



Initial Environmental Examination

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India: Tamil Nadu Urban Flagship Investment Program- Tranche 1

Subproject: Underground Sewerage System for Phase II of Municipal Corporation Covering Zones 3 to 7 in Vellore City

Prepared by Vellore City Municipal Corporation (VCMC), Government of Tamil Nadu for the Asian Development Bank. This is an updated version of the draft originally posted in May 2018 available on <https://www.adb.org/projects/documents/ind-49107-004-iee-5>.

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– Underground Sewerage System for Phase II of
Municipal Corporation Covering Zones 3 to 7 in
Vellore City**

CURRENCY EQUIVALENTS

(as of 29th October 2025)

Currency Unit	–	Indian rupee (₹)
₹1.00	–	\$0.015
\$1.00	=	₹88.41

ABBREVIATIONS

ADB	–	Asian Development Bank
ASI	–	Archaeological Survey of India
CMSC	–	construction management and supervision consultant
CPCB	–	Central Pollution Control Board
CTE	–	consent to establish
CTO	–	consent to operate
DWC	–	double wall corrugated
EAC	–	expert appraisal committee
EHS	–	environmental health and safety
EIA	–	environmental impact assessment
EMP	–	environmental management plan
ESS	–	environmental and social safeguards
ESZ	–	eco sensitive zone
GOTN	–	Government of Tamil Nadu
IEE	–	initial environmental examination
MoEF&CC	–	Ministry of Environment, Forest and Climate Change
NOC	–	no objection certificate
PIU	–	program implementation unit
PMU	–	program management unit
PPTA	–	project preparatory technical assistance
REA	–	rapid environmental assessment
ROW	–	right-of-way
SEIAA	–	State Environmental Impact Assessment Authority
SPS	–	Safeguard Policy Statement
STP	–	sewage treatment plant
TNPCB	–	Tamil Nadu Pollution Control Board
TNUFIP	–	Tamil Nadu Urban Flagship Investment Program
TNUIFSL	–	Tamil Nadu Urban Infrastructure Financial Services Limited
VCMC	–	Vellore City Municipal Corporation
WHO	–	World Health Organization

WEIGHTS and MEASURES

°C	degree Celsius
km	kilometer
lpcd	liter per capita per day
msl	mean sea level
m	meter
mm	millimeter
Mgd	million gallons per day
MLD	million liters per day
km ²	square kilometer

NOTE

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

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EXECUTIVE SUMMARY

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, reduced vulnerability to climate change in urban areas, and enhanced share of renewable energy achieved. TNUFIP will have the following outcomes: livability and climate resilience in at least ten cities in priority industrial corridors enhanced.

The TNUFIP is structured under three outputs: (i) climate-resilient sewage collection and treatment, and drainage systems developed in at least eight 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).

The Subproject. Vellore, located in the northern part of Tamil Nadu on a corridor connecting Bangalore-Chennai, is a very prominent education and health center in Tamil Nadu and as well as India. In this subproject to be implemented under the ADB funded TNUFIP, it is proposed to provide underground sewerage system in added areas (Zones 3 to 7 covering areas of Alamelumangapuram, Sathuvachari, Shenpakkam, Konavattam, Vasanthapuram and Velapadi) of Vellore City Municipal Corporation (VCMC). These areas are located in the south of Palar River, surrounding the old core city of Vellore, which is already provided with UGSS. VCMC area is located on both sides of River Palar. Subproject includes the following civil works components: (i) sewage collection system (181.163 kilometers (km) length of sewers and 7848 manholes), (ii) 14 lift stations/Lift Machine Holes, (iii) 4 pump stations, (iv) 15.339 km length pumping main sewers, (v) sewage treatment plant (STP) of 50 million liters per day (MLD) capacity and 2.127 km length outfall sewer from STP to disposal point, (vi) 20059 house service connections and 164.937 km road restoration works. STP is proposed under design-build contract.

Project Implementation Arrangements. The Municipal Administration and Water Supply Department (MAWS) of Government of Tamil Nadu (GOTN) 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 bodies (ULBs). Vellore City Municipal Corporation (VCMC) is the implementing agency for this subproject. A program implementation unit (PIU) has been established in VCMC headed by a full-time Project Manager (Executive Engineer or above) and comprising dedicated full-time staff of the VCMC for day-to-day implementation of the subproject. A Safeguards Officer (environment, involuntary resettlement, gender) has been placed in PIU from VCMC to coordinate monitoring and implementation of safeguards at subproject level. PIU is assisted by construction management and supervision consultant (CMSC) in implementation. Environmental and social safeguard (ESS) Managers in PMU/TNUIFSL is having overall responsibility of safeguard related activities of the subproject and is ensuring the compliance with EMP and EARF. Environmental Specialist of the CMSC is assisting PIU in implementation of subproject in compliance with EMP and EARF, and is carrying out all necessary tasks.

Screening and Assessment of Potential Impacts. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. The SPS 2009 also requires that ADB-financed sub-projects to comply with host country regulations. As per the Government of India EIA Notification, 2006, this subproject does not require EIA study or environmental clearance. For the STP sub-component, the consent to establish has been obtained from the Tamil Nadu Pollution Control Board and Consent to Operate would be obtained prior to commissioning of STP. 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.

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

Description of the Environment. The subproject components are located in Vellore, in the northern part of Tamil Nadu. It is an important city providing one of the best education and healthcare facilities in the country. Topography of Vellore city is mostly plain with slight slope from west to east. It experiences dry and hot climate and average annual rainfall is nearly 1000 mm. Vellore is an historical city, and there are three nationally important protected monuments: Vellore Fort, located in the center of the city, and temple and a mosque located inside the Fort. None of the components are located within the protected monuments, but few components are located near the monument – sewer lines and a sewage pumping station (SPS 6) are proposed within 300 m distance of monument (which is regulated buffer zone). Sewage pumping station is proposed at about 250 m from the monument. Small sections of sewer line also fall within 100 m of monument. All works within 300 m from the boundary (regulated buffer zone) of protected monument will require prior permission from National Monument Authority (NMA). This will be obtained prior to start of construction works. City is originally developed on the southern bank of River Palar. Due to expansion in all directions including north, the present municipal area of the city spread over both banks of the river. At present, sewerage system is available in the old town area of Vellore, and under the current project it is proposed to provide sewerage system in the areas located around the old city area, in the northern part of Palar River. Project area comprises zones of Alamelumangapuram, Sathuvachari, Shenpakkam, Konavattam, Vasanthapuram, and Velapadi (Zone 3 to Zone 7). Proposed subproject components are located within the urban area of Vellore City. Sewers will be laid in the public roads, and lifting stations, pumping stations, and STP will be constructed on government owned vacant land parcels. Based on the review of design and topography of the land, one sewage pumping station (SPS 7) is deleted. Due to lack of suitable lands, the pumping station sites are located close to houses. STP is located on the northern bank of River Palar, surrounded three sides by agricultural and vacant lands and river Palar, and on northern side by residential areas, from about 50 m distance. The STP is designed to provide maximum available buffer towards north by utilizing the available land in the site and by also located units with maximum odor potential away from houses. It was proposed to dispose the treated effluent into Pandiyan Channel at 2.4 km from the STP. Due to lack of clearance from statutory authority, the disposal site of treated effluent is shifted to Palar River at Kangeyanallur near the burial ground about 2.127 km from STP. Part of the municipal area in the eastern part of the city is under reserve forest, none of the components however are located in the forest area.

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 sewer alignment.

Sewerage system performs a crucial function of safely collecting, transporting, treating and disposing domestic wastewater, including, human excreta (designed as a separate system). Subproject is likely to have numerous positive impacts on the environment and public health. In this IEE, negative impacts were identified in relation to pre-construction, construction, and operation phases. Planning principles and design considerations have been reviewed and incorporated into the site planning and design process wherever possible; thus, environmental impacts as being due to the project design or location were not significant. Sewage pumping and lifting stations, which collect sewage to further pump to a higher elevation manhole, pump station or STP, are likely to generate odor. Although utmost care is taken to locate these away from the houses, due to design considerations and land constraints, some sites are located close to the houses. Various site planning, green buffer and design related measures are included in the project to prevent and control odour generation. Another impact is that of STP operation: from malfunction or decrease in treatment efficiency and sludge handling and disposal. This will result in release of untreated or partially treated wastewater that will pollute environment and cause public health issues. Mixing of industrial waste in sewage is also identified as one of the risk which could render treatment inadequate. Accumulation of silt in sewers in areas of flow over time, overflows, blockages, power outages, harmful working conditions for the workers cleaning sewers etc. may create nuisance, unhealthy and hazardous conditions.

Although there are no components located in the monument area, there are residential areas developed around the Fort (especially in the north) within its regulated buffer zone (300 m). Besides sewer lines, a sewage pumping main and a sewage pumping station is also proposed within the regulated zone.) Permission will also entail Archaeological Survey of India's (ASI) scrutiny of proposals to ensure that there is no risk of damage to the protected monument due to proposed works. Components will be implemented with ASI permission, and recommendations, if any, of ASI will be included in the project implementation. For the works within 300m of the Fort, permit from ASI has been obtained.

STP site is located on the northern side of Palar River. The treated wastewater from STP was proposed to dispose into an irrigation canal (Pandiyar Channel). This channel originates from Kalinjur lake and carries its overflow for irrigation needs and discharges surplus in Palar River after flowing 15- 16 km through outer areas of Vellore city (for about 4-5 km) and through agricultural lands (for about 10-12 km). Water from the channel is used for irrigation purposes along its course. Since Kalinjur lake is mostly dry, this channel seldom carries overflow, and along its course, untreated wastewater from surrounding residential areas join the channel, so most of the time the flow in the channel is low and comprises only wastewater. Owing to good monsoon, during the IEE preparation, lake was full, and overflow noticed. Lake also receives untreated wastewater from surrounding residential areas of Vellore city. Considering the existing situation where untreated wastewater is disposed into channel/lakes, the proposed disposal of treated wastewater meeting the disposal standards to Pandiyar channel is unlikely to have any significant adverse impacts. Technical assessment indicates that Pandiyar channel hydraulic capacity is adequate to carry the STP discharge safely throughout its course from the STP and up to Palar River. Due to lack of permission for disposal of treated sewage into Pandiyar Channel, the location of disposal site is shifted to Palar River at Kangeyanallur near the burial ground about 2.127 km from STP. Palar River flowing through Vellore City Municipal Corporation limit receives untreated sewage generated in the city and highly polluted. The disposal of treated sewage as per the standard prescribed will improve the quality of water in the river and will not have any adverse impact on the river.

Sludge management plan will be prepared for treatment, disposal or safe reuse of sludge. Monitoring of treated wastewater and sludge quality, safe reuse limits are provided in EMP.

Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result significant measures have already been included in the designs for the infrastructure. Various measures suggested for odor control including: appropriately locating sewage wells within sites 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.

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.), sourcing of construction material from the existing government licensed mining areas, occupation health and safety aspects. Sewer works will be conducted along public roads in an urban area congested with people, activities and traffic. Therefore, these works will have significant impacts arising mainly: from the disturbance of residents, businesses and traffic due to construction work; safety risk to workers, public and nearby buildings due to deep trench excavations in the road 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.

Environmental Management Plan. An EMP has been developed to provide mitigation measures to reduce all negative impacts to acceptable levels, along with the delegation of responsibility to appropriate agency. As stated above, various design related measures are already included in the project design. During construction, the EMP includes mitigation measures such as (i) 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 (v) finding beneficial use of excavated materials to extent possible to reduce the disposal quantity. Existence of Hard rock is noticed at certain part of the sewer network and site for lifting and pumping stations. Removal hard rock through controlled blasting has been identified for some sections of the sewer alignment and in the pumping station sites in Package 1 and 2 areas. Mitigation measures to be adopted during controlled blasting to ensure safety of humans and structures within the area of influence and impacts were drawn up and included in the EMP. EMP will guide the environmentally-sound construction of the subproject. EMP includes a monitoring program to measure the effectiveness of EMP implementation and include observations on-and-off-site, document checks, and interviews with workers and beneficiaries.

The EMP is 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 had submitted to PIU, for review and approval, a site environmental management plan (SEMP) including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; and (iii) monitoring program as per EMP. 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. 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.

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, VCMC and TNUFSL 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.

Monitoring and Reporting. Contractors are submitting monthly EMP implementation report to PIU. PIU, with the assistance of CMSC, is monitoring the compliance of Contractors, preparing a Quarterly Environmental Monitoring Report and submitting to PMU. The PMU is overseeing the implementation and compliance, and is submitting semi-annual monitoring reports to ADB. ADB will post the environmental monitoring reports on its website. Monitoring reports will also be posted on VCMC and TNUFSL websites.

Conclusions and Recommendations. Therefore, as per ADB SPS, the project is classified as environmental category B and does not require further environmental impact assessment. However, to conform to government guidelines STP requires consent to establish (CTE) and consent to operate (CTO) from Tamil Nadu Pollution Control Board (TNPCB). STP is proposed under DBOT and design has been prepared by the Contractor and CTE has been obtained from TNPCB. Application for extending the validity of CTE is submitted and is being processed by TNPCB. For the project components located within the regulated zone of protected monument (Vellore Fort), permission of ASI has been obtained. The IEE is updated incorporating approved design details of STP, variations in the project activities and location of treated sewage disposal site and mitigation measures to be followed during controlled blasting. The updated IEE is submitted to ADB for concurrence and disclosure.

