil Nadu Water and Drainage Board, ULB = urban local body.

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

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

158. **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.

159. **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.

160. **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.

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

VIII. ENVIRONMENTAL MANAGEMENT PLAN

A. Environmental Management Plan

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

163. The EMP will guide the environmentally-sound construction of the subproject and ensure efficient lines of communication between TNUIFSL, PMU, Rajapalayam Municipality, PIU, consultants and contractors. The EMP will (i) ensure that the activities are undertaken in a responsible non-detrimental manner; (i) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (ii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iii) detail specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (iv) ensure that safety recommendations are complied with. The EMP includes a monitoring program to measure the environmental condition and effectiveness of implementation of the mitigation measures. It will include observations on- and off-site, document checks, and interviews with workers and beneficiaries. TNUIFSL will be overall responsible for monitoring the implementation of the various provisions elaborated in this draft updated IEE document by the PIU, Rajapalayam Municipality and the contractors and report on its compliance to ADB through submission of semi-annual environmental monitoring reports.

164. 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 ADB-cleared IEE and EMP; and (iii) monitoring program as per IEE and EMP. No works are allowed to commence prior to approval of SEMP.

165. A copy of the site-specific environmental management plan (SEMP) will be kept on site during the construction period at all times. The EMP is included in the bid and contract documents to ensure compliance with the conditions set out in this document .

166. For civil works, the contractor will be required to (i) carry out all of the mitigation and monitoring measures set forth in the ADB-cleared IEE and 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.

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

Table 17:Design Stage Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
Design of sewage treatment plant (STP)	Deficient treatment due to substandard operation / system malfunction	(i) Design the treatment process to meet the applicable discharge standards (i) Ensuring continuous uninterrupted power supply, including a back-up facility (such as generator) (ii) Providing operating manual with all standard operating procedures (SOPs) for operation and maintenance of the facility (iii) Necessary training to Rajapalayam municipality staff dealing with STP. (iv) Extended contractor period for operation and maintenance (O&M), proper transfer of facility to urban local body (ULB) with adequate technical know-how on O&M and hands-on training to Rajapalayam municipality staff (v) Provision for online monitoring of crucial wastewater quality parameters at the inlet and outlet of the plant (BOD, pH, ammonia etc.,)	DB Contractor and Project Implementation Unit (PIU)	Project cost - DB Contractor
STP treatment efficiency	Change of inlet sewage parameters and deficient treatment quality	(i) No industrial wastewater shall be allowed to dispose into municipal sewers (ii) No domestic wastewater from industrial units shall be allowed into municipal sewers (iii) Ensure that there is no illegal discharge through manholes or inspection chambers (iv) Conduct public awareness programs; in coordination with Tamil Nadu Pollution Control Board (TNPCB) (v) Conduct regular wastewater quality monitoring (at inlet and at outlet of STP) to ensure that the treated effluent quality complies with the applicable standards	PIU/Rajapalayam Municipality	PIU Costs
Discharge of treated wastewater into Kothankulam Tank	Impacts on receiving water body	(i) Review the feasibility studies and finalize detailed design of treatment and disposal system, including reuse and/or safe disposal into downstream water tanks; review the tank stability of bunds to continuously hold water and along with its overflow arrangement and interconnection with other lakes shall be checked for safety and proper disposal of surplus water without any inundation	DB Contractor and PIU	Project cost - DB Contractor

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(ii) Obtain Public Works Department (PWD) and TNPCB consent for disposal of treated wastewater into Kothankulam Tank (iii) Conduct detailed water quality assessment of Kothankulam tank, pre and post monsoon seasons.		
	Nuisance due to STP operation	(i) Develop a green buffer zone of 15-20 m wide all around the STP with trees in multi-rows and land scaping. This will act as a visual screen around the facility and will improve the aesthetic appearance.	DB Contractor and PIU	Project cost - DB Contractor
	Sludge disposal	(i) Prepare sludge management plan (collection, treatment, drying, disposal and periodic testing) and integrate into design, construction and operation	DB Contractor and PIU	Project cost - DB Contractor
	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 1 m (ii) Use appropriate building materials and construction techniques for sewage pumping stations which can absorb sound rather than reflect noise (iii) Use acoustic enclosures – manufacturer specified, for all pumps, motors (iv) Procure only Central Pollution Control Board (CPCB) approved generators with low emission and low noise fitted with acoustic enclosures (v) Provide sound mufflers for ventilators in the plant rooms; and sound proof doors (vi) Provide ear plugs to workers	DB Contractor and PIU	Project cost - DB Contractor
STP operation	Energy consumption	(i) Using low-noise and energy efficient pumping systems (ii) Efficient Pumping system operation (iii) Installation of Variable Frequency Drives (VFDs)	DB Contractor and PIU	Project cost - DB Contractor
Construction of subproject components	Tree cutting	(i) Minimize removal of trees by adopting to site condition and with appropriate layout design/alignment (ii) Obtain prior permission for tree cutting (iii) Plant and maintain 10 trees for each tree that is removed	DB Contractor and PIU	Project cost - DB Contractor
Sewer network	Nuisance due to leaks, overflows, contamination of water supplies,	(i) Limit the sewer depth where possible (ii) Sewers shall be laid away from water supply lines and drains (at least 1 m); if not possible, sewer lines shall be laid below the water lines	PIU	PIU costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
	occupation health and safety of workers, nosie and vibrations, etc.	(iii) In all cases, the sewer line should be laid deeper than the water pipeline (the difference between top of the sewer and bottom of water pipeline should be at least 300 mm) (iv) In unavoidable cases, where sewers are to be laid close to storm water drains, appropriate pipe material (that has no or least infiltration risk) shall be selected (stoneware pipes shall be avoided) (v) For shallower sewers and especially in narrow roads, use small inspection chambers in lieu of manholes; (vi) Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize silt/garbage entry (vii) Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulfide generation (viii) 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.		
Sewage lifting and pumping stations	Odor nuisance	**Site layout planning** (i) Siting of wells within the identified site at an internal location as far as possible from adjoining residential buildings (ii) Develop green buffer zone around the facilities with a combination of tall and densely growing trees in multi rows as per the land availability to control odor and also act as visual shield, and improve aesthetical appearance (iv) Provision of high compound wall **Design measures** (i) Proposed wells to be closed using RCC slabs. Design of RCC slab to consider both superimposed loads (human	PIU	PIU costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		and equipment loads) and severe corrosion risk from sewer gas from within wells. (ii) RCC Slab to be designed and fixed in a modular manner such that access to pumps / appurtenances and other equipment can be provided for maintenance / replacement / renewal purposes. (iii) Since human intervention is involved and safety shall be primary and critical consideration, additional protection by way of a metaled grating / grill work shall be provided over the sections (or full cross section if required) where workers will stand / work for inspection and repair/O and M purposes. (iv) Provision of passive gas ventilation arrangement by providing a take-off vent from top of well by positioning vent in such a way that cover slab fitment / movement / drawl if required for maintenance purposes is not compromised. (v) Height of vent to be provided appropriately and a minimum 2 m above the lintel level (top level) of window(s) / passageways / doors in the nearby adjoining buildings. (vii) Submersible sewage pumps of suitable rating, minimum submergence requirements, open impeller with cutting-tearing arrangement and high strength-corrosion resistant heavy duty construction shall be proposed. (viii) In locations/cases where sewage flow in the present to intermediate design stage is envisaged to be low, position of the submersible pumps and design of the collection well floor by providing necessary side benching / sloped flooring to allow for higher submergence during low flow shall be made to ensure regular pump operation and avoid sewage stagnation beyond the permissible limit. (ix) Diesel Generators shall be provided for all pump stations and in cases of lift stations with space for control room. In cases of lift manholes (road-side or road-center type structures with only provision of kerb-side kiosk), an		

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		electrical cut-out provision shall be made for connecting an Emergency Mobile / Skid Mounted Diesel Generator for pumping out during long period of electricity supply interruption. (x) Develop standard operating procedures / operational manual for operation and maintenance of lifting and pump stations; this shall include measures for emerge situations (xi) Provide training to the staff in SOPs and emergency procedures (x) Periodically monitor odor generation. (xi) Periodic monitoring of H2S levels at sewage pumping and lifting stations using handheld H2S meters		
	Nuisance from sewage pumping stations operation close to houses	*Provision for Avarampatti and Andalpuram SPS* (i) Provide a suitable arrangement to capture the gaseous emissions from the wells and treat via scrubber/activated carbon filter before letting out into the ambient air; such system should be designed appropriately to meet the likely emissions/flow rate of respective pumping stations	PIU	PIU costs
	Noise and vibrations	(i) Procure good quality latest technology high pressure pumps that guarantee controlled noise at a level of around 80dB(A) at a distance of 1 m (ii) Use appropriate building materials and construction techniques for sewage pumping stations 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 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	PIU	PIU costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		structures likely to be impacted by the controlled blasting and take adequate measures to minimize such impacts.		
Sewerage system	Energy consumption	(i) Using low-noise and energy efficient pumping systems (ii) Efficient Pumping system operation (iii) Installation of Variable Frequency Drives (VFDs)	PIU	PIU costs
	Tree cutting	(i) Minimize removal of trees by adopting to site condition and with appropriate layout design/alignment (ii) Obtain prior permission for tree cutting (iii) Plant and maintain 10 trees for each tree that is removed	PIU	PIU costs
Controlled blasting	Ground vibrations Noise (airblast) Flying debris Dust	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. 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. 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	Contractor and PIU	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		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..		

Table 18:Pre-Construction Stage Environmental Impacts and Mitigation Measures

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

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Cost and Source of Funds
	disturbance in natural drainage patterns, ponding and water logging, and water pollution.	(iii) Contractor to submit to PIU on a monthly basis documentation on material obtained from each sources (quarry/ borrow pit) (iv) No new borrow areas, quarries etc., shall be developed for the project;	the approval of PIU	
Consents, permits, clearances, No Objection Certificates (NOCs), etc.	Failure to obtain necessary consents, permits, NOCs, etc. can result to design revisions and/or stoppage of works	(i) Obtain all necessary consents, permits, clearance, NOCs, etc. prior to award of civil works. (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.	CC and PIU	PIU costs for project approvals Contract cost for construction approvals
Chance finds	Damage/disturbance to artifacts	(i) Construction contractors to follow these measures in conducting any excavation work • Create awareness among the workers, supervisors and engineers about the chance finds during excavation work • 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.	CC and PIU	Contractor Costs

Table 19:Construction Stage Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
Environmental Management Plan (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 (OHS), core labor laws, applicable environmental laws, etc.	Contractor	Project cost / PMU cost
Air Quality	Dust, emissions from construction vehicles, equipment, and machinery used for installation of pipelines resulting to	**For all construction works** (i) Provide a dust screen (6 m high) around the construction sites of pumping and lifting stations and sewage treatment plant (STP); provide 2 m high barricades for the sewer works	Contractor	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
	dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons.	(ii) Damp down the soil and any stockpiled material on site by water sprinkling;(3-4 times a day - before the start of work, 1-2 times in between, and at the end of the day); when working in the roads there should permanently be one person responsible for directing when water sprinkling needs to take place to stop the dust moving; (iii) Reduce the need to sprinkle water by stabilizing surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition (iv) Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process (v) Cover the soil stocked at the sites with tarpaulins, and surround by dust screens.(vi) Control access to work area, prevent unnecessary movement of vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation (vii) Use tarpaulins to cover the loose material (soil, sand, aggregate etc.,) when transported by open trucks; (viii) Control dust generation while unloading the loose material (particularly aggregate, sand, soil) at the site by sprinkling water and unloading inside the barricaded area; minimize the drop height when moving the excavated soil. (ix) Clean wheels and undercarriage of haul trucks prior to leaving construction site (x) Ensure that all the construction equipment, machinery are fitted with pollution control devises, which are operating correctly, and have a valid pollution under control (PUC) certificate (xi) no vehicles or plant to be left idling at site generators to be at placed maximum distance from properties **For sewer works** (i) Barricade the construction area using hard barricades (of 2 m height) on both sides (ii) Initiate site clearance and excavation work only after barricading of the site is done		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(ix) Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes etc.,), to the barricaded area (x) Ensure that adequate cover is provided to the trenches to prevent emission of dust during controlled blasting. (iv) Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area (v) Undertake the work section wise: a 500 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 (vi) In the roads that connect to SPS sites, which need to accommodate two main sewers (income and outgoing main sewers of SPS), plan work so that access to houses is maintained throughout the construction phase; first lay one sewer and close the trench, restore the road, and lay the second sewer; (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. (viii) 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. (ix) 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. (xi) Immediately compact 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		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		road is properly restored. Backfilled trench without any road restoration is a major source of dust. (xii) 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. (xiii) 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; (xiv)		
Surface water quality	Mobilization of settled silt materials, and chemical contamination from fuels and lubricants during construction can contaminate nearby surface water quality. Ponding of water in the pits / foundation excavations	(i) All earthworks be conducted during the dry season to prevent the problem of soil/silt run-off during rains (ii) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;do not stock earth/material close to water bodies (at least100 m) (iii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, only designated disposal areas shall be used; (iv) Install temporary silt traps, oil traps or sedimentation basins along the drainage leading to the water bodies; (v) Place storage areas(with impermeable surface) for fuels and lubricants away from any drainage leading to water bodies; these should be at least 100 m away from water bodies and groundwater wells) (vi) Store fuel, construction chemicals etc., on an impervious floor, also avoid spillage by careful handling; provide spill collection sets for effective spill management (vii) Dispose any wastes generated by construction activities in designated sites; (viii) Conduct surface quality inspection according to the Environmental Management Plan (EMP).	Contractor	Contractor costs
	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	Contractor	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(ii) Pump out the water collected in the pits / excavations to a temporary sedimentation pond; dispose off only clarified water into drainage channels/streams after sedimentation in the temporary ponds (iii) Consider safety aspects related to pit collapse due to accumulation of water		
Noise Level	Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people	(i) Plan activities in consultation with PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; especially near schools and other sensitive receptors (ii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and use portable street barriers to 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.	Contractor	Contractor costs
Removal of rock during excavation for sewer works	Increase in vibration due to the controlled blasting and associated activities	(i) During excavation for sewer works, wherever removal of rock is identified, alternatives like drilling and chiselling, controlled blasting etc will be examined and the suitable technology shall be finalised depending upon the site conditions. Following measures for ensuring safety shall be ensured during controlled blasting.	Construction Contractor	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(ii) 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. (iii) Permission shall be obtained from The District Collector for controlled blasting for excavation. For the initial stretches proposed for about 3.2km permission is obtained from The District Collector of Virudhunagar. Conditions stipulated in the permission issued by the District Collector shall be complied with during implementation. (iv) The contractor shall submit a blasting plan in advance to PIU; and implement in accordance to the plan. (v) (vi) Blasting shall be done through an licensed Explosive Contractor only (vii) 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. (viii) Cost for implementation of mitigation measures and liability are the responsibility of contractor. (ix) Proper prior notice will be issued to the Residents before Commencing UGSS activity works Schedule (x) Proper information will be Given to Police Officials (xi) Workers (Flagman) shall be stationed on both end of roads to warn people before firing any blasts and not to permit the traffic. (xii) When blasting, ample warning shall be given to all persons within the vicinity prior to blasting. Warning		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		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. (xiii) 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. (xiv) Minimum Explosive will be used for Control Blasting for Residential areas (xv) 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. (xvi) The contractor shall be responsible for any and 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. (xvii) The contractor shall do the activities after obtaining the blasting permission from District Collector, Virudhunagar. (xviii) For the diversion of traffic in the blasting area, the contractor shall prepare a traffic management plan and obtain permission from Rajapalayam Municipality and traffic police. 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.		
Landscape and aesthetics – waste generation	Impacts due to excess excavated earth, excess construction materials, and solid waste such as	(i) Prepare and implement a Construction Waste Management Plan (refer Appendix 4) (ii) As far as possible utilize the debris and excess soil in construction purpose, for example for raising the ground level or construction of access roads etc.,	Construction Contractor	Cost for implementation of mitigation measures responsibility of contractor.