I. INTRODUCTION

A. Background

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

2. TNUFIP 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). 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 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, reduced vulnerability to climate change in urban areas, and enhanced share of renewable energy achieved. The investment program will have the following outcome: livability and climate resilience in at least 10 cities in priority industrial corridors enhanced. The TNUFIP is structured under following three outputs:

- (i) **Output 1: Climate-resilient sewage collection and treatment, and drainage systems developed in at least eight cities.** This includes (i) 187 million liters per day (MLD) of new and 155 MLD of rehabilitated sewage treatment capacity developed, with solar power systems installed for STP operations on a pilot basis; (ii) treated wastewater reused for industrial purposes in selected areas; (iii) 2,810 kilometers (km) of sewage collection pipelines constructed, with 426,600 households connected; (iv) 173 sewage pumping stations with a combined capacity of 6,390 kilowatts (kW) constructed; (v) 20 all-female community water and sanitation committees formed; and (vi) climate-resilient drainage and flood management systems (250 km of tertiary and 50 km of primary and secondary drains) established in selected cities.¹
- (ii) **Output 2: Water supply systems in at least five cities improved with smart features.** This includes (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% of households (total of 171,000) connected; (ii) 120 km of transmission mains built; (iii) 30 pump stations (1,530 kW capacity) constructed; and (iv) 40 water storage reservoirs (combined capacity of 70 million liters), covering Chennai, Coimbatore, Cuddalore, Tiruppur, and Thoothukudi.
- (iii) **Output 3: Institutional capacity, public awareness, and urban governance strengthened.** This includes (i) establishing within CMA (a) a new state-level urban data and governance improvement cell, and (b) a new project design and management center; and (ii) implementing (a) state-wide performance-based

¹ The eight cities are Ambur, Chennai, Coimbatore, Rajapalayam, Tiruchirappalli, Tirunelveli, Tiruppur, and Vellore. Drainage systems are proposed in Chennai, Cuddalore, and Thoothukudi.

urban governance improvement program for Tamil Nadu's 135 cities to improve revenue, financial management, administration, service delivery, gender mainstreaming, wastewater reuse, and fecal sludge management; and (b) public awareness campaigns on water conservation, sanitation, and hygiene in project cities. The program will intensify the capacity building of key urban institutions and continue providing incentives for urban governance improvement. Project design consultants will be recruited by the PMU to prepare new projects in subsequent tranches that meet 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 six cities.** This includes (i) five new STPs with a combined treatment capacity of 165 MLD constructed, including one STP with a 2-megawatt solar photovoltaic system installed to power its operations; (ii) one STP (37 MLD capacity) rehabilitated; (iii) 8,000 cubic meter treated wastewater reused per day; (iv) 1,860 km of new sewage collection pipelines constructed, with 100% households connected (297,547 households); (v) 124 pump/lift stations (combined capacity of 4,473 kW) constructed; and (vi) 12 all-female community water and sanitation committees formed. The breakdown by city is: (i) new Tirunelveli—sewage collection system and 32 MLD STP (to supply treated wastewater for industrial reuse) constructed; (ii) new Coimbatore sewage collection system and 30 MLD STP, with a 2-megawatt solar photovoltaic system, constructed; (iii) new Tiruchirappalli—sewage collection system with 30 MLD STP constructed and existing 37 MLD STP rehabilitated; (iv) new Vellore—sewage collection system and 50 MLD STP constructed; (v) new Chennai—sewage collection systems constructed in four areas in Chennai; and (vi) new Rajapalayam sewage collection system and 21 MLD STP constructed. In addition, in each city, two all-female community water and sanitation committees will be formed.
- (ii) **Output 2: Water supply systems in one city improved with smart features.** Four areas in Chennai will have (i) 275 km of distribution pipelines constructed, with 100% metered connections (30,800 households) in 20 newly established DMAs to manage and reduce NRW;⁴ (ii) 11 km of new transmission pipes constructed; (iii) nine new storage reservoirs (four underground and five overhead) of combined capacity of 11 million liters constructed; and (iv) five pump stations (combined capacity of 230 kW) constructed.
- (iii) **Output 3: Institutional capacity, public awareness, and urban governance strengthened.** This includes (i) establishing within CMA (a) a new state-level urban data and governance improvement cell, (b) a new project design and management center, and (c) a state-wide performance-based urban governance improvement program implemented for all 135 cities to improve financial management (audited accounts), municipal revenues (taxes and user fees), municipal administration (filling vacancies), and gender mainstreaming (gender

² Tirunelveli signed a purchase agreement for treated effluent from the proposed STP with an adjoining industrial park.

³ This pilot project will (i) produce 90% of the STP's energy requirement; (ii) reduce 72% of annual energy charges; and (iii) avoid 3,400 tons of carbon dioxide equivalent of emissions per year.

⁴ Smart water features in Tranche 1 include online automatic pressure sensors and flow meters, 100% household metered connections using DMA-based distribution management, and energy-efficient water pumps.

action plan);⁵ and (ii) public awareness campaigns on water conservation, sanitation, and hygiene implemented. Governance improvement and awareness consultants will support output 3.

5. Vellore, located in the northern part of Tamil Nadu, is a very prominent educational and healthcare hub in the Country. City has two top educational institutes in the country. It is also an industrial hub, and is a top exporter of leather goods. Existing underground sewerage system cover the core (old) city area of Vellore. At present sewerage system is provided only in the core area of the city, which covers 5.95 km² area, about 6.5% of the total municipal area and about 11% of total population. It is proposed to provide sewerage system in the remaining areas of the city in two phases (Phase I and Phase II). Phase I covers the area immediately surrounding the core city, on the southern side of Palar River. Rest of the areas in the southern and northern outskirts will be taken up for sewerage in Phase II. Under the ADB funded TNUFIP, it is proposed to develop UGSS in phase II area, covering 26% area and 41% population.

6. Proposed subproject includes: (i) sewage collection system (181.163 kilometer (km) length of sewers and 7,848 manholes), (ii) 14 lift stations/lift machine holes, (iii) 4 pump stations, (iv) 15.339 km length pumping main sewers, (v) sewage treatment plant (STP) of 50 million liters per day (MLD) capacity, (vi) 164.937 km of road restoration works; and 2.127 km length outfall sewer from STP to disposal point, and (vi) 40,675 houses service connections.

B. Purpose of this IEE Report

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

8. This IEE is based on the detailed project report (DPR) prepared by VCMC through an external DPR consultant. However, the treatment and disposal system (STP) is proposed under design-build type implementation. Accordingly, the STP under design-build contract was awarded and detailed design has been prepared by the contractor. The draft IEE is updated based on the detailed design of the treatment and disposal system, variations in the project activities and location of treated sewage disposal site and controlled blasting activities proposed now. The draft IEE was based mainly on field reconnaissance surveys and secondary sources of information. As part of the pre-construction activities the Contractors carried out baseline environmental quality studies such as surface water quality, ambient air quality and ambient noise level at various locations in the subproject area. The results are presented in the IEE and will be the basis to ensure no degradation will happen during subproject implementation. Stakeholder consultation was an integral part of the IEE, which is presented under Chapter VI.

⁵ Details are in the Facility Administration Manual and Attached Technical Assistance Report (accessible from the list of linked documents in Appendix 2).

C. Report Structure

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

- (i) Executivesummary;
- (ii) Introduction;
- (iii) Description of theproject;
- (iv) Policy, legal and administrativeframework;
- (v) Description of theenvironment;
- (vi) Anticipated environmental impacts and mitigationmeasures;
- (vii) Public consultation and informationdisclosure;
- (viii) Grievance redressmechanism;
- (ix) Environmental management plan;and
- (x) Conclusion and recommendation.

II. DESCRIPTION OF THE PROJECT

A. Project Area

10. Project area comprises Alamelumangapuram, Sathuvachari, Shenpakkam, Konavattam, Vasanthapuram, Velapadi covering 32 municipal wards (17 fully and 15 partly, out of total 60 wards) in the southern part of Palar River in Vellore City, in Vellore District in the northern part of Tamil Nadu State. Total population of subproject area is 261,881 (design base population of 2020) and has a geographical area of 23.04 square kilometer (km²).

B. Existing Sewerage System

11. At present, underground sewerage system is provided in core town area of Vellore Town covering 24 wards out of the 48 wards of the erstwhile Vellore Municipality. This system covers only about 6-7% of area and about 10-11% of population of the present municipal corporation area consisting of total 60 wards. Sewage is collected via underground sewers, conveyed to sewage treatment plant (STP) near Muthumandapam at Old Parar Bridge. The STP process is based on activated sludge process (ASP), and the capacity is 10.28 MLD. After treatment the treated wastewater is disposed into Velavadi Eri (lake/pond) in Alamelumangapuram, which is used for agricultural purpose.

12. Rest of the households depend on septic tanks and soak pits, and few households also let the sewage directly into open drains. Existing open drains carry both sullage and stormwater. The sullage from the northern part of the town is collected from the main drains along Arni road and Katpadi road which is then taken to sewage pumping station near the existing Palar water supply Head works by gravity and then taken across Palar River to its northern bank by means of pumping and finally let into the sewage farm of about 20 acres located at Virugampattu Village.

13. The sullage from the southern portion of the town is collected through drains/streams channeling through Salavanpet, Velapadi, Suriyakulam which then runs parallel to the railway line along the western corporation limit and bye-pass road and crosses the Katpadi road and let into Palar river. Wastewater accumulates at many places, resulting in breeding of mosquitoes and flies resulting in insanitary conditions. Indiscriminate disposal of wastewater from the city directly into the River Palar lead to pollution of river.

14. VCMC proposed to provide sewerage system to cover entire area of the current municipal corporation area in two phases (phase II and phase III). Phase II covers the area immediately surrounding the core city, on the southern side of Palar River. Rest of the areas in the southern and northern outskirts is proposed under phase III. In the present subproject, phase II of the sewerage system will be implemented. This covers sewerage zones of 3, 4, 5, 6 and 7, with 26% of municipal area and 41% of municipal population. In terms of municipal wards it will cover 17 wards fully (17 to 24, 26, 27, 54 to 60), and 15 wards partially (16, 25, 30, 31, 33, 35 to 41, 51 to 53).

15. Vellore City Municipal Corporation (VCMC) is the responsible agency for providing basic urban services including sewerage in the City, and is the implementation agency for this subproject. Detailed project report for the underground sewage scheme in Phase II has been prepared by VCMC through an external consultant.

C. Proposed Subproject

16. Table 1 shows the nature and size of the various components of the subproject. Location of subproject components and conceptual layout plans are shown in Figure 1 to Figure 6. 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 design with gravity flow as far as possible, however topography do not permit a complete gravity system from collection to inlet at the STP, and therefore wherever required sewage lifting and pumping stations introduced to optimize the system design.

D. Implementation Schedule

17. The subproject activities are planned to implement in three packages. Contract for Package 1, Package 2 and Package 3 were awarded on 19-12-2018 and agreement signed with the Contractors for all the packages on 7th January 2019. The contractors started mobilization of manpower and machineries and pre-construction activities in January 2019. All the works of Package 1 and 2 are scheduled to be completed by 07.01.2022 and Package 3 by 12.12.2021. The works are re-scheduled to be completed by 31.05.2025 (Package 1 and 2) and 31.05.2025 (Package 3).

18. The scope of work is revised due to the following reason.

- Due to the public objection the location of STP treated effluent disposal point is revised
- Redesigned based on actual site condition to optimize the length of pipeline as per PCB norms
- Existing Utilities obstructions like water supply, sewerage system, electric cable and lines etc.
- Obtaining clearances from Government department and agencies and connected issues

Table 1: Proposed Sewerage Subproject Components

Infrastructure	Function	Description	Location
Sewer network	Collect wastewater from houses and convey by a combination of gravity and pressure pumping to the sewage treatment plant(STP)	181.163 km 200-900 mm diameter sewers <i>m = millimeter</i> <i>m = meter</i> Manholes 7848no. (brickwork and reinforced cement concrete) Minimum distance between manholes of 30 m is adopted for sewer size up to 400 mm and larger spacing up to 60m for large diameter sewers.	Sewers will be laid underground in the roads and internal streets in the project area comprising Zone 3 to Zone 7 (Alamelumangapuram, Sathuvachari, Shenpakkam, Konavattam, Vasanthapuram, Velapadi covering 32 municipal wards). Sewer lines will be laid in the center of road by cutting black top, within the road right of way. In wider roads, like SH, NH, divided 2-way roads etc., sewers will be laid in the service roads, and where service roads are unavailable, will be laid along the edge of the road, but mostly within the black top portion. For the roads where adequate land in the road shoulder is available along the blacktop and is clear of any structures or activities, pipes will be laid in this earthen shoulder. Large diameter pipes will be laid mostly on main roads (300 – 1300 mm), while the tertiary sewers of small size (200 mm to 300 mm dia) that collect wastewater from each house will be laid in all streets in the subproject area. Trench size to bury these sewers will be of 0.8 m to 1.5 m wide and 1.2 m to 6 m deep. Some sewage pumping stations (e.g. SPS 6) is located inside a residential area and accessible by only a narrow road. There will be two pipelines (incoming and outgoing pumping mains) in the narrow road. For manholes, an area of 1.5 m x 1.5 m to 2.5 m x 2.5 m will be excavated.
Sewage lift Stations/lift machine holes	Lifting station is a small pumping station to lift the sewage to higher level and discharge into The screen arrangement is provided in the	14 nos. Components of Lift Station - Lift well of dia 2.0 m to 2.5 m and depth 5 – 7.5m - Non-clog submersible pumpsets - Control panel box 4 Lift Station have one suction well each (LS-8, LS-10, LS-11, LS-12), and 3 have two suction wells each (LS-7, LS-9, LS-12a)	Lift well will be constructed on the road (like manhole) where the sewer ends terminates into the lift well. Pumps will be installed in the well, and a control panel box will be installed near the well. Lift stations are proposed at following locations: - LS7: Ward No. 18, Ponnamman Nagar, Sathuvachari - LS8: Ward No. 57, Ragavendra Nagar, Shenpakkam - LS9: Ward No. 57, Bhathma Colony, Shenpakkam - LS10: Ward No. 57, Near Bus Depot, Konavattam - LS11: Ward No. 56, Near Shoe Company, Konavattam - LS12: Ward No. 56, Near Subramanya Iyer, Street, Vasanthapuram - LS12a: Ward No. 56, Periyar Nagar, Dhidir Nagar