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

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(iii) Avoiding conducting work in all roads in a colony at one go; it will render all roads unusable due to excavations at the same time, creating large scale inconvenience (iv) Undertake the work section wise: a 500 section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones (v) Confine work areas in the road carriageway to the minimum possible extent; all the activities, including material and waste/surplus soil stocking should be confined to this area. Proper barricading should be provided; avoid material/surplus soil stocking in congested areas – immediately removed from site/ or brought to the as and when required (vi) Limit the width of trench excavation as much as possible by adopting best construction practices; adopt vertical cutting approach with proper shoring and bracing; this is especially to be practiced in narrow roads and deeper sewers; if they deep trenches are excavated with slopes, the roads may render completely unusable during the construction period (vii) Leave spaces for access between mounds of soil to maintain access to the houses / properties; access to any. house or property shall not be blocked completely; alternative arrangements, at least to maintain pedestrian access at all times to be provided (viii) Provide pedestrian access in all the locations; provide wooden/metal planks with safety rails over the open trenches at each house to maintain the access. (ix) Inform the affected local population 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		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(xiii) At work site, public information/caution boards shall be provided including contact for public complaints **Controlled blasting** (xix) The contractor shall submit a blasting plan in advance to PIU; and implement in accordance to the plan. (xx) Proper prior notice will be issued to the Residents before Commencing UGSS activity works Schedule (xxi) Proper information will be Given to Police Officials (xxii) Workers (Flagman) shall be stationed on both end of roads to warn people before firing any blasts and not to permit the traffic. (xxiii) 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. (xxiv) For the diversion of traffic in the blasting area, the contractor shall prepare a traffic management plan and obtain permission from Rajapalayam Municipality and traffic police. **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.		
Controlled blasting	Ground vibrations Noise (airblast) Flying debris	Carryout controlled blasting in consultation with PIU so that blasting activities are conducted during periods of the day	Contractor and PIU	Contractor Costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
	Dust	which will result in least disturbance; especially near schools and other sensitive receptors. The contractor shall submit a blasting plan in advance to PIU for approval; and implement in accordance to the plan once approved. 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 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. For the initial stretches proposed totalling to about 3.2 km permission has been obtained from The District Collector of Virudhunagar. Blasting shall be carried out through a licensed Explosive Contractor only. 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. Cost for implementation of mitigation measures and liability are the responsibility of contractor. 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. 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		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		about the preventive, precautionary, mitigation and emergency response measures being taken to address their concerns. Prior information will be given to Police Officials 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 Rajapalayam Municipality and traffic police. 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. Sites shall be provided with necessary shields all around. Minimum explosive will be used for Controlled Blasting specifically within residential areas. 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. 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.		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		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); 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. 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. 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. Training related to controlled blasting activity will be included in the overall safeguards training programme meant for PIUs and Contractors.		
Socio-Economic Loss of access to houses and business	Loss of income	(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	Contractor	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		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.		
Socio-Economic - Employment	Generation of temporary employment and increase in local revenue	(i) Employ local labor force as far as possible (iii) Comply with labor laws	Contractor	Contractor costs
Occupational Health and Safety	Occupational hazards which can arise during work	(i) Follow all national, state and local labor laws (indicative list is in Appendix 2); (ii) Develop and implement site-specific occupational health and safety (OHS) 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 personal protective equipment; (c) OHS Training for all site personnel, (d) excluding public from the work sites; and (e) documentation of work-related accidents; Follow International Standards such as the World Bank Group's Environment, Health and Safety Guidelines.[a]	Contractor	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		For controlled blasting activity, identify the risks involved for the labourers and public and include measures in the OHS plan. Provide necessary training and PPEs to the labourers to ensure safety during implementation. (iii) Ensure that qualified first-aid is provided at all times. Equipped first-aid stations shall be easily accessible throughout the sites; (iv) Secure all installations from unauthorized intrusion and accident risks (v) Provide 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; (vi) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; (vii) Ensure the visibility of workers through their use of high visibility vests and other PPE when working in or walking through heavy equipment operating areas; (viii) Ensure moving equipment is outfitted with audible back-up alarms; (ix) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards 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	(i) Consult PIU before locating project offices, sheds, and construction plants;	Contractor	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
	material and waste transportation	(ii) Select a camp site sufficiently away from residential areas or locate the camp site within the existing facilities of Rajapalayam Municipality (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 water bodies, flood plains flood prone/low lying areas, or any ecologically, socially, archeologically sensitive areas (vi) Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit (vii) Ensure conditions of livability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be used as accommodation for workers (viii) Camp shall be provided with proper drainage, there shall not be any water accumulation (ix) Provide drinking water, water for other uses, and sanitation facilities for employees; 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		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		designated areas; provide a compost pit for bio degradable waste, and non-biodegradable / recyclable waste shall be collected and sold in local market (xv) Remove all wreckage, rubbish, or temporary structures which are no longer required; and (xvi) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to PIU; PIU to review and approve camp clearance and closure of work site		
Work Camps and worksites	Temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants Unsanitary and poor living conditions for workers	(i) As far as possible located the camp site within the work sites (at STP or large pumping station sites); if any camp to be established outside these, then select a camp site away from residential areas (at least 100 m buffer shall be maintained) (ii) Avoid tree cutting for setting up camp facilities (iii) Ensure that a proper compound wall is provided, and erect a wind/dust screen around (iv) Camp site shall not be located near (100 m) water bodies, flood plains flood prone/low lying areas, or any ecologically, socially, archeologically sensitive areas (v) Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit (vi) Provide proper temporary accommodation with proper materials, adequate lighting and ventilation, appropriate facilities for winters and summers; ensure conditions of livability at work camps are maintained at the highest standards possible at all times; (vii) Consult PIU before locating project offices, sheds, and construction plants; (viii) Minimize removal of vegetation and disallow cutting of trees (ix) Ensure conditions of livability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be allowed as accommodation for workers	Contractor	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(x) Camp shall be provided with proper drainage, there shall not be any water accumulation (xi) Provide drinking water, water for other uses, and sanitation facilities for employees (xii) Prohibit employees from cutting of trees for firewood; contractor should be provide proper facilities including cooking fuel (oil or gas; fire wood not allowed) (xiii) Train employees in the storage and handling of materials which can potentially cause soil contamination (xiv) Recover used oil and lubricants and reuse or remove from the site (xv) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; provide a compost pit for biodegradable waste, and non-biodegradable / recyclable waste shall be collected and sold in local market (xvi) Remove all wreckage, rubbish, or temporary structures which are no longer required (xvii) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to PIU; PIU to review and approve camp clearance and closure of work site		
Post-construction clean-up	Damage due to debris, spoils, excess construction materials	(i) Remove all spoils wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (ii) All excavated roads shall be reinstated to original condition. (iii) All disrupted utilities restored (iv) All affected structures rehabilitated/compensated (v) The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up. (vi) All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be top soiled and regrassed using the guidelines set out in the revegetation specification that forms part of this document. (vii) The contractor must arrange the cancellation of all temporary services.	Contractor	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(viii) Request PIU to report in writing that worksites and camps have been vacated and restored to pre-project conditions before acceptance of work.		
Temporary economic impacts	Disruption to vendors, hawkers on ROW during sewer laying works	(i) Contractor is required to provide notice to the shop owners of the need to shift kiosk/wares displayed on ROW as soon as the work plan is ready, with minimum 7 working days. (ii) No works can be commenced unless 100% shifted in sections ready for implementation.	CC and PIU	Contractor / PIU

[a] IFC World Bank Group. Environmental, Health & Safety Guidelines101.

Table 20:Operation Stage Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
Sewage treatment plant (STP) operation – malfunction and effect on efficiency	Public health, safety and environmental impacts	(i) Ensure proper knowledge transfer, hands-on training to municipal staff engaged in STP operation has been provided by contractor prior to handover of facility (ii) Ensure continuous uninterrupted power supply (iii) Operate and maintain the facility following standard operating procedures of operational manual (iv) Undertake preventive and periodic maintenance activities as required (v) Maintain the mechanical/electrical parts as per the maintenance plan to avoid any hazards (vi) Conduct periodic training to workers (vii) Ensure that all safety apparatus at STP including personal protection equipment are in good condition all times; and are at easily accessible and identifiable place; periodically check the equipment, and conduct mock drills to deal with emergency situations (viii) Implement sludge management plan at the STP (ix) No wastewater from industrial premises (including domestic wastewater) shall be allowed to dispose into municipal sewers (x) Monitor regularly and ensure that there is no illegal discharge through manholes or inspection chambers; conduct public awareness programs; in coordination with Tamil Nadu Pollution Control Board (TNPCB) (vii) Conduct regular wastewater quality monitoring at inlet and at	Project Implementation Unit (PIU)/ Rajapalayam Municipality	Operating costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		outlet of STP to ensure that the treated effluent quality complies with the standards (viii) Conduct periodic testing of dried sludge/compost to check presence of heavy metals and confirming stipulated concentrations to use as compost		
Operation of sewage lifting and pumping stations	Odor nuisance	(i) Strictly follow standard operating procedures / operational manual for operation and maintenance of lifting and pump stations (ii) Ensure that operating staff is properly trained, and have clear understanding of odor issues vis-à-vis its related with operational practices (iii) Ensure that pumping cycles are properly followed; and there is no buildup of sewage beyond design volume in the wells (iv) Conduct monitoring (periodically at pumping stations and lifting stations);	PIU/Rajapalayam Municipality	Operating costs
Operation and maintenance of sewerage system	Blocks, overflows, system malfunction, occupational health and safety	(i) Establish regular maintenance program, including: • Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas • Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration; and • Monitoring of sewer flow to identify potential inflows and outflows • Conduct repairs on priority based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages); (ii) Maintain records; review previous sewer maintenance records to help identify “hot spots” or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed; (iii) When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain	PIU/Rajapalayam Municipality	Operating costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system. (iv) Prohibit/prevent disposal of wastewater/effluent from industrial units in the sewers; ensure regular checking to ensure no illegal entry of industrial wastewater into sewers (v) Develop an Emergency Response System for the sewerage system leaks, burst and overflows, etc. (vi) Provide necessary health and safety training to the staff in sewer cleaning and maintenance (vii) Provide all necessary personnel protection equipment (viii) Do not conduct manual cleaning of sewers; for personnel engaged sewer maintenance work, there is a risk due to oxygen deficiency and harmful gaseous emissions (hydrogen sulfide, methane, etc.); provide for adequate equipment (including oxygen masks) for emergency use		

Table 21:Pre-Construction and Construction Stage Environmental Monitoring Plan

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
Baseline water quality of receiving water body (Kothankulam Tank and downstream Pudukulam Tank)	4 points (2 samples from each tank)	• pH, TDS, TSS, DO, BOD, COD, E-coli, Total coliform, Nitrate, Total Phosphates, Oil & grease, Total hardness, Sulphate, Fluoride, Chloride, Ammonia, Aluminum, Manganese, Iron, Zinc, Nickel, Magnesium, Phenolic compounds, Chromium, Arsenic, Mercury, Cadmium, Lead, Pesticides	Twice during detailed design phase (Pre monsoon and post monsoon during design phase)	DB Contractor	Cost for implementation of monitoring measures responsibility of DB contractor (4 samples x 8000 per sample = 32,000)
Baseline sediment quality in receiving water bodies (Kothankulam Tank)	1 points (Kothankulam tank)	• EC, pH, calcium, magnesium, % of total organic matter, Total organic carbon, N, P, K, Aluminum, fecal coliform, As,	Twice during detailed design phase (Pre monsoon and post	DB Contractor	Cost for implementation of monitoring measures

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
		Cu, Cd, Cr, Pb, Fe, Mn, Hg, Zn, Ni.	monsoon during design phase)		responsibility of DB contractor (2 samples x 10000 per sample = 20,000)
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 PIU	Staff and consultant costs are part of incremental administration costs
Ambient air quality	5 location (STP and 4 monitoring locations 50 m downwind direction near sewer and pumping station work sites in the town)	• PM10, PM2.5 NO2, SO2, CO	Once before start of construction Quarterly (yearly 4-times) during construction (2 year construction period)	DB Contractor	Cost for implementation of monitoring measures responsibility of DB contractor (45 samples x 5000 per sample = 225,000)
Ambient noise	5 location (STP and 4 monitoring locations 50 m downwind direction near sewer and pumping station work sites in the town)	• Day time and night time noise levels	Once before start of construction Quarterly (yearly 4-times) during construction (2 year construction period)	DB Contractor	Cost for implementation of monitoring measures responsibility of DB contractor (45 samples x 1500 per sample = 67,500)

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
Surface water quality	2 sampling locations (Kondanerikanmaai and Kothankulam irrigation tank)	• 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 (2 year construction period)	DB Contractor	Cost for implementation of monitoring measures responsibility of DB contractor (5 samples x 4000 per sample = 20,000)

Table 22:Operation Stage Environmental Monitoring Plan

Monitoring Field	Monitoring Location	Monitoring Parameters	Frequency	Responsibility	Cost and Source of Funds
Monitoring of treated wastewater quality from sewage treatment plant (STP)	Inlet and outlet of STP, and within the treatment process	Parameters as specified by Tamil Nadu Pollution Control Board (TNPCB) in the consent. Concentration of various parameters in treated wastewater shall be within the specific limits as per the discharge standards for STP .	Daily	Operator/Rajapalayam Municipality	Operating Cost
Water quality of receiving water body	2 points (1 at outfall discharge point intoKothankulamtanks;1 in Kothankulam tank)	pH, Cl, F, NO_3, TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalinity, coliform heavy metals and pesticides	Monthly once during operation Yearly twice (pre & post monsoon)	Operator/Rajapalayam Municipality	Operation and maintenance(O&M) costs (water quality will be tested at the internal laboratory part of STP)
	1 point in Pudukulam tank	pH, Cl, F, NO_3, TC, FC, Hardness, Turbidity BOD, COD,	Yearly once (pre & post monsoon)	Operator/ Rajapalayam Municipality	O&M costs (water quality will be tested at the internal laboratory part of STP)

Monitoring Field	Monitoring Location	Monitoring Parameters	Frequency	Responsibility	Cost and Source of Funds
		DO, Total Alkalinity, coliform			
Water quality of irrigation water (used for vegetable and fruit crops)	At the just upstream of nearest irrigation field	Nematode (should be less than one viable nematode egg per liter) Fecal coliforms (less than 1000 fecal coliforms per 100 ml).	Monthly once during first year operation Quarterly during the entire operation phase	Operator/ Rajapalayam Municipality	O&M costs (water quality will be tested at the internal laboratory part of STP)
Odor monitoring at STP	1 point (boundary of the STP in downwind direction)	Hydrogen sulfide(H_2S) •	One baseline prior to start of operation Monthly once	Operator/ Rajapalayam Municipality	O&M Costs
Ambient noise	1 point (boundary of the STP in downwind direction)	Day time and night time noise levels	One baseline prior to start of operation Monthly once	Operator/ RajapalayamMunicipality	O&M Costs
Sludge quality and suitability as manure	STP	Analysis for concentration of heavy metals and confirm that value are within the limits specified in the SWM rules.	Start of operation and Yearly once	Operator/ Rajapalayam Municipality	O&M costs (testing to be done at an accredited external laboratory)
Odor monitoring at pumping stations	3 points (downwind direction) at all pumping stations: near inlet/suction well; outside the pumping station and at nearest house	Hydrogen sulfide (H_2S) •	Half yearly (yearly twice) and as and when based on public complaints (throughout the operation phase)	Operator/ Rajapalayam Municipality	O&M Costs
Odor monitoring at lifting stations	1 point at each LS (downwind direction) at the boundary wall of the pumping stations	Hydrogen sulfide (H_2S) in ambient air •	Periodically.	Operator/ Rajapalayam Municipality	O&M Costs

B. Implementation Arrangements

168. The MAWS acting through TNUIFSL will be the executing agency. A program steering committee, headed by Principal Secretary, MAWS, Government of Tamil Nadu, will provide overall guidance and strategic directions to the program. A program management unit (PMU) for TNUFIP, headed by the Managing Director, TNUIFSL acting as Program Director will be established within TNUIFSL for overall management, planning, implementing, monitoring, reporting, and coordinating TNUFIP. The CMA will act as the Deputy Program Director in the PMU. The project ULBs, represented by respective Municipal Commissioners, will be the implementing agencies for works in cities/towns. ULBs or in case some ULBs (i.e. Coimbatore, Rajapalayam and Ambur), TWAD Board, will establish program implementing units (PIUs) headed by an executive engineer as full-time Project Manager. PIUs will comprise of dedicated staff responsible for overseeing implementation of projects on a day-to-day basis. The PIUs will be supported by a contract management and supervision consultant (CMSC) recruited by TNUIFSL. In towns where TWAD Board establishes PIUs, there will be no CMSC, the TWAD Board staff will handle all the implementation tasks include safeguards. For the institutional capacity, public awareness, and urban governance component, CMA acting through its Commissioner, will establish a PIU and appoint a governance improvement and awareness consultant (GIAC) responsible for supporting these activities.

169. The implementing agency for this subproject is Rajapalayam Municipality. A Project Implementation Unit (PIU) has been established by TWAD Board in Rajapalayam headed by full-time a Project Manager (a senior official of TWAD Board) and comprising dedicated full-time staff from TWAD Board. PIU will be responsible for planning, implementation, monitoring and supervision, and coordination of all activities of subproject.

170. **Safeguards Compliance Responsibilities**. Environmental and Social Safeguards (ESS) managers in the PMU, TNUIFSL will have overall responsibility of safeguard compliance with ADB SPS 2009. ESS Managers report to Vice President in the Projects Wing. At ULB level, a Safeguards Officers will be appointed, who will be an Assistant Engineer rank officer and will coordinate all safeguard tasks (environment, social and gender). An Environmental Expert will also be appointed in PIU, specifically to implement environmental safeguards.

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

172. **Detailed Project Report finalization and Bidding Stage:**

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

173. **Construction Stage:**

(i) Prior to start of construction:
- Ensure that all necessary clearances/permissions/licences, including that of contractor's are in place prior to start of construction.
- provide oversight on environmental management aspects of subprojects and ensure EMPs are implemented by PIUs and contractors.

(ii) Oversee and provide guidance to the PIU to properly carry out the environmental monitoring as per the EMP

(iii) Oversee grievance redress mechanism to address any grievances brought about in a timely manner; ensure that records are properly maintained

(iv) Consolidate quarterly environmental monitoring reports from PIU and submit semi-annual monitoring reports to ADB

(v) Oversee site closures to ensure that all work / facility sites are restored properly prior to issuing work completion certificate to the contractor

174. **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 STP from TNPCB.