	previous manhole to the lift station.		
Sewage pumping stations (SPS)	Collect sewage and pump to main pumping stations	4 nos. Components of SPS - Inlet chamber length (2 – 3.5 m), width (1.5 m) and depth (2.3 – 4.3 m) - Screen chamber length (4 – 4.5 m), width (2 - 3.5 m) and depth (2.3 – 5.3 m) - Gritwell Dia (4.5 – 8 m) and depth (3.3 – 6.3) m) - Suctionwell Circular at SPS 3 Dia (5.5 – 6 m) and depth (6.6 – 8.7 m) Rectangular at SPS 4, 5 and 6 length (9.5 – 15.5 m), width (6 - 12 m) and depth (8.4 – 9.6 m) - Pump room (3 x 2m²) - Non-clog submersible pumpsets	Sewage pump stations are proposed at following locations: - SPS-3: Alamelumangapuram - SPS-4: Vasantham Nagar, Sathuvachari, - SPS-5: Solid Waste Management Segregation Shed, Sathuvachari - SPS-6: Shenbakkam SPS-7 Velapadi: CMSC reviewed the Design report and Bid document drawings of sewage collection system of Zone 6 and 7. The SPS 7 is located in zone 7 and sewage is pumped into RMH 1712 through 300mm dia 1090 m length in the pumping main. From the drawing of the collection systems it has been revealed that SPS 7 can be deleted since ground profile of Zone 6 is sloping towards manholes 1718. The sewage pump zone 7 is proposed to be conveyed by gravity to zone 6 at manholes 1718. 500mm dia gravity main 1220m length from manhole 492 to manhole 1718 with 1 in 700 gradient the depth of cut will marginally increase however there will be overall savings in the capital cost of Rs 2.29 Crores. The annual O&M cost for operating the SPS is also calculated and there will be savings of Rs. 0.76 Crores/year. Hence it is decided to delete SPS 7 SPS from scope of work. The updated IEE will be made available at public locations and will be disclosed in websites of ADB, VCMC, and TNUIFSL
Pumping main sewers	Transfer sewage from SPS to another SPS or to STP	15.339 km 300-800 mm diameter Cast Iron sewers	Pumping main will be laid along the main roads, and the internal roads connecting sewage pumping stations and STP. Sewers will be laid underground in the road carriage way. Pumping main from SPS 6 will be laid partly along the bank of Palar River. Two pumping mains from SPS 5 and SPS 6 will carry sewage to STP, which is located on the northern side of Palar, over a pipe carrying bridge to be constructed across Palar River.
Sewage Treatment Plant (STP)	Treatment of collected wastewater to comply with disposal standards	New STP of capacity 50 MLD Design process: SBR (sequential batch reactor). The Design-Build contractor has finalized the design of STP after the award of contract. As per the detailed design, the Components of STP are: - Receiving chamber - Coarse Screen chamber - Detroiter - Flow Measuring chamber - SBR Tanks - Air Blower Rooms - Final Effluent chamber - UV Disinfection - Outlet Pipe - Sludge Balancing Tank	Site is located at Viruthampattu on the northern (left) bank of River Palar STP site is located adjacent to a solid waste management (segregation) facility. There are agricultural lands between the river and the site. Housing development is in the north and the nearest house is at about 50 m. Site is vacant and covered with shrubs and bushes. Site is accessible by an existing road. Treated sewage was proposed to dispose into Pandiyan Channel, which is an overflow channel of Kalinjur lake. Water is used for irrigation. Due to lack of permission for disposal of treated sewage into Pandian Channel, the location of disposal site is shifted to Palar River at Kangeyanallur near the burial ground about 2.127 km from STP.

		• Filter press Platform • Screw Pump/Blower House • PLCC, DG, Main Panel & Transformer Room • Road Works • Storm Water Drains • Pathways • Administration & Lab building • Landscaping • Security Cabin • Staff Quarters ▪ Compound Wall	
Outfall sewer	Disposal oftreated water from STP into Palar River	2127m length800mm diameter gravity main	Pipes will be laid from STP to Palar River at Kangeynallur near the burial ground about 2.127 km from STP.aid in the internal roads, and then along public road to the disposal point.
House service connections	Collect sewagefrom individual houses and convey intonetwork	• 40675	At each household, connected to wastewater outlet drain