175. **PIU Safeguard Responsibilities**. Key tasks and responsibilities of the PIU (established by TWAD Board) for this subproject include the following:

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

(i) Include design related measures of the EMP in the project design and DPR.

(ii) Include EMP in the bidding documents and civil works contracts, including requirement ofstaff (EHS supervisor) with contractor for EMP implementation.

(iii) Provide necessary budget in the project as IEE for EMO Implementation.

(iv) Ensure that the bid/contract documents include specific provisions requiring contractors to comply with all applicable labor laws and core labor standards including:
   a. Labour welfare measures and provision of amenities
   b. prohibition of child labor as defined in national legislation for construction and maintenance activities;
   c. equal pay for equal work of equal value regardless of gender, ethnicity, or caste;
   d. elimination of forced labor;
   e. the requirement to disseminate information on sexually transmitted diseases, including HIV/AIDS, to employees and local communities surrounding the project sites.

(v) In the pre-bid meeting, provide insight into EMP measures, and overall compliance requirements to the bidders

(vi) Obtain all clearance/permissions as required for implementation of subproject, including consent to establish (CTE) from TNPCB for STP prior to invitation of bids and/or prior to award of contract as appropriate

177. **Construction stage:**

(i) Identify regulatory clearance requirements and obtain all necessary clearances prior to start of construction; ensure construction work by contractor is conducted in compliance with all government rules and regulations including pollution control, labour welfare and safety etc.;

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

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

179. **Contractor's Responsibilities:**

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

181. **Construction stage:**

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

C. Training Needs

182. The following Table 23 presents the outline of capacity building program to ensure EMP implementation. These capacity building and trainings will be conducted at the offices of PMU and PIU by the environmental safeguards specialist of PMU/PIU and their consultants, which are part of project implementation set-up, and therefore no separate or additional costs are envisaged. Adequate costs are already considered in project's capacity building program. The detailed program and specific modules will be customized for the available skill set after assessing the capabilities of the target participants and the requirements of the project by the PMU.

Table 23: Outline Capacity Building Program on Environmental Management Plan Implementation

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

Description	Target Participants and Venue	Estimate (₹)	Cost and Source of Funds
2. EMP implementation (1/2 day) - EMP mitigation and monitoring measures -Roles and responsibilities - Public relations, - Consultations - Grievance redress - Monitoring and corrective action planning - Reporting and disclosure - Construction site standard operating procedures (SOP) -- Chance find (archeological) protocol - Work near the ASI monuments - AC pipe protocol - Traffic management plan - Waste management plan - Site clean-up and restoration - Controlled blasting	All PIU staff, contractor staff and consultants involved in the subproject At PIU	-	To be conducted by PIU at the PIU office; part of project implementation cost
3. Contractors Orientation to Workers (1/2 day) - Environment, health and safety in project construction Health & safety measures during coronavirus disease (COVID-19) pandemic	Once before start of work, and thereafter regular briefing every month once. Daily briefing on safety prior to start of work All workers (including unskilled laborers)	-	Contractors' EHS officer to conduct program, with guidance of PIU Environmental Expert

D. Monitoring and Reporting

183. 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.

184. During construction, results from internal monitoring by the contractor will be reflected in their monthly EMP implementation reports to the PIU. Safeguards Officer and PIU Environmental Expert will monitor, review and advise contractors for corrective actions if necessary. Quarterly report summarizing compliance and corrective measures, if any, taken will be prepared by 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 annual report.

185. 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, TWAD Board and Rajapalayam Municipality websites.

186. 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.

187. ADB's monitoring and supervision activities are carried out on an on-going basis until a Project Completion Report (PCR) is issued. ADB issues a PCR within 1-2 years after the project is physically completed and in operation.

E. Environmental Management Plan Implementation Cost

188. 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 24:Cost Estimates to Implement the Environmental Management Plan

	Particulars	Stages	Unit	Total Number	Rate (₹)	Cost (₹)	Costs Covered By
A.	**Implementation staff**						
1	EHS Supervisor	Construction	per month	24	35,000	840,000	Civil work contract
	Subtotal (A)					**840,000**	
B.	**Mitigation Measures**						
1	Providing gas capture and treatment system at STP, selected pumping and lifting stations	Design	Lump sum provision	-	-	1,000,000	Provisional sums of contract (PIU)
2	Consent for establishments and consent for operation from TNPCB	Pre construction	Lump sum			200,000	Project costs (PIU)
3	Provision for tree cutting and compensatory plantation measures (1: 10 ratio replantation)	Construction	Per tree	100	1,000	100,000	Project costs (PIU)
4	Preparation of plans traffic management plan, waste (spoils) management plan etc.,) traffic management at work sites(Pavement Markings, Channelizing Devices, Arrow Panels and Warning Lights)	Construction	Lump sum	-	-	250,000	Civil works contract
5	Safety barricading	Construction	Lump sum	Lump sum		2,000,000	Civil works contract
	Subtotal (B)					**3,550,000**	
C.	**Monitoring Measures**						
1	Air quality monitoring	Construction	per sample	45	5,000	225,000	
2	Noise levels monitoring	Construction	Per sample	45	1,500	67,500	
3	Surface water monitoring	Construction	Per sample	5	4,000	20,000	
4	Baseline water quality (receiving water body)	Design	Per sample	4	8000	32,000	

	Particulars	Stages	Unit	Total Number	Rate (₹)	Cost (₹)	Costs Covered By
5	Sediment quality (receiving water body)	Design	Per sample	2	10000	20,000	
	Subtotal (C)					**364,500**	
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)						
	Total (A+B+C+D)				₹	**4,754,500**	

Contractor Cost -3,454,500
PIU Cost -1,300,000

IX. CONCLUSION AND RECOMMENDATIONS

189. The process described in this document has assessed the environmental impacts of all elements of the proposed underground sewerage subproject in Rajapalayam Municipality. 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: providing safe disposal of treated wastewater; efficient treatment to meet disposal standards, odor control at pumping stations, uninterrupted power supply provision; standard operating procedures for operation and maintenance; and imparting necessary training for ULB staff; providing necessary safety no manual cleaning of sewers, and personal protection equipment for workers (protection against oxygen deficiency, harmful gaseous emissions) and sludge handling, and development of green buffer zone around the sewage treatment plant.

190. Proposed sewage treatment plant (STP) site is located on the eastern side of the town, away from the habitation. Site is selected within the existing solid waste disposal facility (compost plant); of the total 20 acres area, 5 acres is allotted to STP. There are no streams/rivers flowing through or close to Rajapalayam municipal area. It is proposed to discharge STP treated wastewater into Kothankulam Irrigation Tank, which is located at about 1.4 km north of STP site. Given the current status of tank with negligible storage, polluted nature of water, no dependent potable uses, no notable aquatic life, etc., there are no adverse impacts likely due todisposal of STP treated wastewater meeting the set quality standards. Given the proposed disposal standards, the disposal will improve the existing water quality, and will raise the water level, and can be utilized for irrigation in the command area.

191. STP and all the lifting and pumping station sites are situated on government owned vacant land parcels, and sewers will be laid on the public roads. Therefore subproject do not involve any private land acquisition. All the subproject components are located within urban environment. STP site is located outside the town, surrounded by agricultural and barren lands. There are no ecologically sensitive or protected wildlife or archeological areas in or close to subproject area. Nearest protected area is Srivilliputhur Grizzled Squirrel Wildlife Sanctuary, about 8 km from the Rajapalayam Municipal boundary in the west.

192. 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, most of the sites identified are close to the houses. Various site planning, green buffer and design related measures are included in the project to prevent and control odor generation. These include: appropriately locating sewage wells within site maintaining maximum distance from the nearby houses; developing tree cover; closed facilities; design and operation measures to prevent odor; and, providing gas collection and treatment facilities at sewage pumping stations.Odor monitoring is also proposed.

193. STP malfunction or decrease in treatment efficiency will have adverse impacts.This will result in release of untreated or partially treated wastewater that will pollute the receiving water body, and may cause public health issues. Besides measures to select an efficient treatment process to treat sewage to disposal standards of MOEFCC, various measures are included in the design and operation phase to ensure that sewage system is operated and maintained with designed efficiency. Proper sludge management system to collect, treat and dispose safety will be developed and followed. Periodic monitoring of dried sludge to check suitability as a manure is suggested.

194. Except sewer works, all other construction activities will be confined to the selected sites, and the interference with the general public and community around will be minimal. There will be temporary negative impacts, arising mainly from construction dust and noise, hauling of construction material, waste and equipment on local roads (traffic, dust, safety etc.,), mining of construction material, occupation health and safety aspects. Sewer line works will be conducted along public roads in an urban area congested with people, activities and traffic, subproject is likely to cause 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 sections 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.

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

196. 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), water quality of receiving water body, sludge and odor at pumping stations. Mitigation and monitoring measures, along with the project agency responsible for such actions, form part of the Environmental Management Plan.

180. Stakeholders were involved in developing the IEE through face-to-face discussions, on site meetings, and a city level consultation workshop, which was conducted for larger public participation in the project. Views expressed by the stakeholders were incorporated into the IEE and the planning and development of the project. The IEE will be made available at public locations and will be disclosed to a wider audience via the PMU, Rajapalayam municipality 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. 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.

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

198. The citizens of Rajapalayam Municipality will be the major beneficiaries of this subproject. The new sewerage system will remove the human waste from those areas served by the network rapidly and treated to an acceptable standard, and treated wastewater is utilized beneficial purposes. In addition to improved environmental conditions, the subproject will improve the over-all public health in theproject area. Diseases of poor sanitation, such as diarrhea and dysentery, should be reduced, so people should spend less on healthcare and lose fewer working days due to illness, so their economic status should also improve, as well as their overall health.

199. 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), including permission to discharge treated effluent into Kothankulam Irrigation Tank, and consent to operate (CTO) from Tamil Nadu Pollution Control Board. As the Kothankulam Tank is under Public Works Department (PWD), disposal action will require prior permission of PWD.

200. This draft updated IEE shall be further updated by PIU during the implementation phase to reflect finalization of STP design, any other changes, and amendments and will be reviewed and approved by PMU and would be then submitted to ADB for its concurrence and disclosure..

RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

Sewerage

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

Country/Project Title: India / Tamil Nadu Urban Flagship Investment Program – Underground Sewerage Subproject for Rajapalayam Town, Virudhanagar District

Sector Division: Urban Development

Screening Questions	Yes/No	Remarks
A. Project Siting **Is the project area…**		
• Densely populated?	☒Yes ☐No	Project activities are located in the areas of Rajapalayam city. The center of town areas within the municipality have density residential pockets, with narrow and congested roads. Newly developing residential areas have low density and well planned layouts. Agriculture is still practiced in the outer areas.
• Heavy with development activities?	☒Yes ☐No	It is a developing area; urban expansion is considerable
• Adjacent to or within any environmentally sensitive areas?	☐Yes ☒No	-
• Cultural heritage site	☐Yes ☒No	
• Protected Area	☐Yes ☒No	No. Nearest protected area is Srivilliputhur Grizzled Squirrel Wildlife Sanctuary, in the western ghats, about 8 km west of the town boundary.
• Wetland	☐Yes ☒No	-
• Mangrove	☐Yes ☒No	-
• Estuarine	☐Yes ☒No	-
• Buffer zone of protected area	☒Yes ☐No	-
• Special area for protecting biodiversity	☐Yes ☒No	-
• Bay	☐Yes ☒No	-
B. Potential Environmental Impacts		

Will the Project cause…		
Sewerage		
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?	☐ Yes ☒ No	-
▪ 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 ☐ No	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?	☐ Yes ☒ No	Do not involve land acquisition or resettlement
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?	☐ Yes ☒ 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 ☒ No	Adequate capacity sewage treatment facility is being development under this subproject; proper treatment process, regular monitoring is part of the project, so no degradation of water quality envisaged
▪ overflows and flooding of neighboring properties with raw sewage?	☒Yes ☐No	Sewerage system has been designed considering the population growth. It has been designed to accommodate sewage until design year. Design considers standard peak factors and therefore no such impact envisaged.
▪ environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?	☐ Yes ☒ No	Proper sludge collection, treatment and disposal process is part of STP; sewerage system caters only domestic sewage; no industrial effluent is allowed into sewers
▪ noise and vibration due to blasting and other civil works?	☒Yes ☐No	Controlled blasting would be undertaken based on the site conditions. controlled blasting shall be done only by licensed explosive contractor. All Temporary nuisance/disturbance due to construction activities will be minimized with appropriate mitigation measures. Necessary noise and vibration control measures such as designing the blast charge by complying with the applicable Indian regulations and standards, Covered with MS sheet + Excavated earth + sand filled gunny bags, are deployed. Necessary permissions are obtained from District Collector, Virudhunagar prior to start of the controlled blasting work.
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, and biological hazards during project construction and operation?	☒Yes ☐No	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 ☒ No	There are no sources of hazardous material that will find its way into the sewers. Wastewater other than domestic will not be discharged into the sewers.
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?	☒ Yes ☐ No	Due to technical constraints and land availability, some pumping stations are located close to houses, however, necessary measures are included in site planning, design and operation.

		No net negative impacts envisaged
▪ road blocking and temporary flooding due to land excavation during the rainy season?	☒Yes ☐No	Complete road blocks 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 ☐ No	Controlled Blasting proposed will be carried out with necessary precautionary measures. Dust will be controlled with proper measures.
▪ traffic disturbances due to construction material transport and wastes?	☒Yes ☐No	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?	☒Yes ☐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 ☐No	A chance of failure of sewerage system is very remote; proper design and standard operating procedures will be followed in O&M; necessary equipment and training to workers will be provided
▪ deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?	☐ Yes ☒ No	The STP design include adequate sludge treatment facilities
▪ contamination of surface and ground waters due to sludge disposal on land?	☐ Yes ☒ No	The STP design include adequate sludge treatment facilities and the dried sludge will be utilized as manure
▪ Health and safety hazards to workers from toxic gases and hazardous materials which may be contained in confined areas, sewage flow and exposure to pathogens in untreated sewage and unstabilized sludge?	☒Yes ☐No	Manual cleaning of sewers and facilities will be avoided. All necessary health and safety training and necessary personal protection equipment will be given to workers and staff during operation of sewerage system
▪ Large population increase during project construction and operation that causes increased burden on social infrastructure (such as sanitation system)?	☐ Yes ☒ 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?	☐ Yes ☒ 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?	☐ Yes ☒ 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 the community throughout project construction, operation and decommissioning?	☒Yes ☐No	Operational area will be clearly demarcated and access will be controlled. Only worker and project concerned members will be allowed to visit the construction sites. .

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	Remarks
Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes?	√		Moderate earth quake risk zone (Zone III)
Could changes in temperature, precipitation, or extreme events patterns over the Project lifespan affect technical or financial sustainability (e.g., changes in rainfall patterns disrupt reliability of water supply; sea level rise creates salinity intrusion into proposed water supply source)?		√	No
Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g.,high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		√	No
Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by using water from a vulnerable source that is relied upon by many user groups, or encouraging settlement in earthquake zones)?		√	No

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

(i) Workmen Compensation Act, 1923 - The Act provides for compensation in case of injury by accident arising out of and during the course of employment.

(ii) Payment of Gratuity Act, 1972 - Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years' service or more or on death at the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.

(iii) Employees' PF and Miscellaneous Provisions Act, 1952 - The Act provides for monthly contributions by the employer plus workers @10 % or 8.33 %. The benefits payable under the Act are: (a) Pension or family pension on retirement or death as the case may be; (b) deposit linked insurance on the death in harness of the worker; (c) payment of PF accumulation on retirement/death etc.

(iv) Maternity Benefit Act, 1951 - The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.

(v) Contract Labor (Regulation and Abolition) Act, 1970 - The Act provides for certain welfare measures to be provided by the Contractor to contract labor and in case the Contractor fails to provide, the same are required to be provided by the Principal Employer by Law. The principal employer is required to take Certificate of Registration and the Contractor is required to take a License from the designated Officer. The Act is applicable to the establishments or Contractor of principal employer if they employ 20 or more contract labor.

(vi) Minimum Wages Act, 1948 - The employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment. Construction of Buildings, Roads, Runways are scheduled employment.

(vii) Payment of Wages Act, 1936 - It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.

(viii) Equal Remuneration Act, 1979 - The Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees in the matters of transfers, training and promotions etc.

(ix) Payment of Bonus Act, 1965 - The Act is applicable to all establishments employing 20 or more workmen. The Act provides for payments of annual bonus subject to a minimum of 8.33 % of wages and maximum of 20 % of wages to employees drawing Rs. 3,500/- per month or less. The bonus to be paid to employees getting Rs. 2,500/- per month or above up to Rs.3,500/- per month shall be worked out by taking wages as Rs.2,500/- per month only. The Act does not apply to certain establishments. The newly set up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of the Act.

(x) Industrial Disputes Act, 1947 - The Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.

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

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

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

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

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

SAMPLE OUTLINE SPOILS (CONSTRUCTION WASTE) MANAGEMENT PLAN

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

I. Spoils information

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

II. Spoils management

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

III. Documentation

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

PUBLIC INFORMATION NOTICE TEMPLATE

Public Announcement
Providing Underground Sewerage System in Rajapalayam Town
Rajapalayam Municipality

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

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

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

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

Inconvenience caused is regretted.

PIU - Contact No.
Contractor – Contact no.

SAMPLE GRIEVANCE REGISTRATION FORM
(To be available in Tamil and English)

The _____Project welcomes complaints, suggestions, queries, and comments regarding project implementation. We encourage persons with grievance to provide their name and contact information to enable us to get in touch with you for clarification and feedback.
Should you choose to include your personal details but want that information to remain confidential, please inform us by writing/typing *(CONFIDENTIAL)* above your name. Thank you.

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

FOR OFFICIAL USE ONLY

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

SAMPLE OUTLINE TRAFFIC MANAGEMENT PLAN

A. Principles for Traffic Management Plan 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 A6.2 to Figure A6.12**illustrates the operating policy for TMP for the construction of water pipes and the sewers along various types of roads.

C. Analyze the Impact Due to Street Closure

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

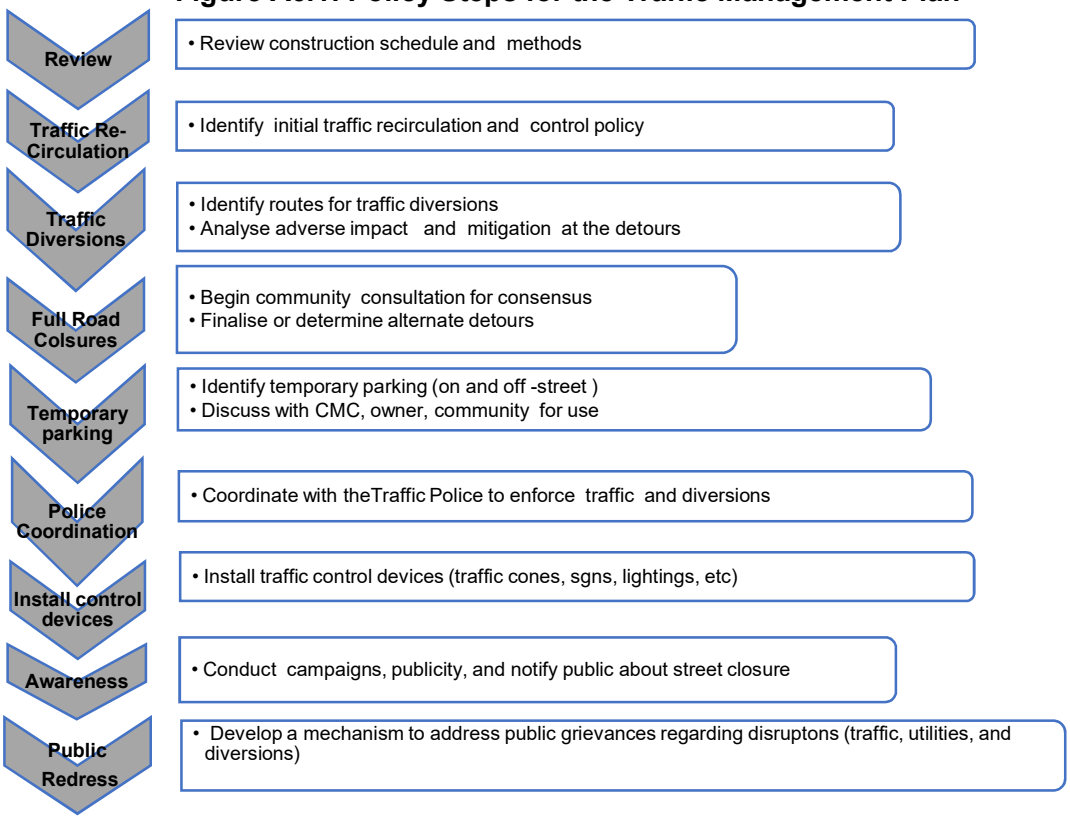
(i) approval from the ULB/Public Works Department (PWD) to use the local streets as detours;
(ii) consultation with businesses, community members, traffic police, PWD, etc., regarding the mitigation measures necessary at the detours where the road is diverted during the construction;
(iii) determining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

(vi) contacting emergency service, school officials, and transit authorities to determine if there are impacts to their operations; and

(vii) developing a notification program to the public so that the closure is not a surprise. As part of this program, the public should be advised of alternate routes that commuters can take or will have to take as result of the traffic diversion.

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

Figure A6.1: Policy Steps for the Traffic Management Plan



D. Public awareness and notifications

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

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

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

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

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

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

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

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

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

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

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

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

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

12. **Figure A6.2 to Figure A6.6** illustrates a typical set-up for installing traffic control devices at the work zone of the area, depending on the location of work on the road way, and road geometrics:

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

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

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

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

Figure A6.2 and A6.3: Work on Shoulder or Parking Lane and Shoulder or Parking Lane Closed on Divided Road

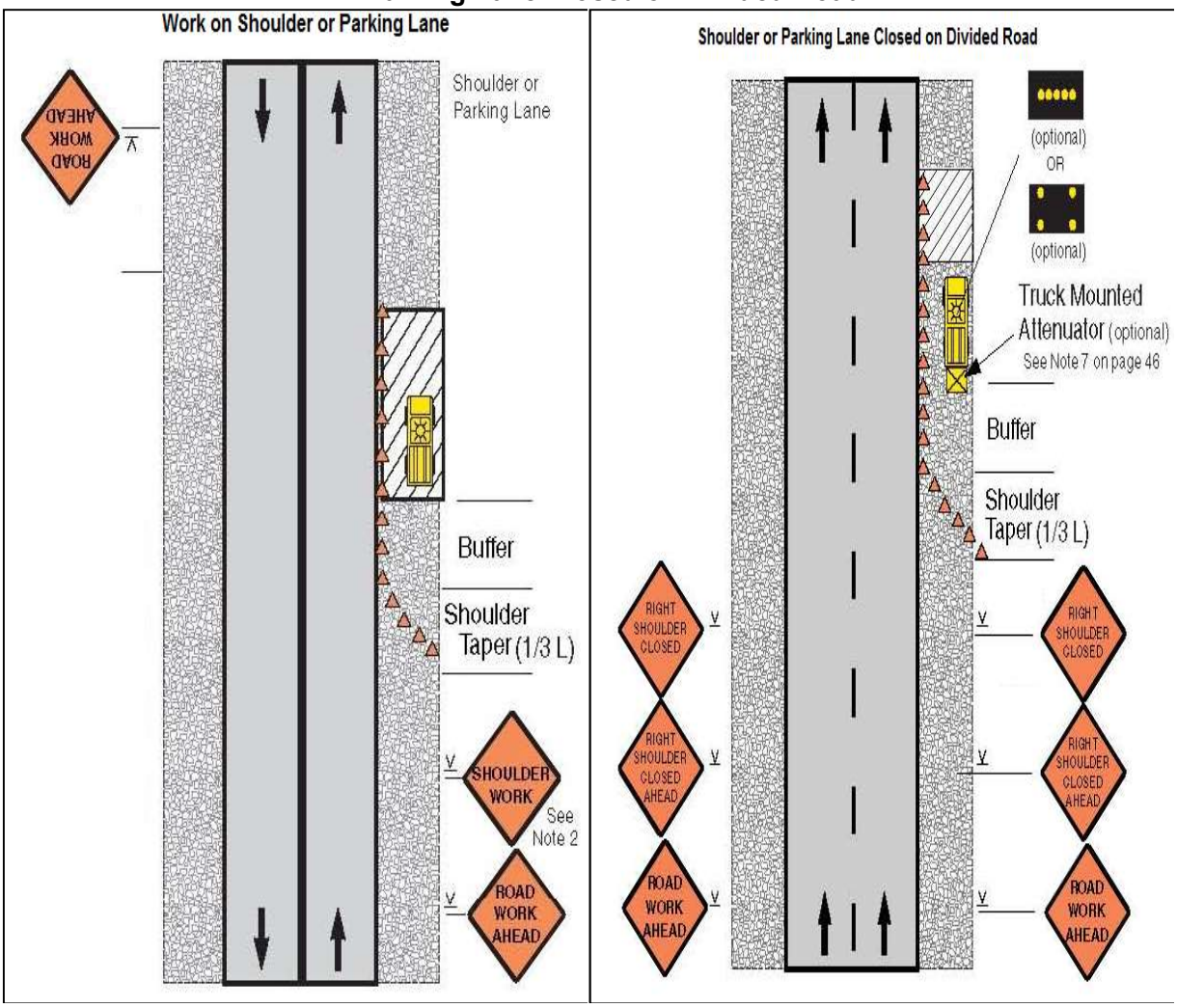


Figure A6.4 and A6.5: Work in Travel Lane and Lane Closure on Road with Low Volume

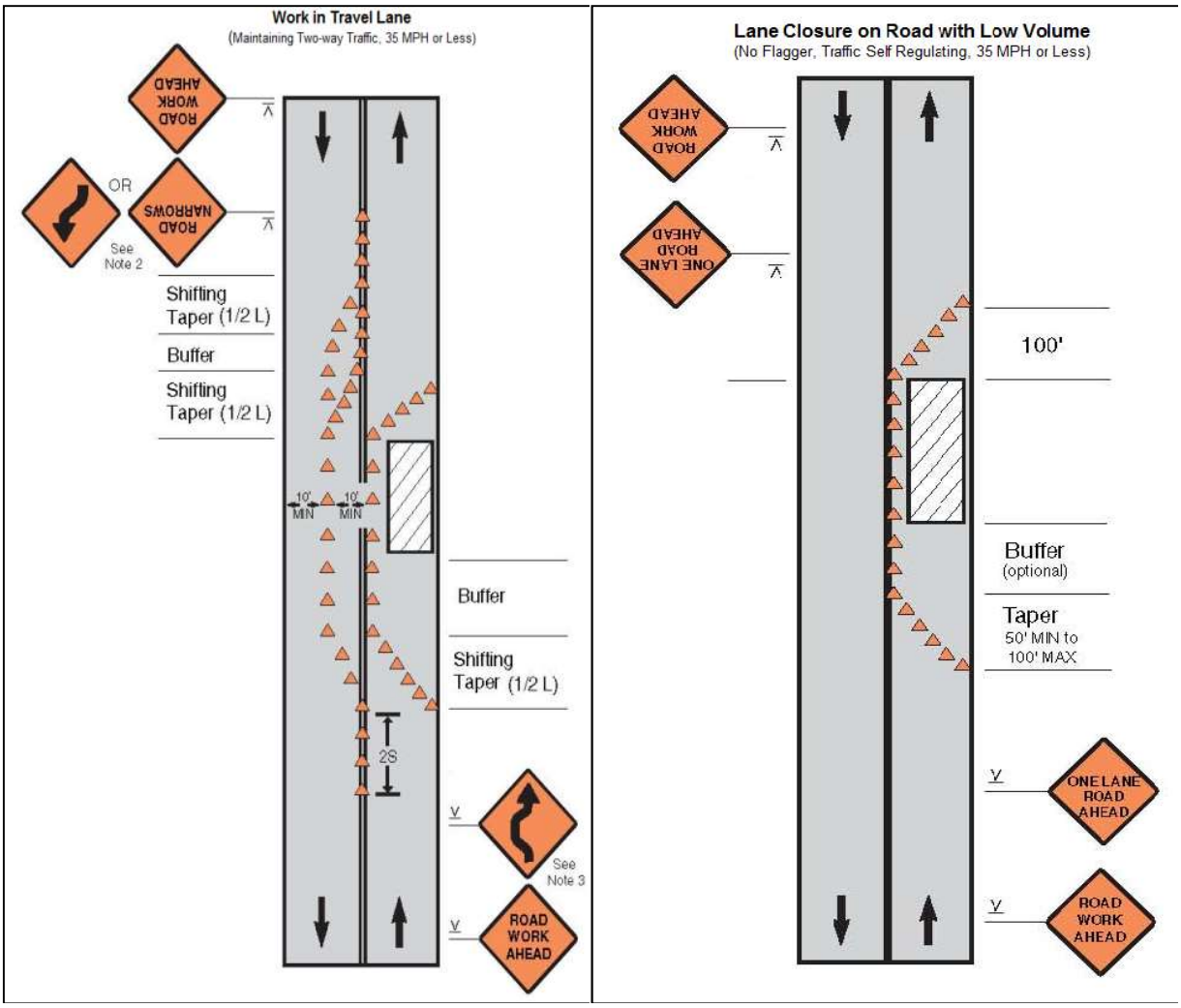
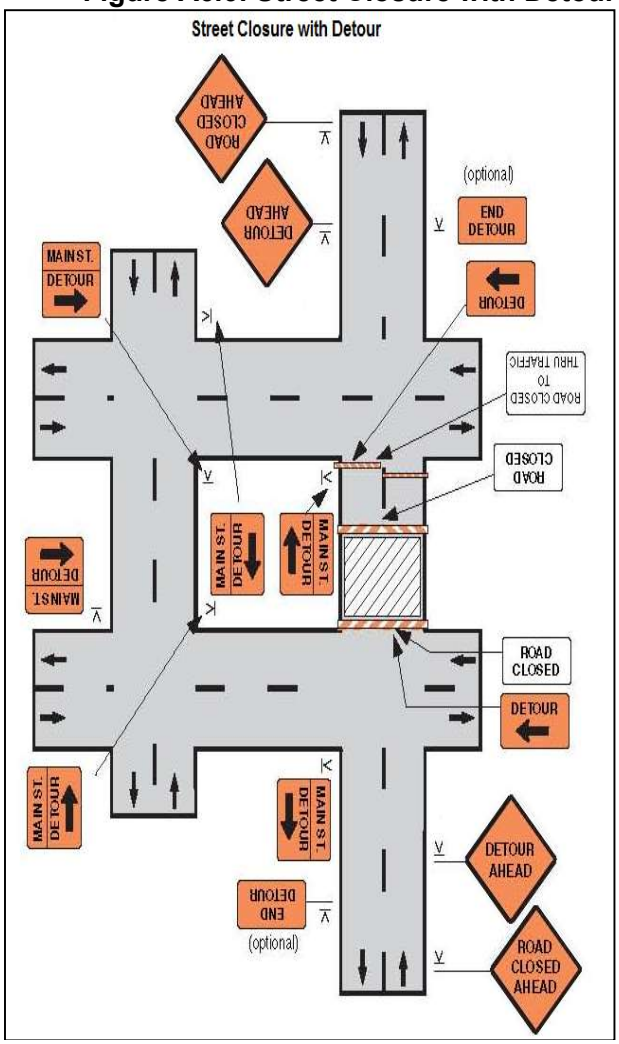


Figure A6.6: Street Closure with Detour



SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name
Contract Number

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

WEATHER:

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

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

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

Signature

_____

Sign off

_____	_____
Name	**Name**
Position	**Position**

SAMPLE SEMI-ANNUAL ENVIRONMENTAL MONITORING REPORT TEMPLATE

I. Introduction

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

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

- Overall project and 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)[a]	Contract Status (specify if under bidding or contract awarded)	If On-going Construction	
				%Physical Progress	Expected Completion Date

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

Compliance status with National/State/Local statutory environmental requirements[17]

[17] All statutory clearance/s, no-objection certificates, permit/s, etc. should be obtained prior to award of contract/s. Attach as appendix all clearance obtained during the reporting period. If already reported, specify in the "remarks" column.

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

[a]Specify (environmental clearance? Permit/consent to establish? Forest clearance? Etc.)
[b]Specify if obtained, submitted and awaiting approval, application not yet submitted
[c]Example: Environmental Clearance requires ambient air quality monitoring, Forest Clearance/Tree-cutting Permit requires 2 trees for every tree, etc.

II. Compliance Status with Environmental Loan Covenants

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

III. Compliance status with the environmental management Plan (Refer to EMP Tables In Approved IEE/S)

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

Package-wise Implementation Status

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

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

- Include as appendix all supporting documents including **signed** monthly environmental site inspection reports prepared by consultants and/or contractors.
- With reference to approved EMP/site-specific EMP/construction EMP, complete the table below
- Provide the monitoring results as per the parameters outlined in the approved EMP (or site-specific EMP/construction EMP when applicable).
- In addition to the table on EMP implementation, the main text of the report should discuss in details the following items:

  (i) **Grievance Redress Mechanism.** Provide information on establishment of grievance redress mechanism and capacity of grievance redress committee to address project-related issues/complaints. Include as appendix Notification of the GRM (town-wise if applicable).

  (ii) **Complaints Received during the Reporting Period.** Provide information on number, nature, and resolution of complaints received during reporting period. Attach records as per GRM in the approved IEE. Identify safeguards team member/s involved in the GRM process. Attach minutes of meetings (ensure English translation is provided).

    - Confirm if any dust was noted to escape the site boundaries and identify dust suppression techniques followed for site/s.
    - Identify muddy water was escaping site boundaries or muddy tracks were seen on adjacent roads.
    - Identify type of erosion and sediment control measures installed on site/s, condition of erosion and sediment control measures including if these were intact following heavy rain;
    - Identify designated areas for concrete works, chemical storage, construction materials, and refueling. Attach photographs of each area.
    - Confirm spill kits on site and site procedure for handling emergencies.
    - Identify any chemical stored on site and provide information on storage condition. Attach photograph.
    - Describe management of stockpiles (construction materials, excavated soils, spoils, etc.). Provide photographs.
    - Describe management of solid and liquid wastes on-site (quantity generated, transport, storage and disposal). Provide photographs.
    - Provide information on barricades, signages, and on-site boards. Provide photographs.
    - Provide information on
    - Checking if there are any activities being under taken out of working hours and how that is being managed.