Figure 1: Location of the Subproject



Figure 2: Proposed Sewerage Scheme Phase II in Vellore

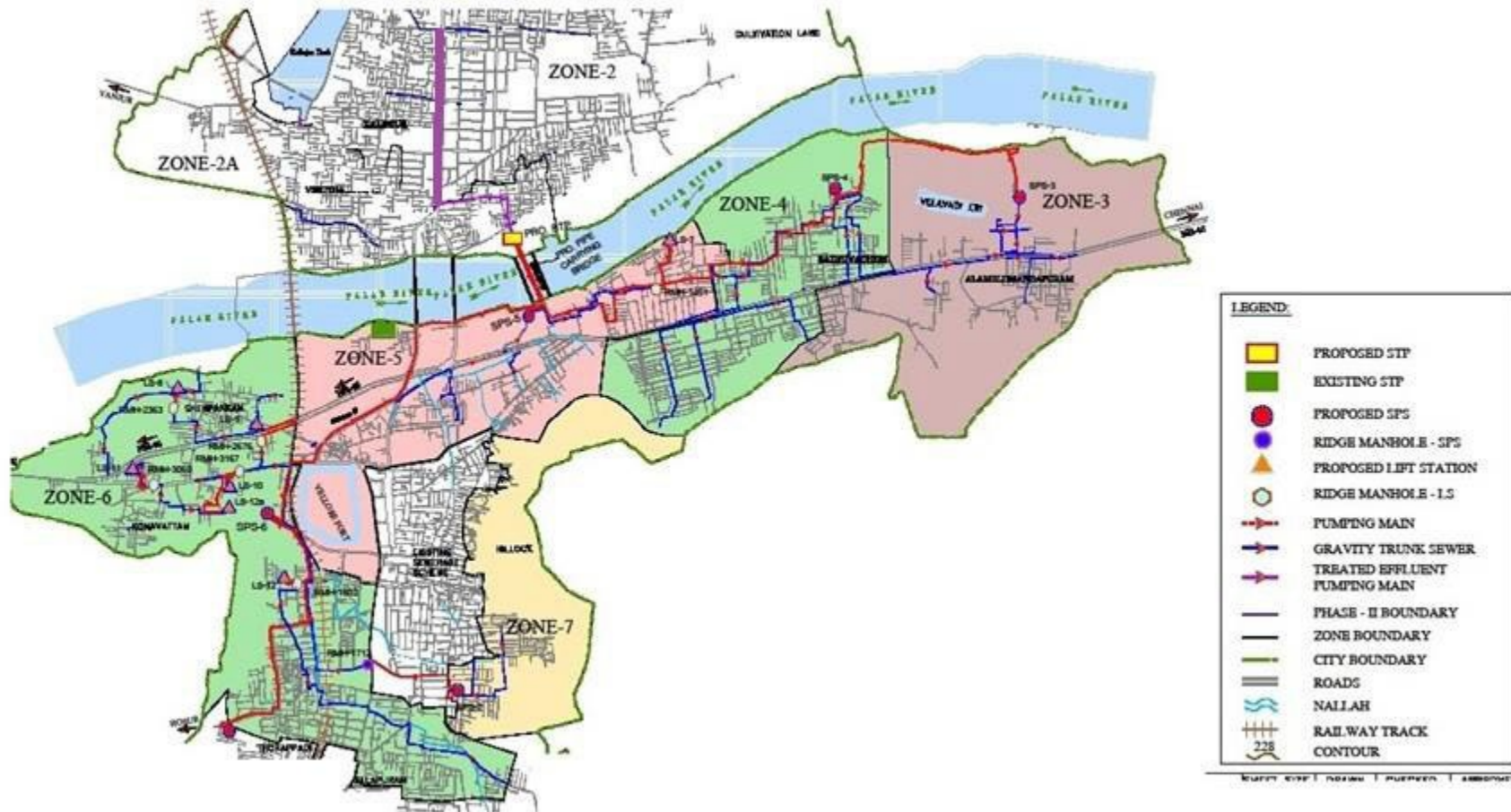


Figure 3: Pumping Main Pipe Bridge Alignment on Palar River

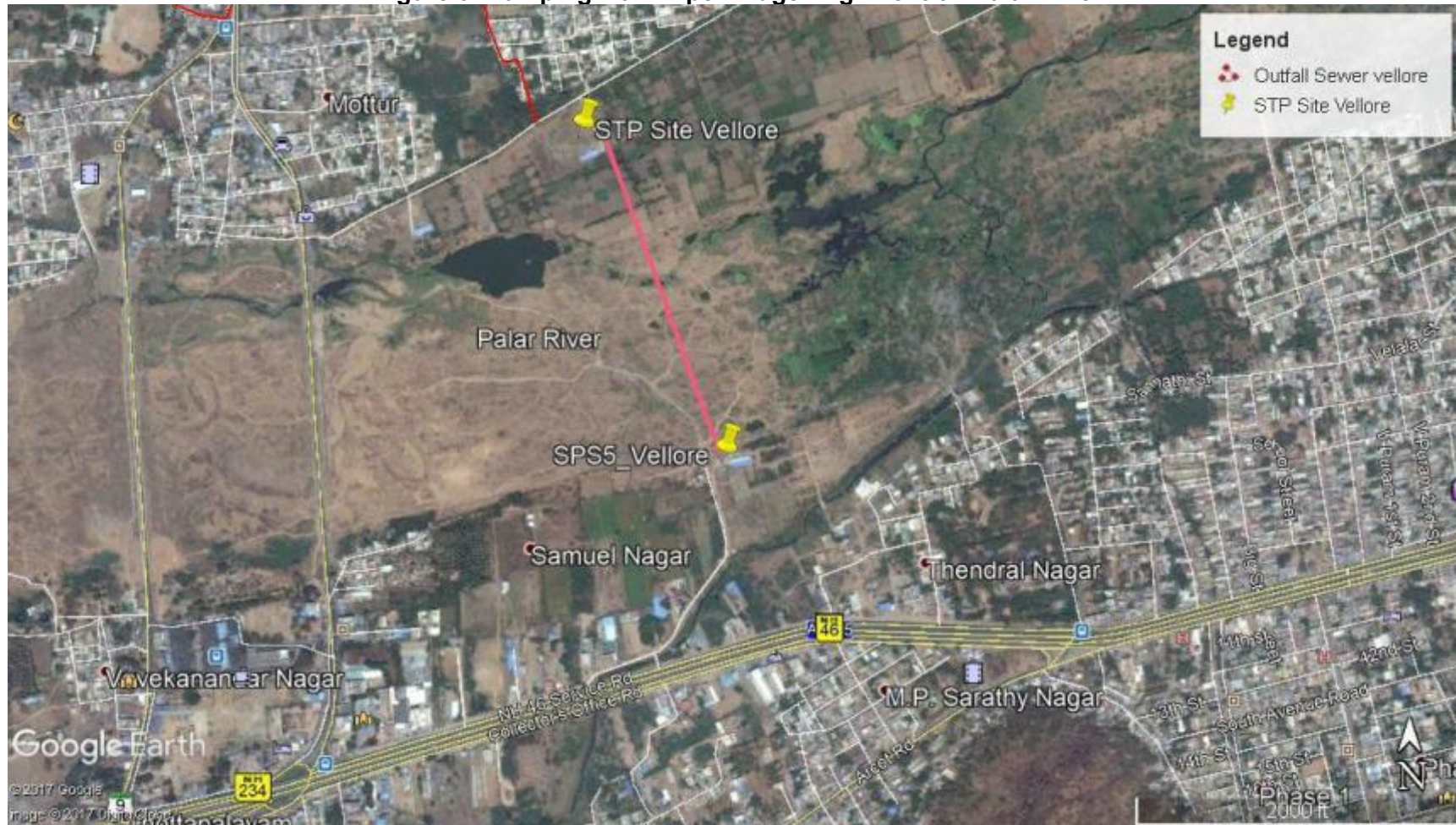


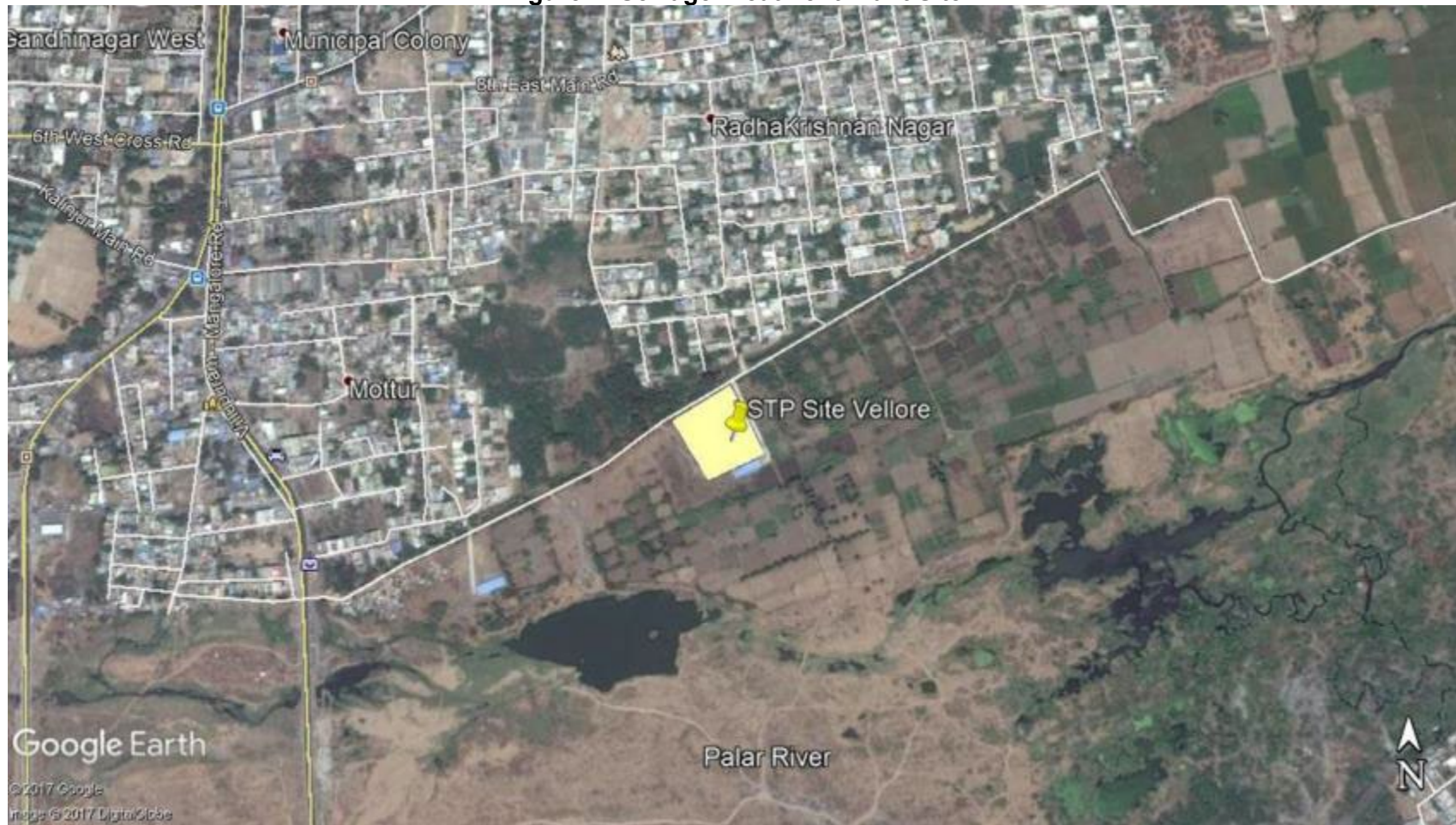
Figure 4: Sewage Treatment Plant Site

Figure 5: Revised Location of Outfall Sewer from Sewage Treatment Plant



Figure 6: Revised Location of Treated Sewage Outfall at Palar River in Revenue Map

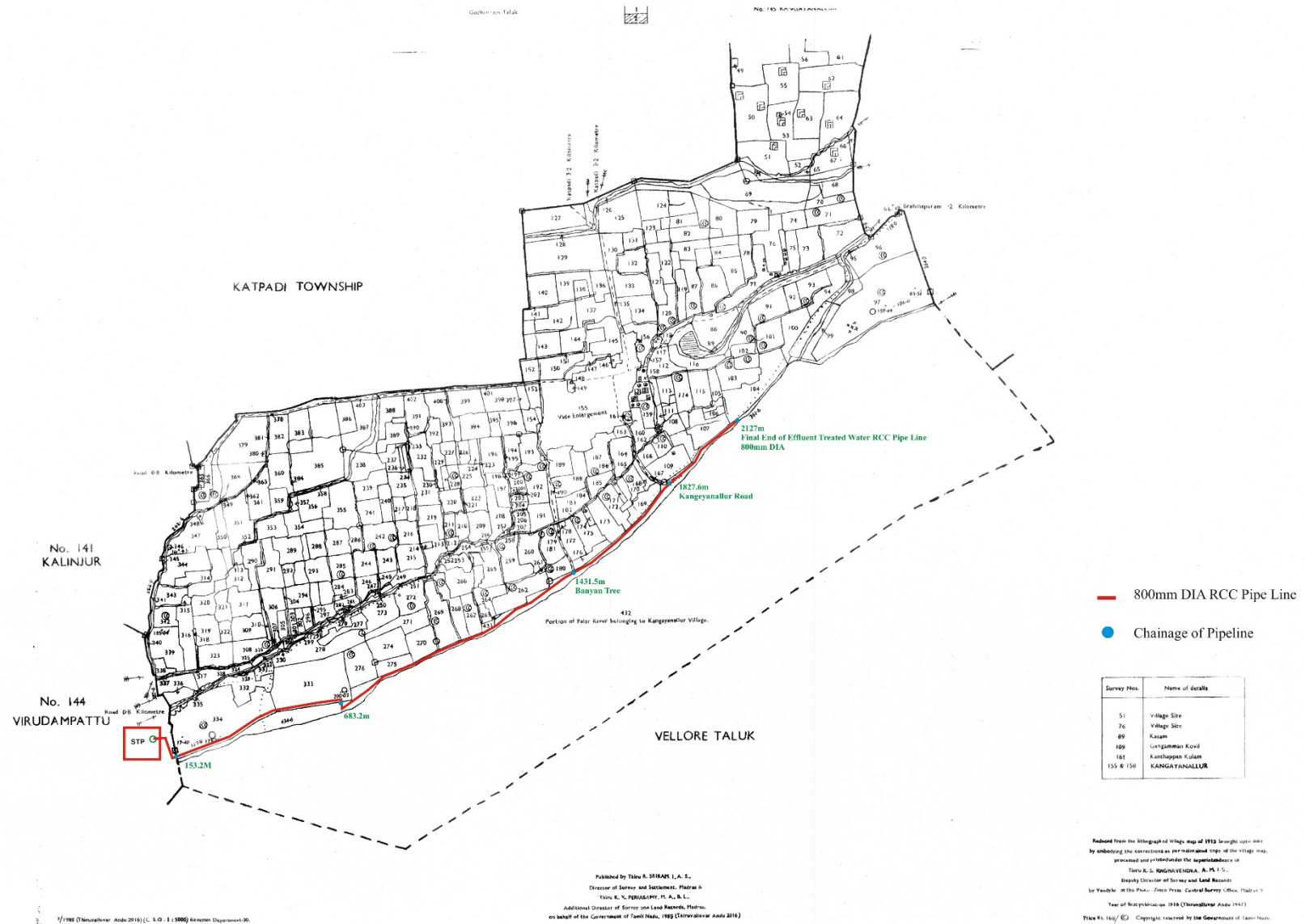
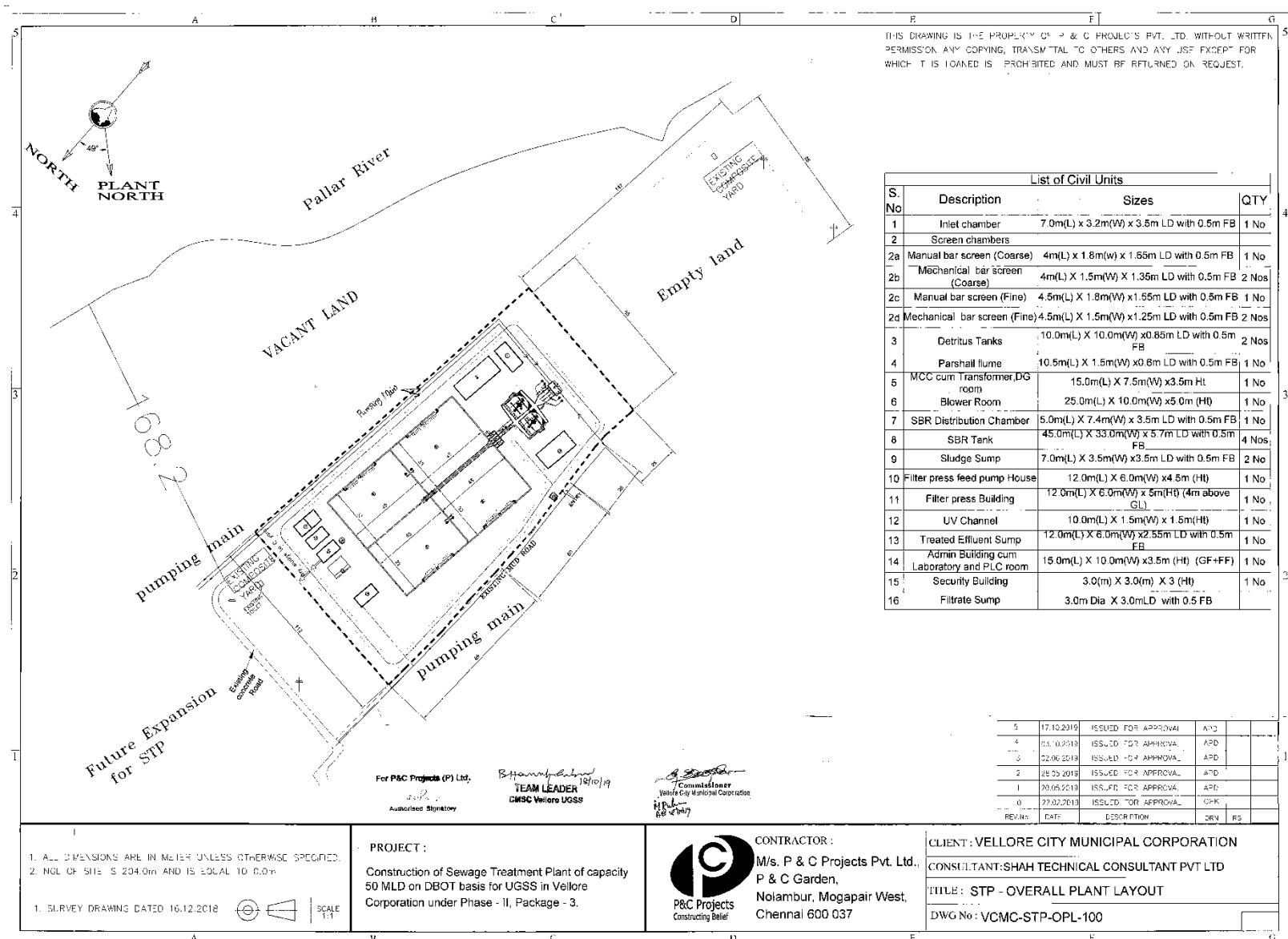


Figure 7: Layout of Sewage Treatment Plant



III. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. ADB Policy

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

20. **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).

21. **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.

22. **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

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

24. Category A projects require Environmental Clearance from the central Ministry of Environment, Forests and Climate Change (MoEF&CC). 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 MoEF&CC prepares comprehensive terms of reference (TOR) for the EIA study. On completion of the study and review of the report by the EAC, MoEF&CC considers the recommendation of the EAC and provides the environmental clearance if appropriate.

25. 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.

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

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

Table 2: Applicable Environmental Regulations

Regulation	Description	Requirements	Status
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.	Sewage treatment plant STP requires CTE and CTO from TNPCB. Application has to be submitted online at http://tnocmms.nic.in/OCMM/S/	Consent to Establish obtained. Valid upto 31-03-2024 (Consent No. 1901121969000 dated 12/12/2019). CTE renewal obtained with validity upto 31 st March 2026;
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 100 meters (m) around the monument as prohibited area and 100 to 300m as regulated area for construction works; - No excavation/construction work is allowed within 100 m of boundary of the protected monument; - Requires prior permission of National Monument Authority (NMA) for taking up works within 300 m of the boundary of protected Monuments.	There are three protected monuments in Vellore: Fort, Old Mosque In The Fort, and Jalkanteswara Temple also located in the Fort. City is developed around this Fort, and there are residential areas all around. One pumping station and (SPS 6), and sewer lines in the adjoining area of the Fort fall within 300 m regulated buffer from the boundary and therefore require prior permission of NMA	Obtained vide order No. 1656/NMA/CA(TN)/2019/154 dated 5-10-2020; valid upto 4-10-2023.
Environment (Protection)	Emissions and discharges from the facilities to be created or refurbished or augmented shall	To comply with applicable notified standards	

Act, 1986 and Environment (protection) Rules 1986	comply with the notified standards		
Noise Pollution (Regulation and Control) Rules, 2000 amended up to 2010.	Rule 3 of the Act specifies ambient air quality standards in respect of noise for different areas/zones.	To comply with the noise standards.	Generators complying with the noise standard is proposed to be installed at all sites.
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.	As per the revised categorization of industries (TNPCB order dated 2-8-2016), diesel generators below 1000 kVA is kept outside the preview of Consent Administration. Necessary action will be initiated once the design of generators were finalised
Municipal 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	Not applicable to the subproject
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.	Not applicable to the subproject
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	Disposing the excess soil and construction wastes at VCMC approved sites
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	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.	All contractors obtained Labour License and Labour Insurance

	wages and benefits to men and women for work of equal value or type.		
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Table 3: Effluent Disposal Standards of Sewage Treatment Plants Applicable to All Modes of Disposal

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

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

Note :

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

28. The National Green Tribunal (NGT) had vide order dated 30-04-2019 in specified the following standard to be achieved by the new and existing sewage treatment plants and instructed MoEF & CC to issue appropriate notification in this regard.

Table 4: Effluent Standard Specified by NGT

Sl. No.	Parameter	Unit	Standard (Applicable to all Mode of Disposal)
1	pH		5.5 – 9.0
2	Biochemical oxygen Demand (BOD)	mg/l	10
3	Total Suspended Solid (TSS)	mg/l	20
4	Chemical Oxygen Demand (COD)	mg/l	50
5	Nitrogen – Total	mg/l	10
6	Phosphorous-Total (For Discharge into Ponds, Lakes)	mg/l	1.0

7	Fecal Coliform(FC) (Most Probable Number per 100ml (MPN/100ml)	MPN/100ml	100 (Desirable) 230 (Permissible)
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29. Tamil Nadu Pollution Control Board which is empowered to specify more stringent standards as per section 5 of Environment Protection Act 1986 has stipulated the above standards while issuing consent to establish for STP. Hence this standard has been considered for the design of STP and will be complied with for disposal of treated sewage.