Summary of Environmental Monitoring Activities (for the Reporting Period)[a]

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

[a]Attach Laboratory Results and Sampling Map/Locations.

Overall Compliance with CEMP/ EMP

No.	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

IV. Approach and methodology for environmental monitoring of the project

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

V. Monitoring of environmental Impacts on Project Surroundings(ambient air, water quality and noise levels)

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

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

Air Quality Results

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

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

Water Quality Results

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

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

Noise Quality Results

Site No.	Date of Testing	Site Location	LA_{eq} (dBA) (Government Standard)	
			Day Time	Night Time

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

VI. SUMMARY OF KEY ISSUES AND REMEDIAL ACTIONS

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

VII. APPENDIXES

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

SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name
Contract Number

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

WEATHER CONDITION:_____

INITIAL SITE CONDITION: _____

CONCLUDING SITE CONDITION:

Satisfactory _____ Unsatisfactory _____ Incident _____ Resolved _____ Unresolved _____

INCIDENT:
Nature of incident: _____
Intervention Steps:_____

Incident Issues

Resolution

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

Inspection

Emissions	Waste Minimization
Air Quality	Reuse and Recycling
Noise pollution	Dust and Litter Control
Hazardous Substances	Trees and Vegetation

Site Restored to Original Condition Yes ☐ No ☐

Signature
_____

Sign off

Name _____ **Name**
Position_____ **Position**

STAKEHOLDER CONSULTATION

Minutes of the Public Consultation Conducted on 02.02.18 at PSK RukmaniammalMahal, (Gandhi KalaiMandram) for the Proposed Underground Sewerage Scheme in Rajapalayam Municipality by Tamil Nadu Water Supply and Drainage Board and Rajapalayam Municipality

1. The Public Consultation commenced at 4.00 PM with officials from TWAD Board, Rajapalayam Municipality (RM) office bears. The public/residents of the area and the residential association members were present at the meeting based on prior public notice given in newspapers about the details of the public consultation. The list of participants and residents participated in public opinion hearing meeting is as entered in the attendance register.

2. Officials of TWAD andRM welcomed the gathering and outlined the procedure for Public Consultation. They described that the TWAD Board &RM have proposed to develop the Under Ground Sewerage Scheme for Rajapalayam Municipality. They requested the gathered public to express their views and opinions. This was followed by description of the project in detail. The summary of the project details was also circulated to the gathering.

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

4. The proposed UGSS will consist of 3 pumping stations, 4 lifting stations and a STP at Puthupalyam Village. The project area is divided into 3 Zones for better implementation. The sewer network will cover all the streets in the Municipality (Wards 1-42). The proposed project will collect the sewage from residential, commercial and institutional areas. The sewage will be pumped to Sewage Treatment Plant at Puthupalayam for treatment and disposal. The STP will be executed on DBOOT (design, build, own, operate and transfer) basis and the process will provide the treated waste water in line with the discharge standards prescribed by Tamil Nadu Pollution Control Board (TNPCB). After treatment, the treated sewage will be used for agricultural purposes. The proposal will prevent pollution of the natural water bodies present in the area, due to discharge of sewage.

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

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

S. No.	The Views and Questions of the Public/Stakeholders	Clarification Given by the Officials of TWADB/RM
1.	The proposed location of the 3 pumping stations.	The pumping stations are proposed in Indhranagar, North Andalpuram, NorthAvarampatti.
2.	Time period of the project i.e., start and end time of the project	The project will be started after the tender process i.e., about six months from today.
3.	Questioned about whether there will be any impact to the surrounding peoples in the Indhra Nagar because of proposed main pumping station.	The Main Pumping station will be placed beyond the residential units and the proper green belt will be provided in the pumping station so that there will not be any impact to peoples in this locality.

4.	About the project cost and the implementation of project whether increase in the taxes of the households in the project area.	The individual households will have to pay taxes for the sewerage connection as like that of water connection. Also, the tax payment will be calculated based on the type and built-up area of houses.
5.	About the sizes of the pipes used and durability of the pipes.	The sizes of pipes are calculated based on the ultimate period population calculated for 2050. Thus there will not be any resizing of pipes required until the year 2050.
6.	About the implementation schedule of the project proposal	The construction and trial run for the project proposal will be about 3 years.
7.	During implementation whether the connections to the household will be given based on type of houses i.e., only for R.C. houses or on what basis.	The connections will be given to all households in the proposed project area. Only the amount taxed will vary based on the type or built-up area of the house
8.	Whether Under Ground Sewerage Scheme and Storm Water drain are the same.	UGSS will collect only sewage and the storm water will be collected in separate open drain that will be connected to the water bodies.
12.	Whether the proposal will collect grey water and black water	The scheme will collect both the grey and black water from the residential, commercial and institutional areas in the project area
13.	Proposed pumping station will have any odor problems in the vicinity of the area.	There will not be any odor problem as the pumping stations are proposed with development of greenbelt around the periphery. In addition the pumping stations will be fitted with odor control devices, if necessary.
14.	Implementation of project schedule.	The current proposal of UGSS will be available to the public within 3 years of time.
16.	If any discontinuity in the project proposal which will contribute disturbances to the public where should we contact. Kindly give the authorized person's name, designation and address.	Project specific grievance redress mechanism (GRM) is being established to receive and address the comments in timely manner. The concerned authority for this project proposal is the Rajapalayam City Municipal Corporation and it is requested to contact RM officials in their locality directly if there are any disturbances to the public/residents. If no action taken then they can contact the Regional Offices of RM.
18.	Need clarification about any deposit needed for sewerage connection or taxes to be paid.	The deposit and the taxes will be calculated based on type and built-up area of the project. Also, the deposit and taxes will be based on the bye-law passed by Government of Tamil Nadu.
19.	On What basis chambers will be laid and Distance between the chambers	The chambers will be laid at 30 m interval for easy inspection purpose.
20.	Pipe quality and diameter of the pipes	The pipes will be laid based on IS standard so that the durability of pipes will be ensured. The diameter will be vary based on the quantity calculated.
21.	Whether household connections will be given on any priority bases	No priority bases
22.	There are many vacant sites in our locality and this proposal will work if the sites are constructed with residential units.	We will provide temporary facilities for collection of sewage so that there will not be any problems in your locality.

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

Brief Summary of the Project Details Circulated to the Stakeholders/Public

விருதுநகர் மாவட்டத்திலுள்ள இராஜபாளையம் நகராட்சி பாதாள சாக்கடை திட்டம்

விருதுநகர் மாவட்டத்தில் அமைந்துள்ள இராஜபாளையம் நகராட்சி பெரு நகராட்சியாகும். இராஜபாளையம் தாலுகாவின் தலைமையிடமாகவும் உள்ளது. இராஜபாளையம் நகராட்சி மதுரை-தென்காசி தேசீய நெடுஞ்சாலையில் மதுரையிலிருந்து 85 கி.மீ தொலைவில் அமைந்துள்ளது. இராஜபாளையம் நகராட்சிக்கு பாதாள சாக்கடை திட்டம் அரசாணை எண்.5/நாள் 22.01.2018-ன் பிரகாரம் அம்ரூத் 2017-20 திட்டத்தின்கீழ் ரூ.246.99 கோடி மதிப்பீட்டில் செயல்படுத்த திட்டமிடப்பட்டு ஒப்புதல் வழங்கப்பட்டுள்ளது.

இராஜபாளையம் நகராட்சி 42 வார்டுகளை கொண்டதாகும். நகராட்சியின் மக்கள் தொகை 155000 (2020) இடைநிலை 1,90000 (2035) மற்றும் 2050-ம் ஆண்டில் எதிர்நோக்கும் மக்கள் தொகை 2,20,000 என கணக்கிடப்பட்டு இத்திட்டம் தயாரிக்கப்பட்டுள்ளது. இந்த திட்டத்திற்காக நகராட்சி முழுமையும் மூன்று மண்டலங்களாக பிரிக்கப்பட்டுள்ளது. மூன்று மண்டலங்களிலும் தனித் தனியாக கழிவு நீரேற்றும் நிலையம் அதாவது, ஆவரம்பட்டி, இந்திரா நகர் மற்றும் ஆண்டாள்புரம் பகுதியில் அமைக்கப்பட உள்ளது.

இராஜபாளையம் பாதாள சாக்கடை திட்டத்தில் கழிவு நீர் சேகரிப்பு மற்றும் கழிவு நீர் உந்து குழாய்கள் 176.04 கி.மீ நீளத்திற்கும், கழிவு நீர் நீரேற்றும் நிலையங்கள் மூன்று எண்ணங்களும், சிறிய கழிவு நீர் உந்து ஆள் நுழைவு குழிகள் - நான்கு எண்ணங்களும் மற்றும் 21.85 MLD கொள்ளளவு கொண்ட கழிவு நீர் சுத்திகரிப்பு நிலையமும் அமைக்கவும் திட்டமிடப்பட்டுள்ளது.

மண்டலம் 2-ல் அடங்கிய வார்டு 20, 21 (பகுதி) 22 முதல் 26 மற்றும் 29 முதல் 40 வரையிலான பகுதிகளிலிருந்து வரும் கழிவு நீர், பள்ளமான பகுதியான திருவனந்தபுரம் தெருவில் அமைக்கப்படவுள்ள கழிவு நீர் உந்து ஆள் நுழைவு குழிகளின் (Lift Manholes) வழியாக உந்தப்பட்டு கழிவு நீர் குழாய்கள் மூலமாகவும், மேடான பகுதிகளிலிருந்து தன்னோட்ட கழிவு நீர் குழாய்கள் மூலமாகவும் கொண்டு சென்று, இந்திரா நகர் பகுதியில் அமையவுள்ள நீரேற்று கழிவு நிலையத்தில் சேர்க்கப்படும்.

பின் கழிவு நீர் இங்கிருந்து உந்தப்பட்டு, மண்டலம்-1 ஆவரம்பட்டி பகுதியில் அமையவுள்ள கழிவு நீர் நீரேற்று நிலையத்தில் கொண்டு சேர்க்கப்படும்.

மேலும், மண்டலம்-1 ஆவரம்பட்டியில் அடங்கிய வார்டுகள் 1 முதல் 19 வரையும் மற்றும் 21 (பகுதி) வார்டுகளிலிருந்து வரும் கழிவு நீர், பள்ளமான பகுதிகளான கொத்தன்குளம், சமந்தாபுரம் மற்றும் சந்தூரணியில் அமைக்கப்படவுள்ள கழிவு நீர் உந்து ஆள் நுழைவு குழிகளின் (Lift Manholes) வழியாக உந்தப்பட்டும், மேடான பகுதிகளிலிருந்து வரும் கழிவு நீர் தன்னோட்ட கழிவு நீர் குழாய்கள் (Gravity Pipe) மூலமாகவும் ஆவரம்பட்டி கழிவு நீர் நீரேற்று நிலையத்தில் கூடுதலாக சேகரிக்கப்படவுள்ளது. பின் கழிவு நீர் உந்தம் செய்யப்பட்டு கழிவு நீர் குழாய்கள் மூலம் புதுப்பாளையத்தில் அமைக்கப்படவுள்ள கழிவு நீர் சுத்திகரிப்பு நிலையத்தில் (Sewage Treatment Plant) சேர்க்கப்படும்.

மணடலம் 3-ல் வார்டு 21 (பகுதி), 27, 28 (பகுதி), 41 மற்றும் 42 அடங்கும். இப்பகுதிகளிலிருந்து வரும் கழிவு நீர் தன்னோட்ட கழிவு நீர் குழாய்கள் (Gravity Pipe) மூலம் ஆண்டாள்புரம் பகுதியில் அமைக்கப்படவுள்ள கழிவு நீர் நீரேற்று நிலையத்தில் சேர்க்கப்படும். பின்னர் கழிவு நீர் உந்தம் செய்யப்பட்டு கழிவு நீர் உந்து குழாய்கள் மூலம் புதுப்பாளைய கழிவு நீர் சுத்திகரிப்பு நிலையத்தில் சேர்க்கப்படும்.

புதுப்பாளையத்தில் அமைக்கப்படவுள்ள கழிவு நீர் சுத்திகரிப்பு நிலையத்தில் கழிவு நீர் சுத்தம் செய்யப்பட்டு, தன்னோட்ட கழிவு நீர் குழாய்கள் மூலமாக கொத்தன்குளம் பகுதியில் அமைந்துள்ள பொதுப்பணித்துறை குளத்தில் சேர்க்கப்படும்.

இத்திட்டம் முடிவுற்றதும் இராஜபாளையம் நகராட்சியில் உள்ள குளங்கள், ஏரிகள், நிலங்கள் அசுத்தம் அடையாமல் பாதுகாப்பாகவும், நகராட்சி தூய்மையாகவும் அமையும். இத்திட்டத்தின்மூலம் 1,55,000 மக்கள் பயன்பெறுவர். இத்திட்டத்திற்கான திட்ட மதிப்பீடு ரூ.246.99 கோடியாகும். இத்திட்டம் மத்திய நிதி உதவி திட்டமான அம்ரூத் நிதி உதவியுடன் செயல்படுத்தப்படும்.

Photographs of Public Consultation Rajapalayam Municipality on 02.02.2018 For Proposed Underground Sewage System in Rajapalyam Municipality

Photographs of Public Consultation Rajapalayam Municipality on 02.02.08 for Proposed UGSS in Rajapalyam Municipality

Photographs of Public Consultation Rajapalayam Municipality on 02.02.08 for Proposed UGSS in Rajapalyam Municipality

News Paper Advertisement

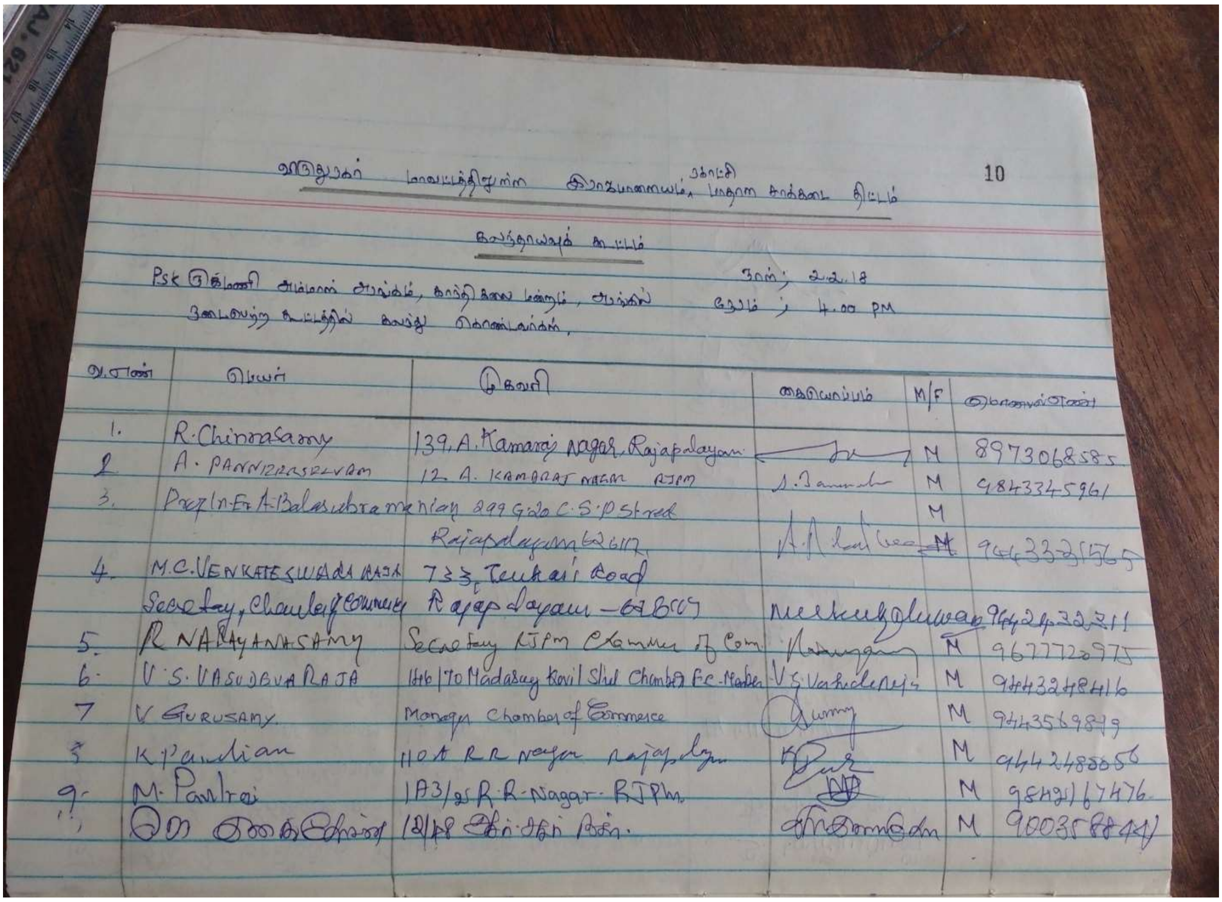
சார் நேற்று இரவு ரோந்து

ராஜபாளையத்தில் பாதாள சாக்கடை திட்டம் குறித்து கலந்தாய்வு கூட்டம்!