Table 5: Standards for Sludge Reuse as Manure

Standards for Composting. As there are no specific standards notified for sludge reuse, the compost quality standards notified under the Solid Waste Management Rules, 2016 (Schedule IIA, 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
Cadmium	mg/kg	5	5
Chromium		50	50
Copper		300	300
Lead		100	100
Mercury		0.15	0.15
Nickel		50	50
Zinc		1000	1000
C/N ratio		<20	<20:1
PH		6.5 – 7.5	(1:5 solution) maximum 6.7
Moisture, percent by weight, maximum		15.0 – 25.0	25.0
Bulk density (g/cm ³)		<1	Less than 1.6
Total Organic Carbon, per cent by weight, minimum		12	7.9
Total Nitrogen (as N), per cent by weight, minimum	percent by weight	0.8	0.4
Total Phosphate (as P ₂ O ₅) percent by weight, minimum	percent by weight	0.4	10.4
Total Potassium (as K ₂ O), percent by weight, minimum	percent by weight	0.4	-
Color			
Odor		Absence of foul Odor	

Standards for Composting. As there are no specific standards notified for sludge reuse, the compost quality standards notified under the Solid Waste Management Rules, 2016 (Schedule IIA, 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)
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.

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

Table 6: Clearances and Permissions Required for Construction

S. No	Construction Activity	Statutory Authority	Statute under which Clearance is Required	Implementation	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 program implementation unit (PIU)	PIU
2	Tree Cutting	Department of Forest and District Collector	Clearances from the authorities as per the Tamil Nadu Timber Transit Rules, 1968 or latest.	PIU	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
6	Sand mining, quarries and borrow areas	Department of Geology and mining, Government of Tamil Nadu (GoTN)	Not applicable Contractor to obtain material from the existing government licensed mines / quarries; Contractor will require prior approval of PIU for obtaining material from a particular source. PIU to review and approve only existing licensed mines	Contractor	PIU
7	For establishing new quarries and borrow areas	MoEF&CC	Not applicable. No new quarries/borrow areas will be created for the subproject.	Contractor	PIU
8	Groundwater extraction	Public Works Department	(Groundwater) Tamilnadu Groundwater Development and Management Act 2000	Contractor	PIU
9	Disposal of bituminous wastes	Tamilnadu State Pollution Control Board	Hazardous Wastes (Management and Handling) Rules. 1989	Contractor	PIU
10	Temporary traffic diversion measures	-	MoRTH 112 SP 55 of IRC codes	Contractor	PIU
11	NOC for Controlled Blasting for excavation	District Collector, Vellore	Explosives Rules, 2008	Contractor	PIU

31. **ADB SPS 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 7: WHO Ambient Air Quality Guidelines

Table 1.1.1: WHO Ambient Air Quality Guidelines ^{7,8}		
	Averaging Period	Guideline value in $\mu\text{g}/\text{m}^3$
Sulfur dioxide (SO_2)	24-hour	125 (Interim target-1) 50 (Interim target-2) 20 (guideline)
	10 minute	500 (guideline)
Nitrogen dioxide (NO_2)	1-year	40 (guideline)
	1-hour	200 (guideline)
Particulate Matter PM_{10}	1-year	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline)
	24-hour	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $\text{PM}_{2.5}$	1-year	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline)
	24-hour	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

Table 8: World Bank Group's EHS Noise Level Guidelines

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

IV. DESCRIPTION OF THE ENVIRONMENT

A. Methodology Used for Baseline Study

32. **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.

33. The literature survey broadly covered the following:

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

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

B. Physical Resources

1. Location, Area and Connectivity

35. Situated in the northern part of Tamil Nadu, about 135 km northwest of capital city Chennai, Vellore is an important city providing one of the best education and healthcare facilities in the country. Vellore has two of India's top most educational institutes in India—Christian Medical College (CMC) and Vellore Institute of Technology (VIT). This city serves as the District Headquarters of Vellore District. Geographically, the city lies between 12°15' to 13°15' North latitudes and 78°20' to 79°50' east longitudes, on the southern bank of River Palar, but, presently, due to urban expansion the municipal corporation area falls on both sides of the river,

36. Vellore Municipality was constituted way back in 1866 under the provisions of Town Improvement Act, 1865 and it was upgraded as Corporation in 2008. Vellore City Municipal Corporation area spreads over an area of 87.92 km² with a population of 5.02 lakh as per 2011 census. The constituent parts of Vellore City Municipal Corporation (VCMC) are: Vellore city and the two erstwhile municipalities (Sathuvachari and Dharapadavedu), six town panchayats (Katpadi, Gandhi Nagar, Allapuram, Thorapadi, Shenbakkam, and Kalinjur) and nine village panchayats (Alamelumangapuram, Viruthampattu, Kangeyanallur, Virupatchipuram, Palavanchathu, Edyanchathu, Ariyur, Chitteri and Konavattam). VCMC is divided into 60 municipal wards.

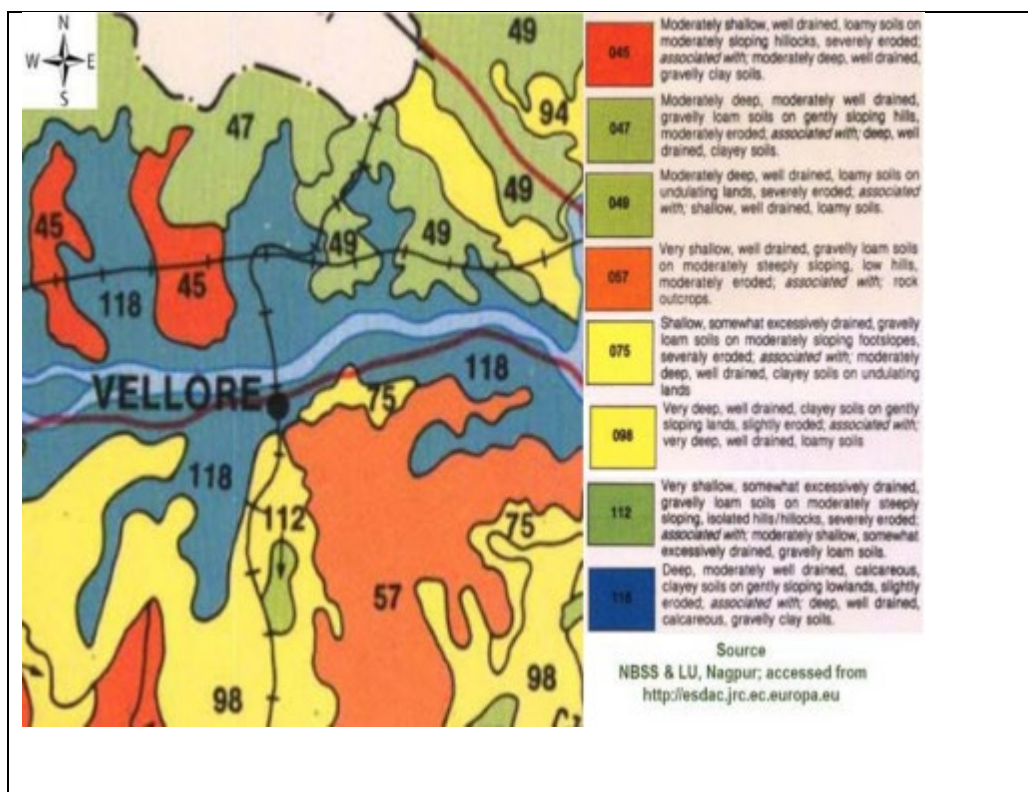
37. Vellore has a well-developed transport infrastructure and is well connected by Road and Rail with most cities and towns in India. National highways NH234 and NH46 crisscross the city. Vellore city has three railway stations, namely Katpadi junction, Vellore Cantonment and Vellore Town connecting the city to Chennai, Bangalore, Tirupati and Trichy. Nearest airports are at Chennai (130 km), Bengaluru (200 km); and Tirupati (100 km).

2. Topography, Soils and Geology

The topography of Vellore city is mostly plain with slight slope from west to east. It is surrounded by hilly terrain in the eastern and south parts. The landscape in the hilly terrain is undulating to rugged, flanked by hill ranges belonging to

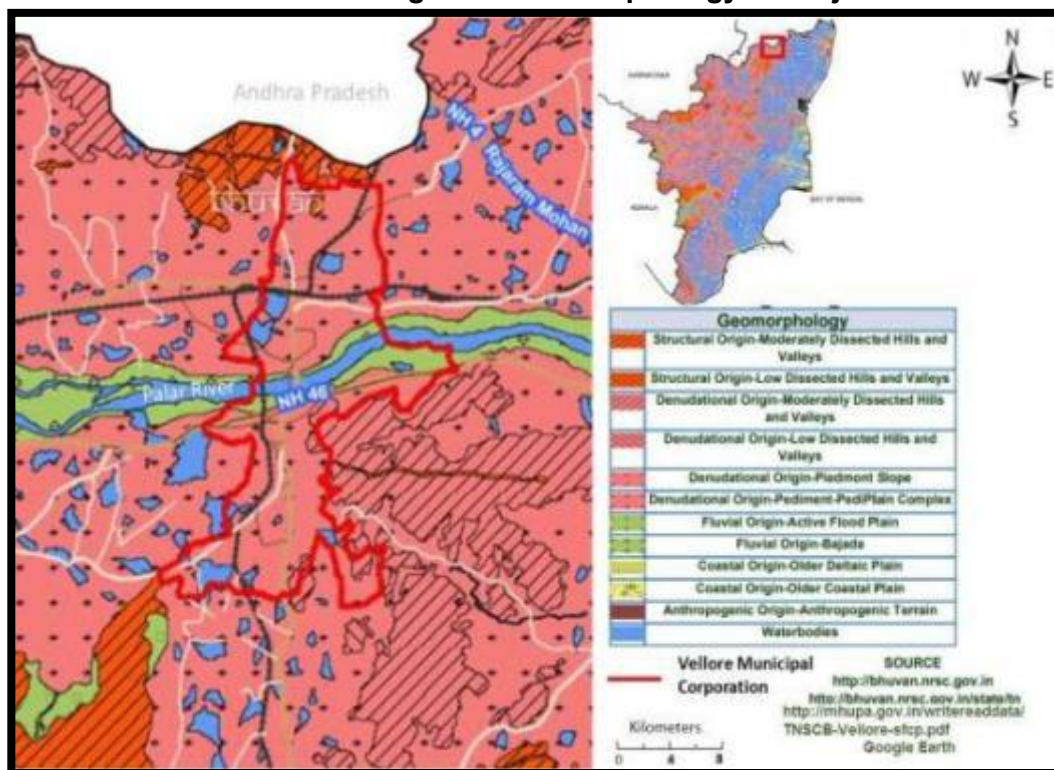
Eastern Ghats. Soils in the region have been classified into: (i) Sandy soil, (ii) Sandy loam, (iii) Red loam, Clay, (v) Clayey loam, and (vi) Black cotton soils. Black loam soil is found in parts of Vellore Taluk. Gravelly clayey soils are found in most parts of the city and along river Palar. In the southern parts of the city loamy soils are found.

Figure 8: Soil Types in the Project Area



Geologically, the area is classified into hard rock and sedimentary formations. The Hard rock formations found in the region are the oldest rocks of the earth crust. They are azoic, crystalline and extremely contorted. Most common hard rock formations in the region are gneisses and charnockite. Sedimentary deposits are found along Palar River which are transported by running water mainly along the course as isolated patches.

Figure 9: Geomorphology of Project Area



32. Geotechnical investigations conducted during the detailed design indicate that the top layer, varying from 1.5 m to 3.5 m, is characterized by soil, and hard rock encounters at the a depth of 4.5 m to 5 m. These two layers sandwich soft disintegrated and medium dense rocks. There are no known or reported cases of land subsidence in or close to the subprojectarea.Hard rock is encountered/anticipated at SPS 5 site, 280 deeper manhole sites and 280 sewer lines in Package 1 area and 155 deeper manhole sites and 145 sewer lines sites and certain part of pumping mains in Package 2 area. Hard rock is not encountered in Package 3 area. The details of sites at Package 1 and Package 2 area are presented in Table below. The area requiring controlled blasting are shown in Fig 9 to 14. It is estimated that about 1.470 km and 6.390 km of sewer lines requires controlled blasting in Package 1 and Package 2 area respectively

Table9: Subproject Area Requiring Controlled Blasting for Hard Rock Removal

UGSS Phase-II, Package -1						
Area Requiring Controlled Blasting						
S.No	Zone	Ward No	Area	Street Name	No MH	No Line
1	Zone - 3	21	Alamelumangapuram	Chenganathan Road	10	10
		21		Alagiri Nagar	5	5
		21		Nada Parai	10	10
2	Zone - 4	22	Vallalar	Thirivika Nagar	5	5
		19		Double Road	150	140
		19		Bhagith sing Street		
		19		Dr.Abdul Kalam Street		
		19		Sekilar Street		
		19		Nakeeran Street		
		20	Sathuvachari	Nethaji Nagar		

		20		Nethaji Nagar, 10th Street		
		20		Nethaji Nagar, 7th Street		
		20		Avvai Nagar, 1st Street		
		20		Rangapuram, Phase-4		
		20		Rangapuram, New Street		
		20		Rangapuram, 5th Street		
		20		Ranga Nagar, School 1st Street		
		20		Shakthi Nagar		
		20		Joseph Nagar		
3	Zone - 5	17		Mariyamman Kovil Street	100	110
		17		CMC Colony, 4th Street		
		18		Ragavendra Nagar		
		17		Thendral Nagar		
		17		J.P.Salai		
		18		Vallalar Street		
			Total		280	280(1.470 km)
UGSS Phase-II, Package -2						
Controlled Blasting Details						
S.No	Zone	Ward No	Street Name	No MH	No.of Line	
1		60	Thendral nagar street	2	2	
2		60	Parai medu	4	3	
3		57	para raja gopal 8th street	2	3	
4		56	Jaffar saib street	7	6	
5		56	Raja muthu street	4	4	
6		56	Bajal koil street	30	35	
7		60	Pillair koil street	5	3	
8		56	Arasamara street	2	2	
9		56	pookara street	11	11	
10		56	Ponniyamman nagar	8	8	
11		56	Konavattam masjid street	3	3	
12		56	pattai street	7	7	
13		56	Abdul kalam street	2	2	
14		56	Madhina Thamaraikulam street	15	15	
15		56	Madhina nagar, 7th street	2	2	
16		55	Kasba, Bayer Line Street	11	11	
17		55	Jony Ponthottam	20	15	
18	Zone-7	36 & 37	Ashok nagar	10	6	
19			Ashok nagar	10	7	
			Total	155	145 (6.390 km)	

Figure 10: Hard Rock Area Requiring Controlled Blasting in Package 1, Zone 3

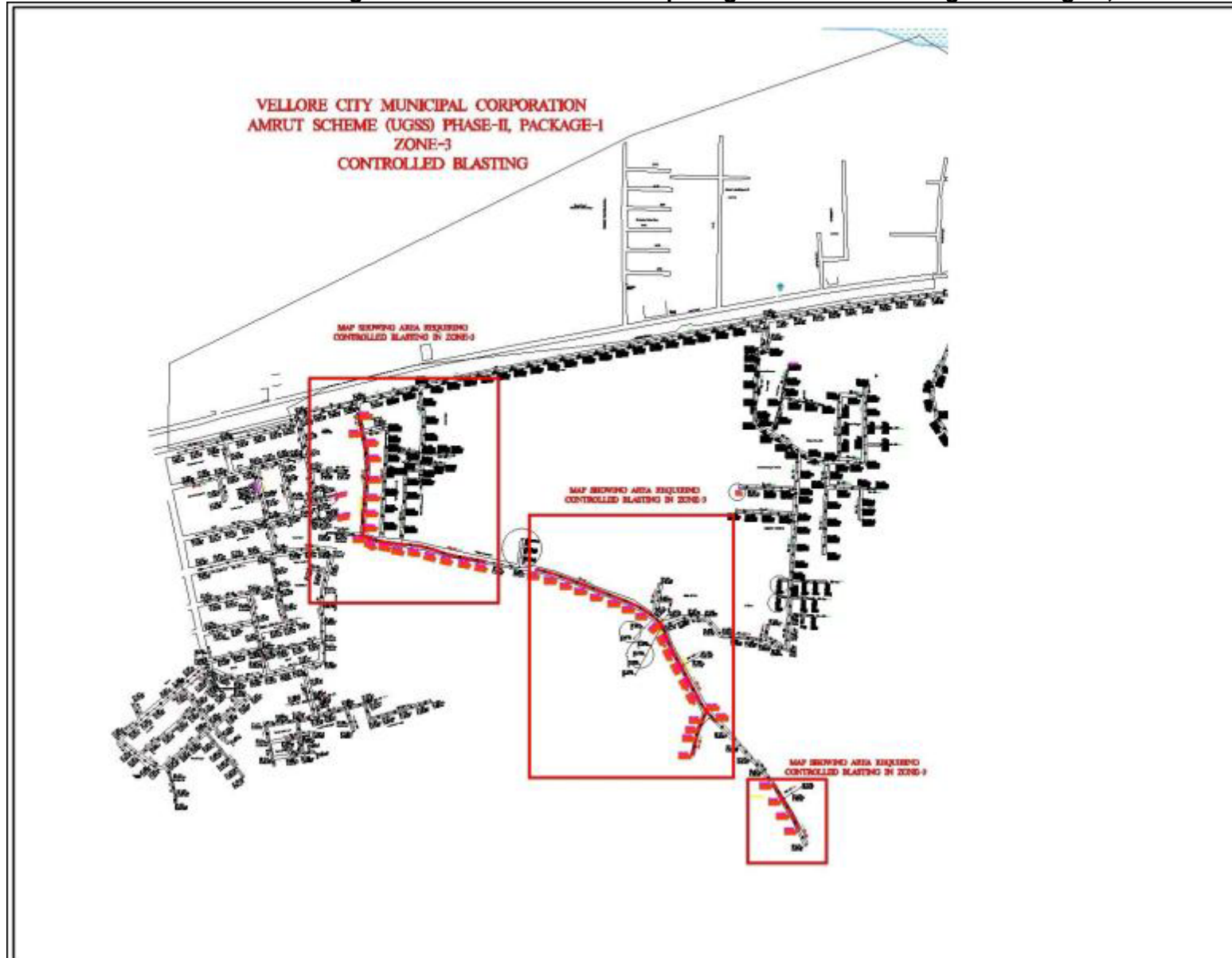


Figure 11: Hard Rock Area Requiring Controlled Blasting in Package 1, Zone 4

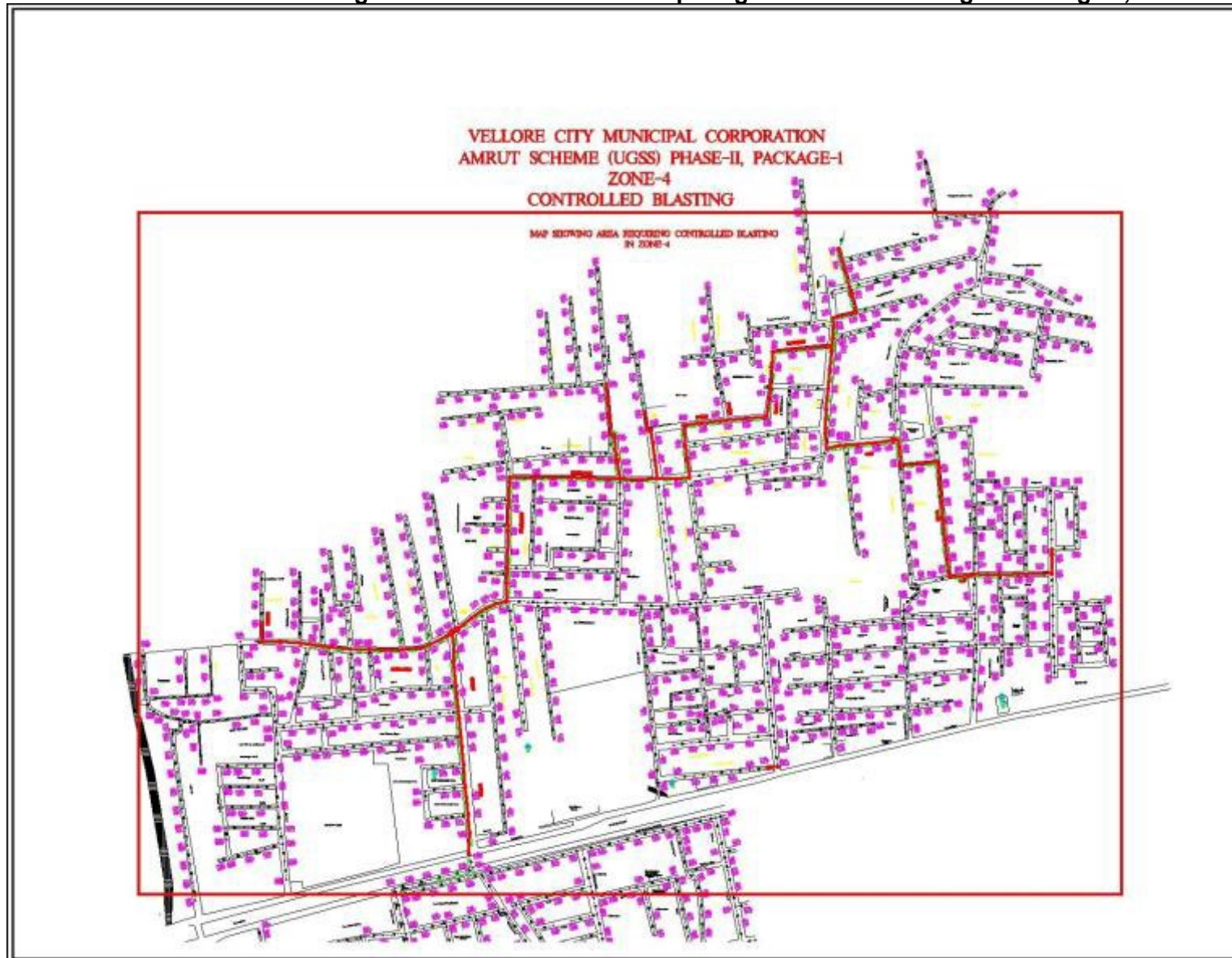


Figure 12: Hard Rock Area Requiring Controlled Blasting in Package 1, Zone 5

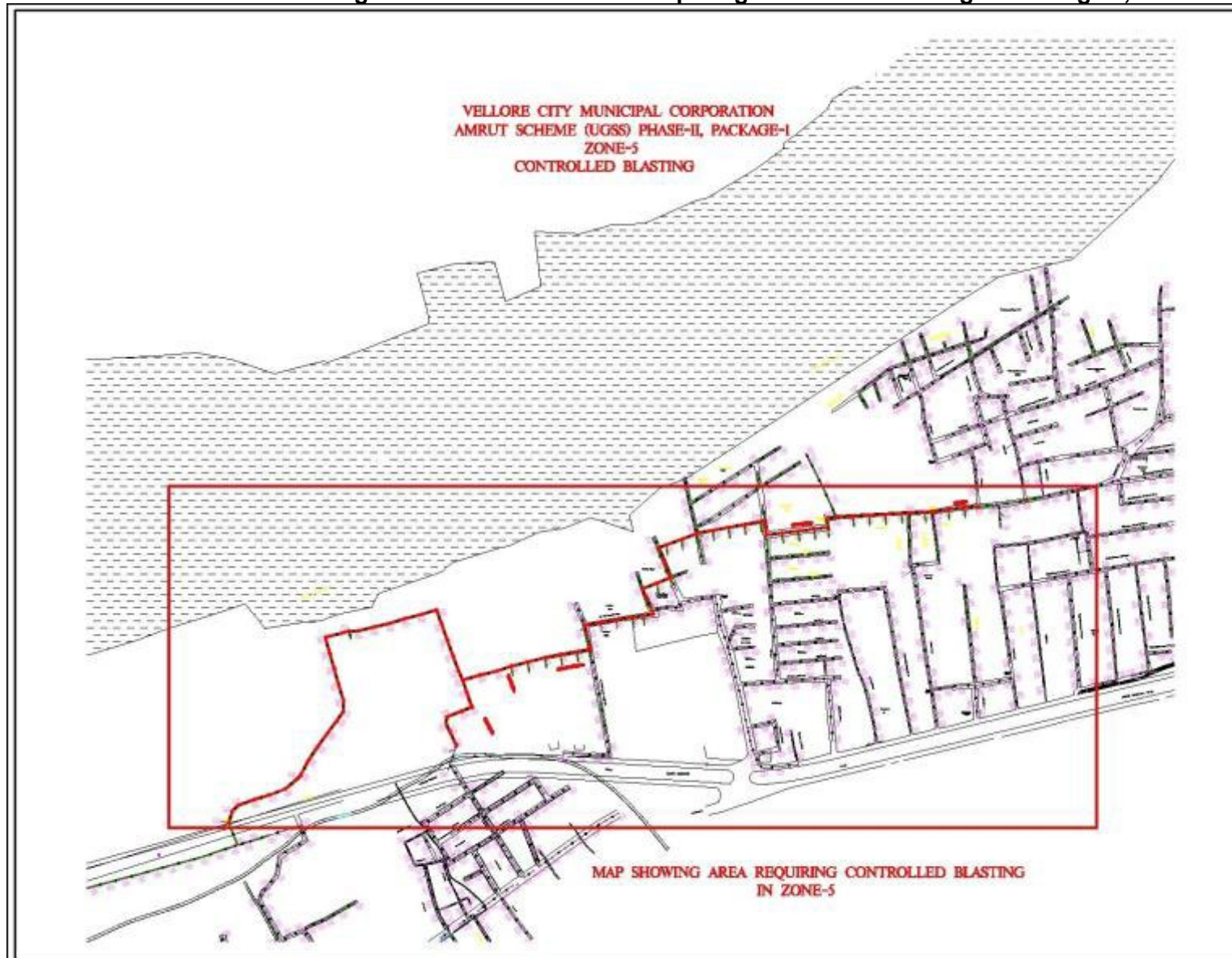


Figure 13: Hard Rock Area Requiring Controlled Blasting in Package 2, Zone 6

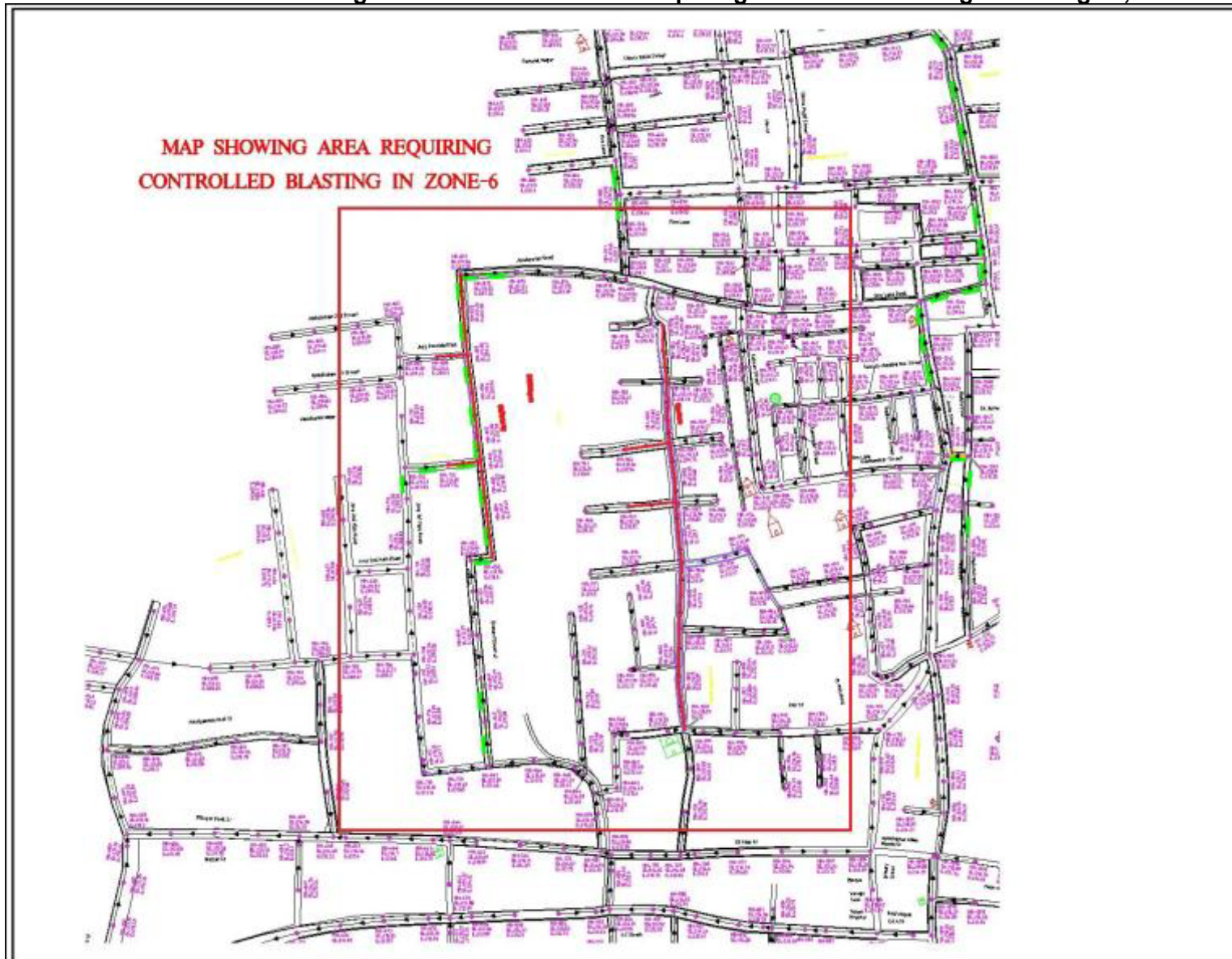


Figure 14: Hard Rock Area Requiring Controlled Blasting in Package 2, Zone 6 – 2

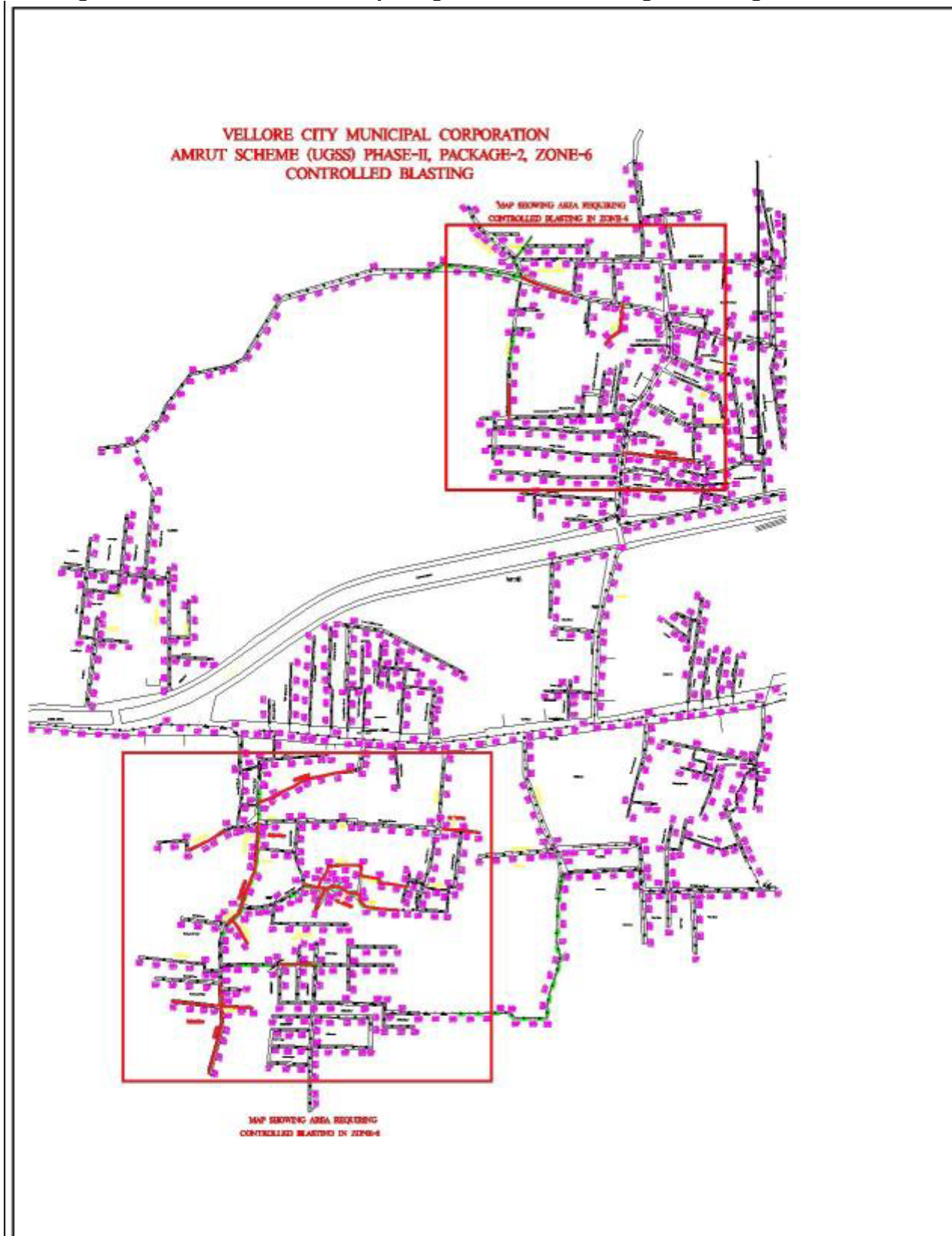