ராஜபாளையம், பிப். 2– ராஜபாளையத்தில் இன்று பிற்பகல் 4 மணியளவில் காந்தி கலைமன்றம் பி.எஸ்.கே. ருக்மணியம்மாள் அம்மாள் அரங்கத்தில் வைத்து அம்ருத் திட்டம் 2017–20–க்கீழ் பாதாளசாக்கடை திட்டம் அமல்படுத்த அரசாணை வழங்கப்பட்டுள்ளது. இதன் முக்கிய அம்சங்கள் குறித்து நகராட்சி மற்றும் குடிநீர் வடிகால் வாரியம் சார்பாக நடத்தப்படுகிறது.

இதில் பொதுமக்கள் கலந்துகொண்டு தங்களது கருத்துக்களை தெரிவிக்கலாம் என்று நகராட்சி ஆணையாளர் சசிகலா வெளியிட்டுள்ள செய்திக்குறிப்பில் அறிவித்துள்ளார்.

Attendance Particulars



10

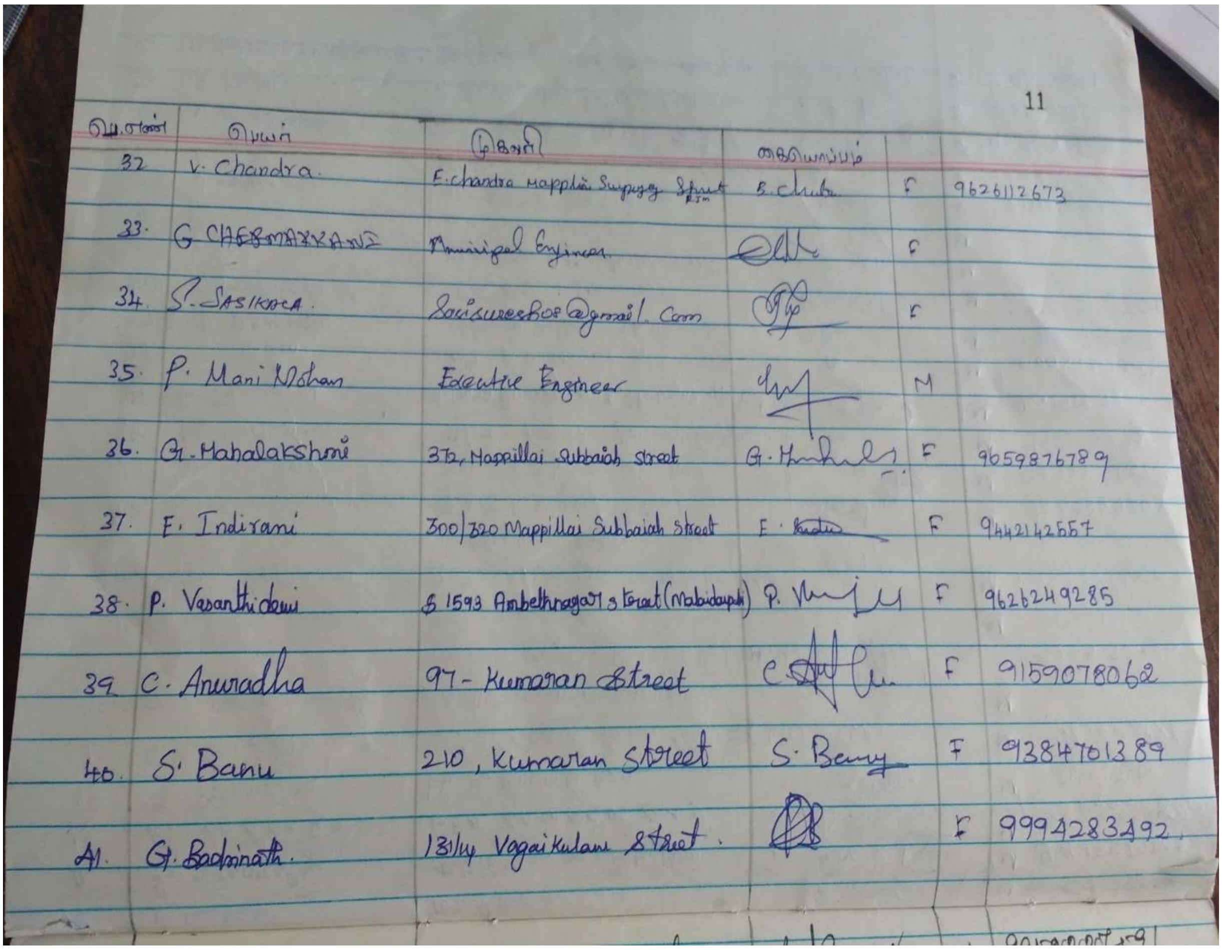
கலந்தாய்வுக் கூட்டம்

நாள்; 2.2.18

நேரம் ; 4.00 PM

வ.எண்	பெயர்	முகவரி	கையொப்பம்	M/F	தொலைபேசி எண்
1.	R. Chinnasamy	139, A. Kamaraj Nagar, Rajapalayam	[illegible]	M	8973068585
2	A. PANNIRSELVAM	12. A. KAMARAJ NAGAR RJPM	[illegible]	M	9843345961
3.	Prof (n.Er) A. Balasubramanian	299 G20 C.S.P Street Rajapalayam 626117	[illegible]	M	9443325565
4.	M.C. VENKATESWARA RAJA Secretary, Chamber of Commerce	733, Tenkasi Road Rajapalayam - 626117	[illegible]		9442422211
5.	R NARAYANASAMY	Secretary RJPM Chamber of Com	[illegible]	M	9677720975
6.	V.S. VASUDEVARAJA	146/70 Madasamy Kovil Street Chamber EC-Member	V.S. Vasudevaraja	M	9443248416
7	V GURUSAMY	Manager Chamber of Commerce	[illegible]	M	9443569879
8	K Pandian	110A R R Nagar Rajapalayam	[illegible]	M	9442488056
9.	M. Pandi	1A3/25 R.R. Nagar. RJPM	[illegible]	M	9842167476
10	[illegible]	[illegible]	[illegible]	M	9003588441

10	[illegible]	107. R.R. [illegible]			
11	S. [illegible]	42/3/16. [illegible] R.R. [illegible]	[illegible]	M	[illegible]
12	R. [illegible]	63A [illegible]	[illegible]	M	[illegible]44356[illegible]
13	T. Selvarajan	64-B, [illegible]	[illegible]	M	9362220820
14	[illegible]	279- [illegible] RJPM F.B FRIENDS	Selvaa	M	9843522560
15.	[illegible]	3A [illegible]	[illegible]	M	9865627376
		[illegible] - RJPM F.B. Friends	[illegible]		9245153426
16	M.S. [illegible] Kumar	14/2 [illegible] F.B [illegible]	[illegible]	M	8778618180
17	[illegible]	207, [illegible] MKS [illegible]	[illegible]	M	94431-10603
18	S. PERUMALSAMY.	89-A. R.R. Nagar, 4th Street	[illegible]	M	9442840245
19	V. VELRAJ	96/1 R.R. Nagar 4th street	[illegible]	M	9842236567
20	M. Sathakar	9/17 North [illegible]	[illegible]	M	9942238930
21	B. Thangaiah	94/1429 Ram nagar North, [illegible] Road.	[illegible]	M	9442959593.
22	A. mani	47. R.R. Nagar 9th street	[illegible]	M	9095220253
23	D. RAMESH	16/7. R.R. Nagar 3th Street	D. Ramesh	M	94429-56078
24	K[illegible]	82, [illegible]	K[illegible]	M	8754278771
25	K. Kali	12A INTUC [illegible]	[illegible]	M	
26.	R. Kumar	4A INTUC [illegible] RJPM	R. Kumar	M	9894390304
27.	V. Kirthavani	185 Bharathi nagar RJPM	V. Kirthavani	F	9788864967
28	K. Jothi	281, Housing Board, Bharathinagar. Rajapalayam	[illegible]	F	7339242675
29	V. vijayalakshmi	332, [illegible] Subbaiah St, Rajapalayam	V. vijay[illegible].	F	9486537822
30	R. Kavitha	A. 341, Singa Raja Kottai St. Rajapalayam	R. [illegible]	F	9843449380
31.	M. SUMANGALI PORGURU DEVI	93J Singaraja kottai periya [illegible] Rpm	M. S. P. [illegible]	F	7094198001


11

வ.எண்	பெயர்	முகவரி	கையொப்பம்		
32	V. Chandra.	E. Chandra Mappillai Subbaiah Street	E. Chandra	F	9626112673
33.	G. CHEBMAXXANI	Municipal Engineer	[illegible]	F	
34.	S. SASIKALA.	Sasisuresh08@gmail.com	[illegible]	F	
35.	P. Mani Mohan	Executive Engineer	[illegible]	M	
36.	G. Mahalakshmi	372, Mappillai Subbaiah street	G. Mahalakshmi	F	9659876789
37.	E. Indirani	300/320 Mappillai Subbaiah street	E. [illegible]	F	9442142557
38.	P. Vasanthidevi	8 1593 Ambethnagar street (Nabidaspet)	P. Vasanthi	F	9626249285
39	C. Anuradha	97 - Kumaran Street	C. [illegible]	F	9159078062
40.	S. Banu	210, Kumaran street	S. Banu	F	9384701389
41.	G. Badrinath.	131/4 Vagaikulam Street.	[illegible]	F	9994283492.

42	K. Palanichamy	S.I. Rajapalayam M'ply	[signature]	M	9952227591
43	M. Rathna	201 C Thiruvalluvar St	M. Rat	M	9842226496
44	A. Radhakrishnan	30/132, Madasamy Koil St.	A. Radhakrishnan	M	99421 38838
45	M. AROCKIARAJ.	201/ South malaiyadi patti	[signature]	M	9789215047.
46	G. Alagarsamy	228A Periya Sivakasi Patti Street	G. Alag	M	9480902020
47	M. Durai	17, Subbasamy Koil St	K. Durai	M	
48	G. RAMACHANDRAN	TB MUNICIPAL OFFICE	[signature]	M	9842660170
49	P.S. Madasamy	Survey Supervisor R.M.C	P.S. [signature]	M	9443427323
50	C. Murugan.	J.V.O. RMC	C. [signature]	M	9994660048
51	P. Elango	S.I. RJPM Municipal.	P. [signature]	M	9442419286.
52	I.B.R. Ragupathi Raja	86, Singaraja Kottai Big Street	[signature]	M	8122175530

Consultation during Construction Stage

Awareness and Discussion Campaign to Public Regarding Controlled Blasting: 18 and 20 July 2020

UGSS to Rajapalayam Municipality Package I Collection System Works are under Progress. During execution, in some of the places hard Rock strata is identified. For laying sewer pipeline in these areas, the hard rocks must be removed to the required depth for supporting gravitational flow. In these Identified areas the excavation of hard Rocks can be done by controlled blasting mechanism. Nine areas/ locations have been identified as hard rock areas i.e. Pachamadam Road, PSK Nagar, RR Nagar, Vettaiperumalkovil Road, Sudharsan Garden Extension, Malaiyadipatti Road, Sankarankovil road, Chatrapatti Road and Tenkasi Road. The main idea of this Awareness Program is to clear the Views on controlled blasting to public and also to explain the safety and Precautionary measures which are taken during Control blasting for the Removal of Hard Rocks. The District Collector, Virudhunagar has given Prior Permission to Carrying out Control Blasting for removal of hard rocks. During control Blasting the following safety and precautionary arrangements are to be followed.

- Proper prior notice will be issued to the Residents in the Vicinity of the blasting area before commencing the blasting activity
- Proper Information will also be given to police officials before the Blasting Activity
- During Controlled Blasting, flagman will be placed at both end of corresponding road to block the road and to give caution to Public
- Minimum Explosive will be used for Controlled blasting for residential area by licensed Explosive contractor
- Trenches will be Properly Covered with Sand bag and the top surface level will be Covered with MS Steel Sheets
- Above the MS steel sheet layer, a layer of shade net is Covered to prevent the movement of dust from the Blasting area.
- Before Commencing of Controlled Blasting Works, it will be informed around to the Residents about the activity of works through Mic.
- Signages will be placed around the site with Visible Warning boards and indicating the start and completion of the blasting.

These safety measures were explained in a detailed manner to the Public in the nine Identified areas of the blasting activity.

Questions raised By Public during Controlled Blasting Awareness Program:

1.) Will Stones or rock fragments fall inside the nearby Residences during the controlled blasting activity??
No, as the entire blasting Surface is loaded with Sand bags and covered with MS steel sheet, does not happen

2.) Will the controlled blasting activity cause any cracks in the nearby buildings/residences??
No, the controlled blasting activity is carried out with minimum explosives, so no cracks will be formed in any nearby buildings

3.) Will the controlled blasting activity cause excessive vibration??
No, the controlled blasting activity is carried out with minimum explosives and loaded with sand bags and covered with MS sheets, so very less vibration will be produced.

4.) Will the controlled blasting activity lead to dust emissions and spread of dust??
No, the top Surface level of the blasting area is Covered with MS steel sheet and shade nets and thus this will prevent the produce of dust.

<table>
<tr><td> 

Issue of Prior Notice to the Public in the nearby Blasting area</td><td> 
இராஜபாளையம் நகராட்சி
பாதாளசாக்கடை திட்டம் (அம்ருத்)
அன்புடையீர்!
இராஜபாளையம் நகராட்சியில் பாதாளசாக்கடை திட்டப் பணிகள் நடைபெற்றுவருகிறது. அதன் ஒருபகுதியாக பாதாளசாக்கடை பிரதான குழாய்கள் மற்றும் வீட்டிணைப்பு குழாய் பதிக்கும் பணிகள் நடைபெற்று வருகின்றது. இதில் மண்தோண்டும் பணியின்போது கடினமான பாறைகள் வருவதால் அதனை அகற்றுவதற்கு விருதுநகர் மாவட்ட ஆட்சித் தலைவர் அவர்களால் பாதுகாக்கப்பட்ட கண்ட்ரோல் பிளாஸ்டிங் (Control Blasting) செய்வதற்கு ஆணை வழங்கப்பட்டுள்ளது மேலும் ஆணையின் வழிகாட்டலின்படி பணியினை மேற்கொள்வதற்கு தங்களது முழு ஒத்துழைப்பை வழங்குமாறு கேட்டுக்கொள்ளப்படுகிறது.
மேலும் தகவல் மற்றும் புகார்களுக்கு,
ஒப்பந்ததாரர் : Eco Protection Engineers Private Limited,
M. MANI - 8754543501, G. RAJA - 7358017650, P. THIRUPATHI - 9003097947
M. VIJAYARAJAN - 9952552063, J. JEIRISH DANIEL - 9486787577, C. KARTHIK - 7010075873
Copy of Notice issued in Local Language</td></tr>
<tr><td colspan="2">Public Awareness and Discussion Campaign Regarding Controlled Blasting</td></tr>
<tr><td> 

PSK Nagar</td><td> 
Malaiyadipatti Road</td></tr>
<tr><td> 
Chatrapatt Road</td><td> 
RR Nagar</td></tr>
</table>

	
Sudharsan Garden Extension	Tenkasi Main Road

Permission for Controlled Blasting
From District Collector, Virudhunagar on12.11.2019

விருதுநகர் மாவட்ட ஆட்சியர் அவர்களின் செயல்முறை ஆணைகள்
முன்னிலை: திரு. அ. சிவஞானம், இ.ஆ.ப.,

ந.க.கேனி1/497/2019 நாள்: 12.11.2019

பொருள்: கனிமம் மற்றும் சுரங்கம் - பாதாள சாக்கடைத் திட்டம் - குடிநீர் வடிகால் வாரியம் - இராஜபாளையம் நகராட்சி பகுதியில் புதிய பாதாள சாக்கடைத் திட்டம் செயல்படுத்த Pumping Station சிப்பம் - I,II,III மற்றும் கழிவுநீர் குழாய்கள் பதிக்க பூமிக்கு அடியில் உள்ள கட்டிடங்களை வெடிமருந்து வைத்து உடைக்க அனுமதி ஆணை வழங்குதல் - தொடர்பாக.

பார்வை: 1. G.O.Ms.No.05/MA&WS Dept (WS2) dated 22.01.2018 for Rs.246.99 Crores.

2. தலைமைப் பொறியாளர், த.கு.வ.வாரியம், மதுரை அவர்களின் வேலை உத்திரவு எண். F.Rajapalayam UGSS – CS/DO II/CW/2018-19/Dt.23.08.2018.

3. தலைமைப் பொறியாளர், த.கு.வ.வாரியம், மதுரை அவர்களின் ஒப்பந்த எண். CER/TWAD/MDU 21/2018-19 dt.10.10.2018 for Rs.189.04 Crores – 3 years.

4. தமிழ்நாடு குடிநீர் வடிகால் வாரிய கடித எண். நி.க. எண்.611/இவ/கோ.இராஜபாளையம்/2019/ நாள்.06.11.2019.