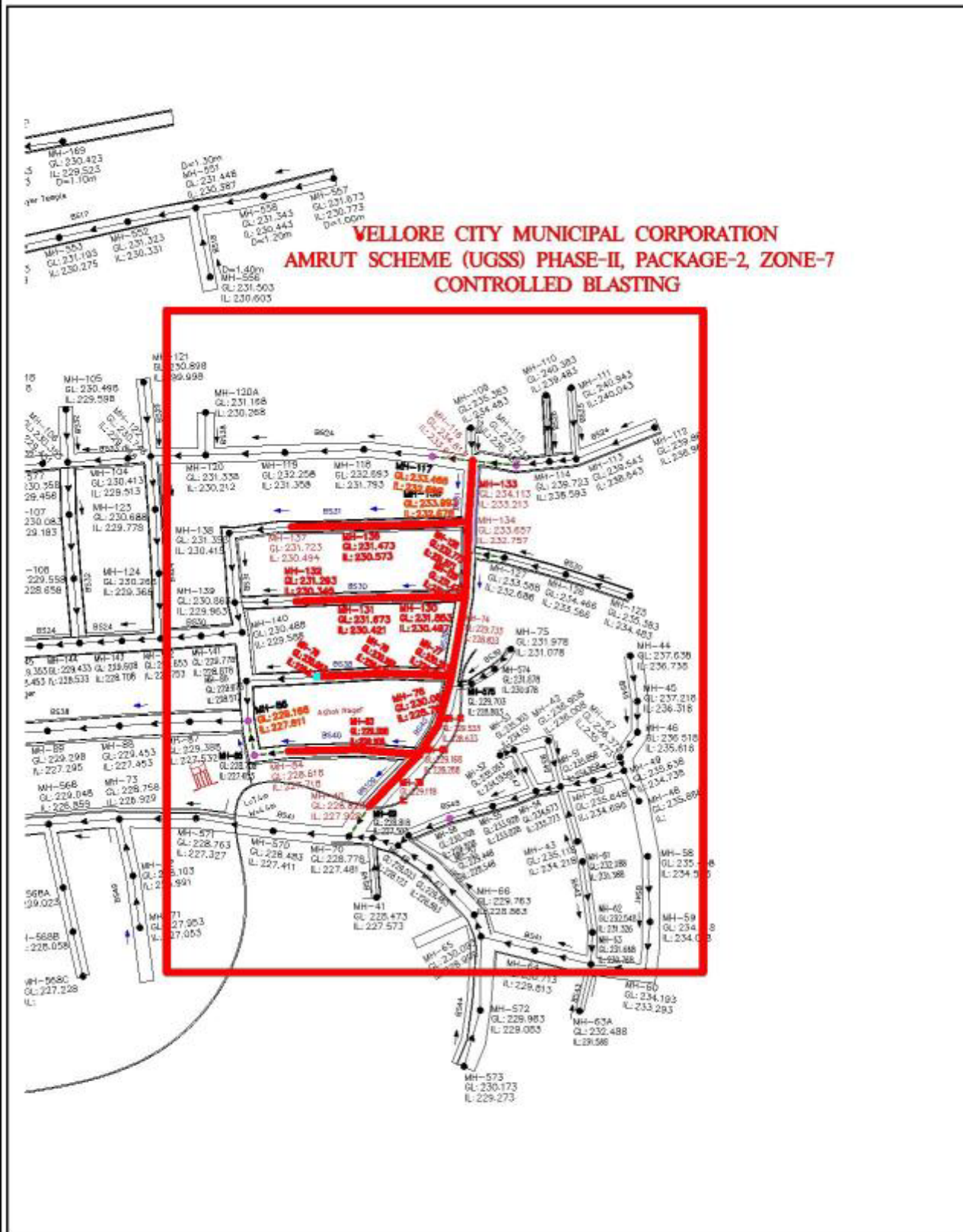


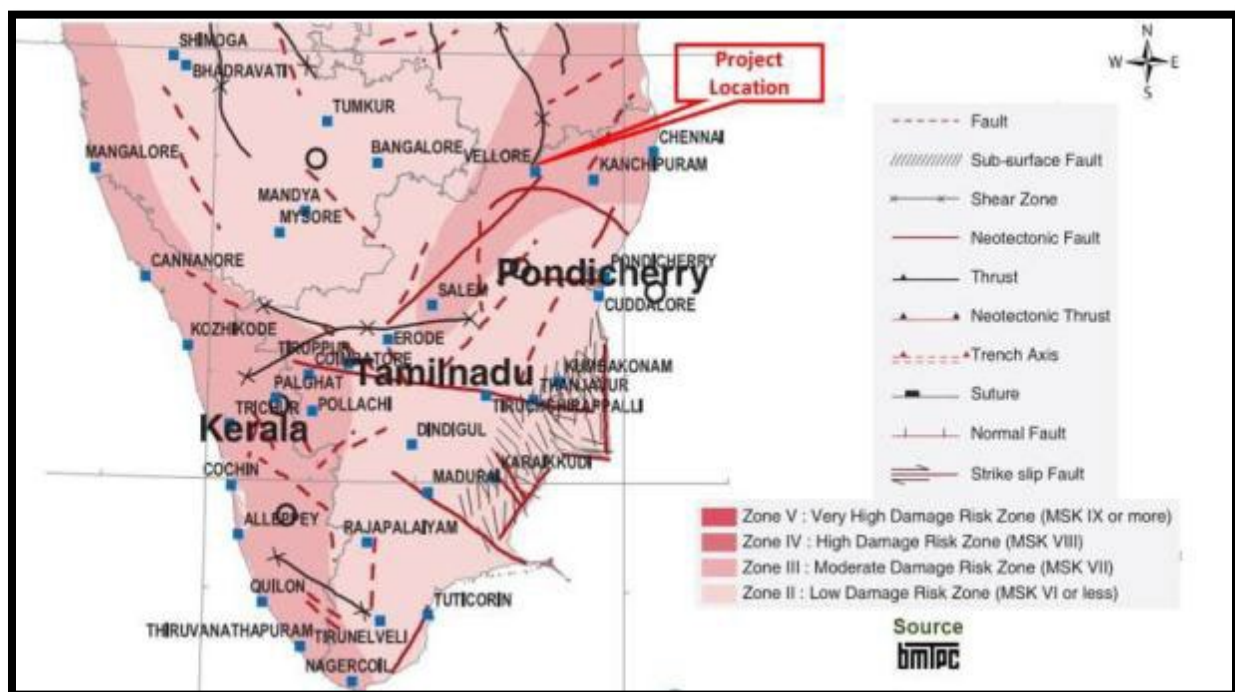
Figure 15: Hard Rock Area Requiring Controlled Blasting in Package 2, Zone 7



3. Seismology

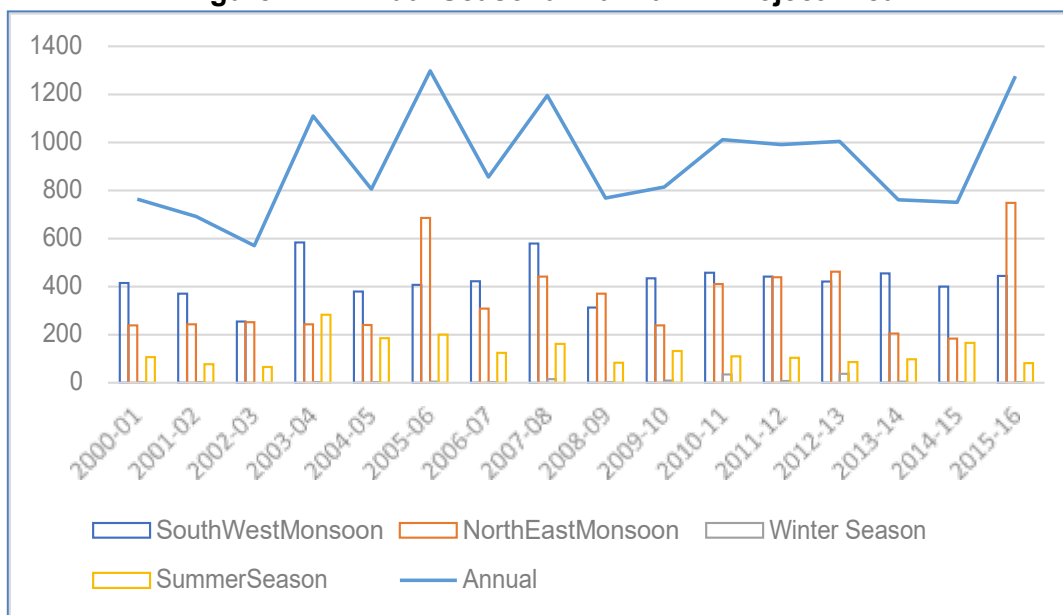
33. According to Bureau of Indian Standards (BIS) [IS 1983 (Part I): 2002], Vellore town falls under Zone III and on the macro seismic intensity scale the project area falls under MSK VII (Moderate Damage Risk Zone). Structural design of infrastructure elements will be done with due consideration to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