*****

ஆணை :

விருதுநகர் மாவட்டம், இராஜபாளையம் நகராட்சிக்குட்பட்ட பச்சமடம் சாலை, P.S.K. நகர், R.R.நகர், வேட்டை பெருமாள் கோவில் சாலை, சுதர்சன் கார்டன் விரிவாக்கம், மலையடிப்பட்டி சாலை, சங்கரன்கோவில் சாலை, சத்திரப்பட்டி சாலை, தென்காசி சாலை பகுதியில் புதிய பாதாள சாக்கடைத் திட்டம் செயல்படுத்த Pumping Station சிப்பம் - I,II,III மற்றும் கழிவுநீர் குழாய்கள் பதிக்க பூமிக்கு அடியில் உள்ள கட்டிடங்களை கீழ்க்கண்ட வழி முறையில் வெடிமருந்து வைத்து பாதைகள் தகர்க்கப்பட உள்ளதாக பார்வை 4-ல் காணும் கடிதத்தில் கூறப்பட்டுள்ளது.

மேற்படி கடிதத்தில் பாதாள சாக்கடை அமைக்கும் இடங்களில் 3 அடி அகலமும் 20cm அகலமும் உள்ள குழிகள் Driller மூலம் போடப்பட்டு அதில் ½ Jelly மற்றும் 1 Kg அளவுள்ள வெடிமருந்துகள் நிரப்பப்பட்டு அனைத்து குழிகளும் வயரின் மூலம் இணைத்து அதற்கு மேலே மணல் மூடைகள் அடுக்கப்பட்டு பாதுகாப்பு கருதி சுற்றளவு 100M தூரம் அளவிற்கு மக்களை அப்புறப்படுத்தி Controlled blasting பாதுகாப்பான முறையில் கடின பாறைகள் வெடிகள் மூலம் தகர்க்கப்படும் எனவும், பாதாள சாக்கடை அமைக்கப்படும் இடங்கள் மற்றும் அளவுகள் குறித்து பின்வரும் பட்டியலில் குறிப்பிட்டு அனுமதி கோரப்பட்டுள்ளது.

வ.எண்	இடங்கள்	வேடி வைக்கப்படும் இடங்கள் அளவுகள்
1.	பச்சமடம் சாலை.	சுமார் 100மீ நீளம் உள்ள Sewerline ல் 2.5மீ ஆழத்தில் சுமார் 0.5மீ ஆழத்திற்கு கடின பாறைகளை தகர்க்க வேண்டியுள்ளது.
2.	P.S.K நகர்	சுமார் 250மீ நீளம் உள்ள Sewerline ல் 3.0மீ ஆழத்தில் சுமார் 1.0மீ ஆழத்திற்கு கடின பாறைகளை தகர்க்க வேண்டியுள்ளது.
3.	R.R.நகர்	சுமார் 270மீ உள்ள Sewerline ல் 3.0மீ ஆழத்தில் சுமார் 1.0மீ ஆழத்திற்கு கடின பாறைகளை தகர்க்க வேண்டியுள்ளது.
4.	வேட்டை பெருமாள் கோவில் சாலை	சுமார் 410மீ உள்ள Sewerline ல் 4.0மீ ஆழத்தில் சுமார் 1.5மீ ஆழத்திற்கு கடின பாறைகளை தகர்க்க வேண்டியுள்ளது.
5.	சுதர்சன் கார்டன் விரிவாக்கம்	சுமார் 220மீ உள்ள Sewerline ல் 2.5மீ ஆழத்தில் சுமார் 1.5மீ ஆழத்திற்கு கடின பாறைகளை தகர்க்க வேண்டியுள்ளது.
6.	மலையடிப்பட்டி சாலை	சுமார் 520மீ உள்ள Sewerline ல் 3.0மீ ஆழத்தில் சுமார் 1.0மீ ஆழத்திற்கு கடின பாறைகளை தகர்க்க வேண்டியுள்ளது.
7.	சங்கரன்கோவில் சாலை.	சுமார் 410மீ உள்ள Sewerline ல் 3.0மீ ஆழத்தில் சுமார் 1.0மீ ஆழத்திற்கு கடின பாறைகளை தகர்க்க வேண்டியுள்ளது.
8.	சத்திரப்பட்டி சாலை.	சுமார் 1000மீ உள்ள Sewerline ல் 6.0மீ ஆழத்தில் சுமார் 1.5மீ ஆழத்திற்கு கடின பாறைகளை தகர்க்க வேண்டியுள்ளது.
9.	தென்காசி சாலை.	சுமார் 520மீ உள்ள Sewerline ல் 3.5மீ ஆழத்தில் சுமார் 1.0மீ ஆழத்திற்கு கடின பாறைகளை தகர்க்க வேண்டியுள்ளது.

மேலும் ஒப்பந்தகாரர் M/s. SRI SELVA GANAPATHY MURUGAN EXPLOSIVES (Occupier: R.SELVAKUMARAN), திருநெல்வேலி எனபவர் மூலம் மேற்கண்ட இடங்களில் கடின பாறைகள் உடைத்து கொள்வதற்கு 31.07.2020 வரை அனுமதி கோரி பார்வை 4-ல் காணும் குடிநீர் வடிகால் வாரிய நிர்வாகப் பொறியாளர் கடிதத்தில் கேட்டுக் கொள்ளப்பட்டுள்ளது.

நிபந்தனைகள்:

1. பாறையை வெடிக்க வைக்க சரியான Shortsite மற்றும் அனுமதி வைத்திருப்பவருடன் குறைந்த அழுத்த திறன் கொண்ட வெடி பொருட்களை கையாண்டு பாறைகளை உடைக்க வேண்டும்.
2. வெடி வைப்பிற்கு முன் வெடி வைப்பு நடவடிக்கை குறித்து சரியான எச்சரிக்கை அனைவருக்கும் வழங்கப்பட வேண்டும்.
3. மேற்படி வெடி வைத்து அகற்றப்பட்ட கடினமான பாறைகளை எந்த வணிக நோக்கத்திற்காகவும் பயன்படுத்தப்படக்கூடாது.

மேற்படி இராஜபாளையம் நகராட்சிக்குட்பட்ட பச்சமடம் சாலை, P.S.K நகர், R.R.நகர், வேட்டை பெருமாள் கோவில் சாலை, சுதர்சன் கார்டன் விரிவாக்கம், மலையடிப்பட்டி சாலை, சங்கரன்கோவில் சாலை, சத்திரப்பட்டி சாலை, தென்காசி சாலை ஆகிய பகுதிகளில் புதிய பாதாள சாக்கடைத் திட்டம் செயல்படுத்த Pumping Station சியம் - I,II,III மற்றும் கழிவுநீர் குழாய்கள் பதிக்க கடின பாறைகளை வெடி மருந்து வைத்து உடைப்பதற்கு ஒப்பந்ததாரர் M/s. SRI SELVA GANAPATHY MURUGAN EXPLOSIVES (Occupier: R.SELVAKUMARAN), திருநெல்வேலி மாவட்டம் என்பவருக்கு நடவடிக்கைகளை கடைபிடித்து 90 நாட்களுக்குள் பணிகளை முடிக்க அனுமதி வழங்கி உத்தரவிடப்படுகிறது.

(ஓம்) ஆ. சிவஞானம்,
மாவட்ட ஆட்சியர்
விருதுநகர்

ஆணைப்படி/அனுப்பப்படுகிறது

மாவட்ட ஆட்சியருக்காக
விருதுநகர்.

பெறுநர்,

தலைமைப் பொறியாளர்,
தமிழ்நாடு குடிநீர் வடிகால் வாரியம்,
கழிவுநீர் அகற்று கோட்டம்,
இராஜபாளையம்.

நகல்:

1) வருவாய் கோட்டாட்சியர், சாத்தூர்
2) வருவாய் வட்டாட்சியர், இராஜபாளையம்.

Permission for Controlled Blasting - Extension
From District Collector, Virudhunagar on 04.06.2020

விருதுநகர் மாவட்ட ஆட்சியர் அவர்களின் செயல்முறை ஆணைகள்
முன்னிலை: திரு.இரா.கண்ணன், இ.ஆ.ப.,

ந.க.கேவி1/497/2019 நாள்: 04.06.2020

பொருள்: கனிமம் மற்றும் சுரங்கம் - பாதாள சாக்கடைத் திட்டம் - குடிநீர் வடிகால் வாரியம் - இராஜபாளையம் நகராட்சி பகுதியில் புதிய பாதாள சாக்கடைத் திட்டம் செயல்படுத்த Pumping Station சிப்பம் - I,II,III மற்றும் கழிவுநீர் குழாய்கள் பதிக்க பூமிக்கு அடியில் உள்ள கடினப்பாறைகளை வெடிமருந்து வைத்து உடைக்க காலம் அவகாசம் நீட்டிப்பு அனுமதி ஆணை வழங்கக் கோரியுள்ளது - உத்தரவு வழங்குவது - தொடர்பாக.

பார்வை:
1. G.O.Ms.No.05/MA&WS Dept (WS2) dated 22.01.2018 for Rs.246.99 Crores.
2. தலைமைப் பொறியாளர். த.கு.வ.வாரியம், மதுரை அவர்களின் வேலை உத்திரவு எண். F.Rajapalayam UGSS – CS/DO II/CW/2018-19/Dt.23.08.2018.
3. தலைமைப் பொறியாளர், த.கு.வ.வாரியம், மதுரை அவர்களின் ஒப்பந்த எண். CER/TWAD/MDU 21/2018-19 dt.10.10.2018 for Rs.189.04 Crores – 3years.
4. தமிழ்நாடு குடிநீர் வடிகால் வாரிய கடித எண். ந.க.எண்.611/இவ/கோ.இராஜபாளையம் /2019/ நாள்.06.11.2019.
5. விருதுநகர் மாவட்ட ஆட்சியர் அவர்களின் செயல்முறை ஆணை எண்.கேவி1/497/2019 நாள்:12.11.2019.
6. நிர்வாக பொறியாளர், தகவவாரியம், கழிவு நீர் அகற்று கோட்டம், இராஜபாளையம் அவர்களின் கடித எண்.13320/இவ/கோ.இராஜபாளையம்/2020 நாள்:13.03.2020

*****

ஆணை :

விருதுநகர் மாவட்டம், இராஜபாளையம் நகராட்சிக்குட்பட்ட பச்சமடம் சாலை, P.S.K நகர், R.R.நகர், வேட்டை பெருமாள் கோவில் சாலை, சுதர்சன் கார்டன் விரிவாக்கம், மலையடிப்பட்டி சாலை, சங்கரன்கோவில் சாலை, சத்திரப்பட்டி சாலை,

தென்காசி சாலை பகுதியில் புதிய பாதாள சாக்கடைத் திட்டம் செயல்படுத்த Pumping Station சிப்பம் - I,II,III மற்றும் கழிவுநீர் குழாய்கள் பதிக்க பூமிக்கு அடியில் உள்ள கடினப்பாறைகளை கீழ்க்கண்ட வழி முறையில் வெடிமருந்து வைத்து பாறைகள் தகர்க்கப்பட உள்ளதாக பார்வை 4-ல் காணும் கடிதத்தில் கூறப்பட்டுள்ளது.

மேற்படி பார்வை 5-ல் காணும் விருதுநகர் மாவட்ட ஆட்சியர் அவர்களின் செயல்முறை ஆணையின்படி விருதுநகர் மாவட்டம், இராஜபாளையம் நகராட்சிக்குட்பட்ட பச்சமடம் சாலை, P.S.K நகர், R.R.நகர், வேட்டை பெருமாள் கோவில் சாலை, சுதர்சன் கார்டன் விரிவாக்கம், மலையடிப்பட்டி சாலை, சங்கரன்கோவில் சாலை, சத்திரப்பட்டி சாலை, தென்காசி சாலை ஆகிய பகுதிகளில் புதிய பாதாள சாக்கடைத் திட்டம் செயல்படுத்த Pumping Station சிப்பம் - I,II,III மற்றும் கழிவுநீர் குழாய்கள் பதிக்க கடின பாறைகளை வெடி மருந்து வைத்து உடைப்பதற்கு ஒப்பந்தகாரர் M/s. SRI SELVA GANAPATHY MURUGAN EXPLOSIVES (Occupier: R.SELVAKUMARAN), திருநெல்வேலி என்பவருக்கு (12.11.2019 முதல் 01.02.2020 வரை) 90 நாட்களுக்குள் கீழ்கண்ட இடங்களில் கடின பாறைகள் உடைத்து கொள்வதற்கு அனுமதி வழங்கப்பட்டது.

வ.எண்	இடங்கள்	வெடி வைக்கப்படும் இடங்கள் அளவுகள்
1.	பச்சமடம் சாலை.	சுமார் 100மீ நீளம் உள்ள Sewerline ல் 2.5மீ ஆழத்தில் சுமார் 0.5மீ ஆழத்திற்கு கடின பாறைகளை தகர்க்க வேண்டியுள்ளது.
2.	P.S.K நகர்	சுமார் 250மீ நீளம் உள்ள Sewerline ல் 3.0மீ ஆழத்தில் சுமார் 1.0மீ ஆழத்திற்கு கடின பாறைகளை தகர்க்க வேண்டியுள்ளது.
3.	R.R.நகர்	சுமார் 270மீ உள்ள Sewerline ல் 3.0மீ ஆழத்தில் சுமார் 1.0மீ ஆழத்திற்கு கடின பாறைகளை தகர்க்க வேண்டியுள்ளது.
4.	வேட்டை பெருமாள் கோவில் சாலை	சுமார் 410மீ உள்ள Sewerline ல் 4.0மீ ஆழத்தில் சுமார் 1.5மீ ஆழத்திற்கு கடின பாறைகளை தகர்க்க வேண்டியுள்ளது.

5.	சுதர்சன் கார்டன் விரிவாக்கம்	சுமார் 220மீ உள்ள Sewerline ல் 2.5மீ ஆழத்தில் சுமார் 1.5மீ ஆழத்திற்கு கடின பாறைகளை தகர்க்க வேண்டியுள்ளது.
6.	மலையடிப்பட்டி சாலை	சுமார் 520மீ உள்ள Sewerline ல் 3.0மீ ஆழத்தில் சுமார் 1.0மீ ஆழத்திற்கு கடின பாறைகளை தகர்க்க வேண்டியுள்ளது.
7.	சங்கரன்கோவில் சாலை.	சுமார் 410மீ உள்ள Sewerline ல் 3.0மீ ஆழத்தில் சுமார் 1.0மீ ஆழத்திற்கு கடின பாறைகளை தகர்க்க வேண்டியுள்ளது.
8.	சத்திரப்பட்டி சாலை.	சுமார் 1000மீ உள்ள Sewerline ல் 6.0மீ ஆழத்தில் சுமார் 1.5மீ ஆழத்திற்கு கடின பாறைகளை தகர்க்க வேண்டியுள்ளது.
9.	தென்காசி சாலை.	சுமார் 520மீ உள்ள Sewerline ல் 3.5மீ ஆழத்தில் சுமார் 1.0மீ ஆழத்திற்கு கடின பாறைகளை தகர்க்க வேண்டியுள்ளது.

பார்வை 6-ல் காணும் நிர்வாகப் பொறியாளர் கடிதத்தில் மேற்கண்ட இடங்களில் ஒப்பந்தகாரர் M/s. SRI SELVA GANAPATHY MURUGAN EXPLOSIVES (Occupier: R.SELVAKUMARAN), திருநெல்வேலி என்பவர் மூலம் கடினப்பாறைகளை பாதுகாப்பான முறையில் வெடிமருந்து வைத்து உடைக்க கால அவகாசம் நீட்டித்து அனுமதி வழங்க கோரப்பட்டுள்ளது.

நிபந்தனைகள்:

1. பாறையை உடைப்பதற்கு தகுதியான வெடி வைப்பாளர்மூலம் குறைந்த திறன் கொண்ட வெடி பொருட்களை கையாள வேண்டும்.
2. வெடி வைப்பிற்கு முன்பாக தகுந்த முன் எச்சரிக்கை நடவடிக்கை மேற்கொண்டு பாறையை உடைக்க வேண்டும்.
3. வெடிக்கும் செயல்பாட்டின் போது அகற்றப்பட்ட கடினமான பாறைகளை எந்த வணிக நோக்கத்திற்காகவும் பயன்படுத்தப்படக்கூடாது.

மேற்படி நிபந்தனைகளின்படி விருதுநகர் மாவட்டம், இராஜபாளையம் நகராட்சிக்குட்பட்ட பச்சமடம் சாலை, P.S.K நகர், R.R.நகர், வேட்டை பெருமாள் கோவில் சாலை, சுதர்சன் கார்டன் விரிவாக்கம், மலையடிப்பட்டி சாலை, சங்கரன்கோவில் சாலை, சத்திரப்பட்டி சாலை, தென்காசி சாலை ஆகிய பகுதிகளில் புதிய பாதாள சாக்கடைத் திட்டம் செயல்படுத்த Pumping Station சிப்பம் - I,II,III மற்றும் கழிவுநீர் குழாய்கள் பதிக்க கடின பாறைகளை பாதுகாப்பான முறையில் வெடி மருந்து வைத்து உடைப்பதற்கு மேலும் 6 மாதம் கால அவகாசம் நீட்டித்து அனுமதி அனுமதி வழங்கி உத்தரவிடப்படுகிறது.

(ஒம்) இரா.கண்ணன்
மாவட்ட ஆட்சியர்
விருதுநகர்

ஆணைப்படி/அனுப்பப்படுகிறது

8/12/2020

மாவட்ட ஆட்சியருக்காக
விருதுநகர்.

பெறுநர்,

8/12/2020

நிர்வாகப் பொறியாளர்,
தமிழ்நாடு குடிநீர் வடிகால் வாரியம்,
கழிவுநீர் அகற்று கோட்டம்,
இராஜபாளையம்.

நகல்:

1) வருவாய் கோட்டாட்சியர், சாத்தூர்
2) வருவாய் வட்டாட்சியர், இராஜபாளையம்.

Translation of Permission – Controlled Blasting

Virudhunagar District Collector Proceeding Order
Present: Thiru.A. Sivagnanam, I.A.S

proceed No: KV 1/497/2019 Date:

12.11.2019

Subject: Mines and Minerals – Sewerage Project – Tamilnadu Water supply and Drainage Board - To implement new underground sewerage project in Rajapalayam municipality Pumping Station Package – I, II, III and permission given to controlled blasting for laying of sewage pipelines in hard rock areas – orders issued – Regarding

References:
1. G.O.Ms.No.05/MA&WS Dept (WS2) Dated 22.01.2018 for Rs.246.99 Crores.
2. Chief Engineer. TWAD Board, Madurai work order No. F.Rajapalayam UGSS – CS/DO II/CW/2018-19 Dt.23.08.2018.
3. Chief Engineer, TWAD Board, Madurai agreement No. CER/TWAD/MDU 21/2018-19 dt.10.10.2018 for Rs.189.04 Crores – 3 years
4. Tamilnadu Water and Drainage Board Letter No. 611/JDO/F. Rajapalayam /2019/Date.06.11.2019

Order:

Rajapalayam Municipality in Virudhunagar district areas like Pachamadam road, P.S.K Nagar, R.R Nagar, Vettaiperumalkovil Road, Sudharsan Garden Extension, Malaiyadipatti Road, Sankarankovil Road, Chathirapatti Road, Tenkasi Road have been taken up for the Implementation of pumping station package – I, II, III and also for laying pipeline in these areas the hard rock beneath the surface will be removed using explosive, following the guidelines of controlled blasting as per the letter in the reference 4 cited

In the above-mentioned areas in the letter for laying sewer pipelines holes are taken to a depth of about 3 feet with 20mm dia using driller. In the drilled holes the explosives are filled and connected with explosive charges using wires and sand bags are filled in trenches area over the explosive. Considering the Safety aspects, the people inside the 100Meteres radius of the blasting area are evacuated and controlled blasting will be

carried out in a safe manner and the sewer pipelines will be laid. The areas to be undertaken with controlled blasting and their respective dimensions are mentioned in the table and requested the permission under.

Sl. No	Places	Size of control blasting locations
1.	Pachamadam Road	About 100mtr length of a sewer line in 2.5mtrs depth, approximately 0.5Mtr depth of hard Rocks must be Removed by controlled Blasting
2.	P.S.K Nagar	About 250mtr length of a sewer line in 3.0mtrs depth, approximately 1.0Mtr depth of hard Rocks must be Removed by controlled Blasting
3.	R.R. Nagar	About 270mtr length of a sewer line in 3.0mtrs depth, approximately 1.0Mtr depth of hard Rocks must be Removed by controlled Blasting
4.	Vettaiperumalkovil Road	About 410mtr length of a sewer line in 4.0mtrs depth, approximately 1.5Mtr depth of hard Rocks must be Removed by controlled Blasting
5.	Sudharsan Garden Extension	About 220mtr length of a sewer line in 2.5mtrs depth, approximately 1.5Mtr depth of hard Rocks must be Removed by controlled Blasting
6.	Malaiyadipatti Road	About 520mtr length of a sewer line in 3.0mtrs depth, approximately 1.0Mtr depth of hard Rocks must be Removed by controlled Blasting
7.	Sankarankovil Road	About 410mtr length of a sewer line in 3.0mtrs depth, approximately 1.0Mtr depth of hard Rocks must be Removed by controlled Blasting
8.	Chathirapatti Road	About 1000mtr length of a sewer line in 6.0mtrs depth, approximately 1.5Mtr depth of hard Rocks must be Removed by controlled Blasting
9.	Tenkasi Road	About 520mtr length of a sewer line in 3.5mtrs depth, approximately 1.0Mtr depth of hard Rocks must be Removed by controlled Blasting

As Per the letter in the Reference 4th Cited, the Executive Engineer has requested that the permission may be issued to carry out the controlled Blasting works in the mentioned above places with the explosive Contractor M/s. SRI SELVA GANAPATHY MURUGAN EXPLOSIVES (Occupier: R. SELVAKUMARAN) Tirunelveli and following safety and precautionary arrangements upto 31.07.2020.

Terms and Conditions:

1. For breaking hard rocks only licensed Explosive Contractor with minimum explosives must handle for the controlled blasting.

2. All necessary precautionary arrangements must be carried out before commencing controlled blasting
3. Hard rock removed from blasting activities should not be utilized for any commercial purposes

As per the terms and conditions, Virudhunagar District, in Rajapalayam Municipality part of Pachamadam Road, P.S.K Nagar, R.R. Nagar, Vettaiperumalkovil Road, Sudharsan Garden Extension, Malaiyadipatti Road, Sankarankovil Road, Chatrapatti Road, Tenkasi Road, areas under Rajapalayam UGSS scheme for constructing and implementing Pumping station Package – I,II,III also for laying sewer pipeline the hard rocks beneath the earth's surface by controlled blasting following proper safety the permission for controlled blasting order has been issued for 90 days.

Sd….. A. Sivagnanam, I.A.S;
The District Collector
Virudhunagar

By Order

Sd……dt. 12.11.2019,
For District Collector,
Virudhunagar.

To
Executive Engineer,
Tamilnadu Water and Drainage Board,
Sewerage Division,
Rajapalayam.

Copy to:
1. R.D.O, Sattur
2. Revenue Tahsildar, Rajapalayam

Translation of Permission – Controlled Blasting – Extension

Virudhunagar District Collector Proceeding Order
Present: Thiru.R. Kannan, I.A.S

Proceed No: KV 1/497/2019 Date:

04.06.2020

Subject: Mines and Minerals – Sewerage Project – Tamilnadu Water supply and Drainage Board - To implement new underground sewerage project in Rajapalayam municipality Pumping Station Package – I, II, III and permission given to Controlled Blasting for laying sewage pipelines in hard rock areas - requested orders for extension of time for permission – orders issued – Regarding

References:
1. G.O.Ms.No.05/MA&WS Dept (WS2) Dated 22.01.2018 for Rs.246.99 Crores.
2. Chief Engineer. TWAD Board, Madurai work order No. F.Rajapalayam UGSS – CS/DO II/CW/2018-19 Dt.23.08.2018.
3. Chief Engineer, TWAD Board, Madurai agreement No. CER/TWAD/MDU 21/2018-19 dt.10.10.2018 for Rs.189.04 Crores – 3 years
4. Tamilnadu Water and Drainage Board Letter No. 611/JDO/F. Rajapalayam /2019/Date.06.11.2019
5. Virudhunagar District collector Proceeding order No.K.V1/497/2019 Date:12.11.2019
6. Executive Engineer, TWAD Board, Sewerage Division, Rajapalayam Letter No.13320/JDO/F. Rajapalayam/2020 Date: 13.03.2020

Order:

Rajapalayam Municipality under virudhunagar district areas like Pachamadam road, P.S.K Nagar, R.R Nagar, Vettaiperumalkovil Road, Sudharsan Garden Extension, Malaiyadipatti Road, Sankarankovil Road, Chathirapatti Road, Tenkasi Road have been taken and for the Implementation of

Pumping Station Package – I, II, III and also for laying pipeline in these areas the hard rock beneath the surface will be removed using explosive, following the Guidelines of controlled blasting as per the letter in the reference 4 cited

As per the Virudhunagar District Collector Proceeding order in the reference 5th cited, Pachamadam Road, P.S.K Nagar, R.R. Nagar, Vettaiperumalkovil Road, Sudharsan garden Extension, Malaiyadipatti Road, Sankarankovil road, Chathirapatti Road, Tenkasi road areas covered under Rajapalayam UGSS scheme for construction and implementation of Pumping Station Package – I,II,III also for laying sewage pipeline, the hard rocks beneath the earths surface must be removed by controlled blasting with a licensed explosive contractor M/s. SRI SELVA GANAPATHY MURUGAN EXPLOSIVES (Occupier: R.SELVAKUMARAN) Tirunelveli. The permission order was given to carry out the Control blasting activities for within a time period of 90 days (from 12.11.2019 to 01.02.2020) in the following areas.

Sl. No	Places	Size of control blasting locations
1.	Pachamadam Road	About 100mtr length of a sewer line in 2.5mtrs depth, approximately 0.5Mtr depth of hard Rocks must be Removed by controlled Blasting
2.	P.S.K Nagar	About 250mtr length of a sewer line in 3.0mtrs depth, approximately 1.0Mtr depth of hard Rocks must be Removed by controlled Blasting
3.	R.R. Nagar	About 270mtr length of a sewer line in 3.0mtrs depth, approximately 1.0Mtr depth of hard Rocks must be Removed by controlled Blasting
4.	Vettaiperumalkovil Road	About 410mtr length of a sewer line in 4.0mtrs depth, approximately 1.5Mtr depth of hard Rocks must be Removed by controlled Blasting
5.	Sudharsan Garden Extension	About 220mtr length of a sewer line in 2.5mtrs depth, approximately 1.5Mtr depth of hard Rocks must be Removed by controlled Blasting

6.	Malaiyadipatti Road	About 520mtr length of a sewer line in 3.0mtrs depth, approximately 1.0Mtr depth of hard Rocks must be Removed by controlled Blasting
7.	Sankarankovil Road	About 410mtr length of a sewer line in 3.0mtrs depth, approximately 1.0Mtr depth of hard Rocks must be Removed by controlled Blasting
8.	Chathirapatti Road	About 1000mtr length of a sewer line in 6.0mtrs depth, approximately 1.5Mtr depth of hard Rocks must be Removed by controlled Blasting
9.	Tenkasi Road	About 520mtr length of a sewer line in 3.5mtrs depth, approximately 1.0Mtr depth of hard Rocks must be Removed by controlled Blasting

As Per the letter in the Reference 6th Cited, the Executive Engineer requested that the extension of time permission may please be issued to carry out the controlled blasting works in the mentioned above places with the explosive Contractor M/s. SRI SELVA GANAPATHY MURUGAN EXPLOSIVES (Occupier: R. SELVAKUMARAN) Tirunelveli and following safety and precautionary arrangements.

Terms and Conditions:

1. For breaking hard rocks only licensed Explosive Contractor with minimum explosives must handle for the controlled blasting.
2. All necessary precautionary arrangements must be carried out before commencing controlled blasting
3. Hard rock removed from blasting activities should not be utilized for any commercial purposes

As per the terms and conditions, Virudhunagar District, in Rajapalayam Municipality Part of Pachamadam Road, P.S.K Nagar, R.R. Nagar, Vettaiperumalkovil Road, Sudharsan Garden Extension, Malaiyadipatti Road, Sankarankovil Road, Chatrapatti Road, Tenkasi Road areas under Rajapalayam UGSS scheme for constructing and implementing pumping station package – I,II,III also for laying sewer pipeline the removal of hard rocks beneath the earth's surface by controlled blasting with following proper safety arrangements, the permission order has been issued for further 6 months.

Sd……. R. Kannan, I.A.S;
The District Collector
Virudhunagar

By Order

Sd……...dt. 08.06.2020,
For District Collector,
Virudhunagar.

To
Executive Engineer,
Tamilnadu Water and Drainage Board,
Sewerage Division,
Rajapalayam.

Copy to:

3. R.D.O, Sattur
4. Revenue Tahsildar, Rajapalayam

PROCEDURES INVOLVED IN CONTROLLED BLASTING

UGSS to Rajapalayam Municipality Package I Collection System Works are under Progress. During execution, in some of the places hard Rock strata is identified. For laying sewer pipeline in these areas, the hard rocks must be removed to the required depth for supporting gravitational flow. In these Identified areas the excavation of hard Rocks can be done by controlled blasting mechanism. Nine areas/ locations have been identified as hard rock areas i.e. Pachamadam Road, PSK Nagar, RR Nagar, Vettaiperumalkovil Road, Sudharsan Garden Extension, Malaiyadipatti Road, Sankarankovil road, Chatrapatti Road and Tenkasi Road. The steps involved in the controlled blasting procedure are furnished below

- **Drilling Holes:**

For carrying out the control blasting, the first step followed is drilling holes on the hard rocks 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 rocks the explosive charges are placed inside the drilled holes. In this 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 Non electric 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 only bought to the site for the required quantity.

- **Detonating the charge:**

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

- Proper prior notice is issued to the residents in the vicinity of the blasting area before commencing the blasting activity
- Proper information is also be given to police officials before the blasting activity
- During Controlled Blasting, flagman is placed at both end of corresponding road to block the road and to give caution to Public
- Minimum Explosive is used for Controlled blasting for residential area by licensed Explosive contractor
- Trenches are properly covered with sand bags and the top surface level will be covered with MS steel sheets

- Above the MS steel sheet layer, a layer of shade net is covered to prevent the movement of dust from the blasting area.
- Before Commencing of controlled blasting Works, it will be informed around to the residents about the activity of works through Mic.
- Signages will be placed around the site with visible warning boards and indicating the start and completion of the blasting.

Notice issued prior to controlled blasting

Presence of Police officials before Controlled blasting

Flagmen and safety signages during the Controlled blasting activity

Proper coverage of trenches with MS sheets and shade net

Announcements made through mic for the Controlled blasting work

After following all the necessary safety and precautionary measures the controlled blasting activity is carried out. The wiring from the Non electric detonators are connected to a battery box using nonel method of 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:**

As there are no norms of fixing the quantity of usage of detonator and no. of explosive at a time. During our work experience gathered from previous UGSS projects we came the conclusion on trial and error method only during initial work experience periods.

During previous UGSS project works, the hard rocks in residential area sewer pipe line had been removed by the method of controlled blasting in Theni Allinagaram UGSS, Bodinayakkanur UGSS and Periyakulam UGSS projects in Theni district for the period from 2011 to 2018. wherein controlled blasting activities were carried out in 15 ft to 40 ft roads. In the initial stages, we used to half of the nitrate mixture ie., 62.5 gm weight in 18 drill holes with 18 explosive charges at a time, then 1/3 of nitrate mixture ie., 40 gm weight in 18 drill holes with 18 explosive charges at a time, compared the production of noise and vibration. So, the explosive charges were reduced gradually to around 15 and 13 at a time. Then the number of explosive charges were further reduced to a count of 10 at a time. When the numbers were reduced to 10 charges at a time the sound and vibrations produced from the controlled blasting activities were too low and the blasting activities did not result in any nuisance to public nor result in any damages/cracks to nearby buildings/establishments etc. All the activities were done under the presence of Police officials only and thus finally we conclude to use the 1/3 quantity of nitrate mixture i.e. 40 gm weight with 10 nos. of explosive at a time and accordingly in all our previous project were successfully without any hindrance to the public and any disturbance to the nearby residential buildings and we completed the above project UGSS works.

Hence, using our previous experiences with observations and also in combination with advanced Non-Electric Detonators (NONEL) technologies for carrying out the controlled blasting activities in Rajapalayam UGSS Project. Non-Electric Detonators (NONEL) technologies were not used at those times of blasting in Theni allinagaram UGSS, Bodinayakkanur UGSS and Periyakulam UGSS projects in Theni district. With the help of the Nonel technology the sound and vibrations from the blasting activities are reduced to a greater extent in Rajapalayam UGSS project.

A reference letter from the explosive supplier about the Controlled Blasting procedure and minimum explosives used is attached for reference. Controlled blasting activity is only carried out in wide roads of width more than 20ft.

❖ **Letter Issued from Explosives Supplier:**

United explosive
Explosive Licence No. E/SC/TN/22/715/(E85413)
Explosive Blasting Service
68/11 Subbaraja madam Street, Rajapalayam 626117.
Virudhunagar Dist.,Tamil nadu.
GST Tin No. 33AAFFU2440R1ZV Magazine at Gorukampatti Village, www.unitedexplosive2018@gmail.com Cell : 94433 83449
98437 64024

Date: 31/07/2020

Normally the Controlled blasting work will be Carried out by using the Combination of Electric Detonators and Nitrate Mixture. In order to Carry out the Controlled blasting work/process the amount of Nitrate Mixture Must be Reduced. Normally a Nitrate mixture tube will be of 125 gms, in Controlled blasting we will use 40 gms only for a hole. for one time of blasting 10 holes will be loaded with 40 gms of Nitrate Mixture with a total length of 4m and area 3.2 Sq.m Connected with non electric Detonator in each holes (Nonel). Non Electric Detonator is specially made to Reduce ground vibrations and noise, so there is no chance for occurence of vibration and Sound. This is how the Control blasting work is Carried out.

For UNITED EXPLOSIVE

N.K.M

Partner

N K Murugesa Raja,

Partner / Occupier /AuthorizedPerson.

❖ Explosive Transport Vehicle:


E
1
CORRECT NAME
EXPLOSIVES
UN NO:1
HAZCHEM
EMERGENCY DIAL
POLICE:100,FIRE:101
CAPACITY:
LICENCE HOLDER
WASH
WITH
WATER
TN·84
E.6225
Diesel


ACE
MEGA
TN84.E.6225