Figure 16: Seismic Zone of Project Area

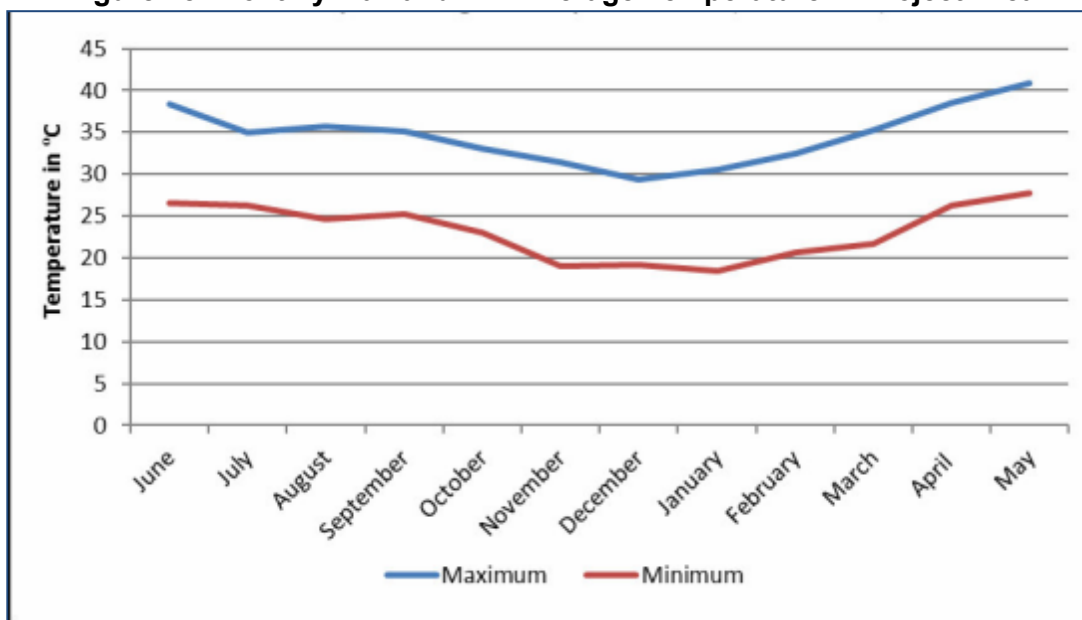


4. Climatic Conditions

34. Vellore is in tropical zone, away from the sea and has an elevation of 220 m above the mean sea level (msl), hence the town experiences dry and hot climate. The average temperature drops to around 18°C during November–January and during April–June reaches 40°C. In summer the humidity ranges between 40%–63% and in winter it rises to 67%–86%. The average annual rainfall is 996.7 mm. The maximum rainfall occurs during September and October through northeast monsoon. The area gets a fairly good rain during southeast monsoon as well.

Figure 17: Annual Seasonal Rainfall in Project Area

Source: Directorate of Economics and Statistics 2015-16

Figure 18: Monthly Max and Min Average Temperature in Project Area

5. SurfaceWater

35. The project area lies within the watershed expanse of the Palar River Basin and consists of a network of tanks and canals. The River Palar is a prominent and historical feature of Vellore. River seldom flows, and according to local information, river experienced flow in 2015 due heavy floods after nearly two decades. There is surface water flow only for a few days in a year in this river. But considerable ground water potential exists in the Palar river bed. There are a number of subsurface water intake structures on the river bed.

36. Apart from Palar river there are few water bodies that dot in and around the city. Gopal Samuthram (Dharadavedu) and Kalinjur lakes on the north-western side and Sandulperi lake on the south are prominent ones. Other lakes/tanks in municipal are

include Vellavadi Eri (meaning lake/pond), Thorapadi Eri, Otteri Eri, Periya Eri, and Sitteri Eri. Except Otteri eri, which is used for drinking purposes by surrounding village areas, water from these surface water bodies are not potable and are generally used for washing and irrigation.

37. Kalinjur lake is mainly fed by Palar River, and substituted by its catchment area. Consequently, lake is mostly dry or have very less water. Lake filled to its capacity in 2015 due to heavy rains and flood in River Palar in 2015, and with subsequent monsoons, at present lake

holds good amount of water. Wastewater from surrounding areas also enter the lake. Lake water is not used for any potable purposes, but used for irrigation in the downstream, when the lake overflows, which is very rare. As per the local information, in the last 20 years, lake overflowed twice – in 2004 and 2015. There are notable aquatic life in the lake. No commercial or leisure or subsistence fishing is practiced.

Figure 19: Pandiyan Channel



38. Kalinjur Lake has a surplus/overflow channel (called Pandiyan Channel) that discharges lake overflow for irrigation purposes and surplus is carried to Palar River. As shown in the figure 19 above, it starts from the overflow weir of lake, and flows for about 15-16 km, mostly through agricultural lands and some residential areas. Residential areas along the channel dispose wastewater into drain, and in agricultural areas, channel water is used for irrigation purpose, and the channel ultimately joins River Palar in the downstream. Except when lake overflows, which is very rare, the channel carries only sewage from the habitations situated along its course. Velavadi lake, which is located in the eastern part of the city, is used by VCMC for disposal of treated wastewater from the existing STP. This water from the lake is being used for irrigation.

39. The water quality of Palar River into which the treated sewage is proposed to be discharged is tested as part of the baseline environmental quality monitoring program. The water quality data is summarised and presented in Table 10. The monitoring report indicates that the river water is already contaminated with the untreated sewage disposed into it.

Table 10: Surface Water Quality of Palar River

SI. No	Parameter	Unit	Observed Value	Standard
1	pH		8.1	8.5
2	Dissolved Oxygen	mg/l	1	6
3	Biochemical Oxygen Demand	mg/l	192	2
4	Chlorides as Cl	mg/l	452	250
5	Nitrate as NO ₃	mg/l	8.05	20
6	Fluorides as F	mg/l	1.26	1.5
7	Total Hardness as CaCO ₃	mg/l	650	300
8	Total Coliforms	CFU/100 ml	Present	50
9	Faecal Coliforms	CFU/100 ml	Present	Absent

Table 10A: Surface Water quality monitoring during pre-construction stage

Parameters	pH	Fe	Res. Cl.	Total Chromium	Cr6+	TDS	TSS	COD	BOD	Ca	CN	Cd	Ni	Cu	Pb	Zn	Total P	TKN	NH3	DO
Sampling Location	Unit in mg/l																			
LS-7 (Pnniamman Nagar)	7.51	0.26	BDL (DL1.0)	BDL (DL1.0)	BDL (DL1.0)	1820	20	48	10	124	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	6.20	40	5.05	4.4
Palar River (SP-5)	7.43	0.28	BDL (DL1.0)	BDL (DL1.0)	BDL (DL1.0)	1380	60	162	19	112	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	8.2	90	8.15	3.0
Bu-rma Colony (SP-4)	7.42	0.28	BDL (DL1.0)	BDL (DL1.0)	BDL (DL1.0)	1560	40	132	15	128	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	7.8	68	6.20	3.8
Vellore Fort Front Side	8.18	0.26	BDL (DL1.0)	BDL (DL1.0)	BDL (DL1.0)	1920	8	10	4	156	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	3.15	4.20	0.42	6.2
Vellore Fort Back Side	8.12	0.22	BDL (DL1.0)	BDL (DL1.0)	BDL (DL1.0)	1960	4	BDL (DL4.0)	BDL (DL2.0)	156	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	2.05	3.8	0.55	6.0
Vellapadi (SPS-6)	7.53	0.25	BDL (DL1.0)	BDL (DL0.5)	BDL (DL0.5)	1810	40	80	12	134	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	BDL (DL0.5)	7.20	55.0	5.20	3.4

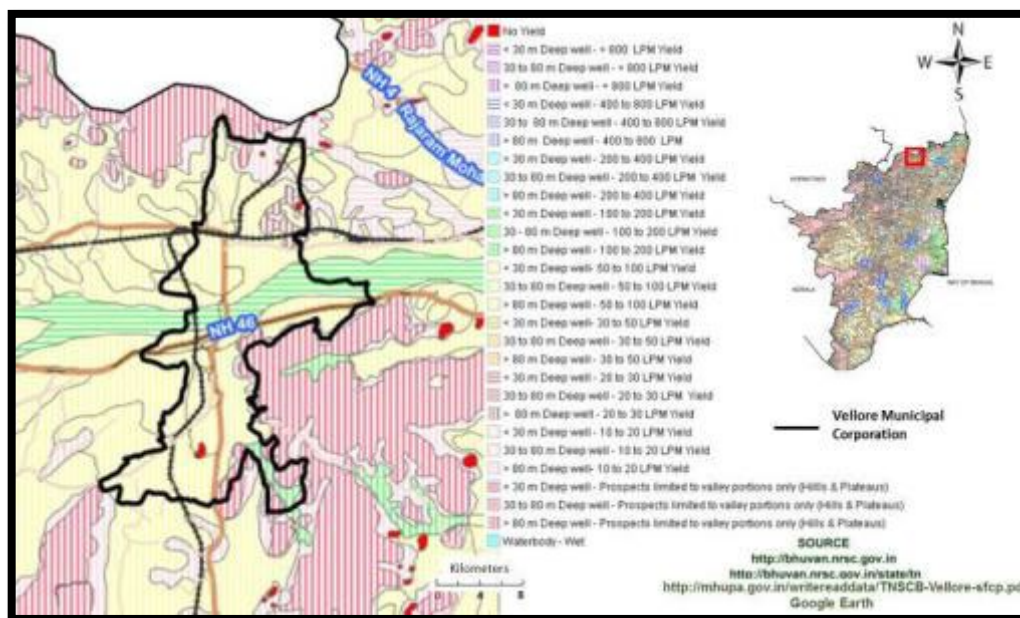
(Source: Lab Reports)

Surface water monitoring has been conducted during pre-construction stage at different location as given in above table 10 A during the month of May 2019. Based on testing of surface water analysis, results clearly indicates that parameters of surface water quality comes within permissible limits of standards except few parameters (TDS, Ca), exceeds from acceptable limits of standards.

6. Groundwater

40. Palar river bed has a considerable ground water potential that facilitates a large-scale groundwater extraction from the river bed. Ground water is the main source of drinking water supply in the absence of reliable surface water source in the region. Millions of gallons of groundwater per day is pumped from the river bed for the major water supply schemes. Due to overexploitation of groundwater, 5 blocks of upper Palar Zone in Vellore District have been classified as Dark, where annual extraction is more than 85% of annual groundwater recharge and resulted in depletion of water level. All these blocks are located on either bank of Palar river. Vellore district as a whole is categorized as “over-exploited” in terms of groundwater potential as of 2011 by Central Ground Water Board. The map below shows the ground water prospects in the project area according to which the water in the region is 30 m to 80 m deep and yield 100 to 200 liters per minute.

Figure 20: Ground Water Prospects in Project Area



Source: Bhuvan.

41. **Groundwater Quality.** As per Central Ground Water Board report of Groundwater quality scenario in India, Vellore is categorized as fluoride affected district with concentration of more than 1.5mg/L. Table 2 summarizes the result of water quality analysis conducted during 2012 at 68 groundwater sampling wells that are spread across the district including wells from the project area. Groundwater was found to be alkaline which catalyzed the mineral leaching adding to the high concentration of fluoride in groundwater. Industries along with agricultural fields contribute to the nitrate and fluoride levels in groundwater.

42. In the entire Palar basin, pollution is more prevalent, in upper Palar where tanneries are located in large number from Vaniyambadi (70 km) to Walajahpet town (30 km). These tanning industries let the untreated or partially treated effluents in large volumes into the river system, thus polluting the cultivable soil and groundwater resources. Following table shows the groundwater quality in Vellore, maximum values of most of the parameters exceed permissible standards.

Table 11: Groundwater Quality in Vellore

Parameters	BIS standard (Desirable - Permissible)	Minimum	Maximum	Mean
pH	6.5 – 8.5	7.2	8.5	7.5
EC (µS)		670	4210	1663
Total dissolved solids (mg/L)	500 – 2000	388	2686	1059
Calcium (mg/L)	75 – 200	18	240	77
Magnesium (mg/L)	30 – 100	24	199	71
Sodium (mg/L)	200	15	621	204
Parameters	BIS standard (Desirable - Permissible)	Minimum	Maximum	Mean
Potassium (mg/L)	-	2	196	17
Nitrate (mg/L)	45 – 100	<1	46	11
Fluoride (mg/L)	1.0 – 1.5	0.02	3	1
Chloride (mg/L)	250 – 100	25	1170	275
Carbonate (mg/L)		<1	24	10
Bicarbonate (mg/L)	-	238	946	474
Sulphate (mg/L)	200 – 400	7	394	128

Source: P. J. Sajil Kumar, P. Jegathambal, E. J. James (2014), "Factors influencing the high fluoride concentration in groundwater of Vellore District, South India", Environ Earth Sci., 72:2437–2446.

7. Ambient Air Quality

43. At present there is no air quality monitoring station set up by Tamil Nadu Pollution Control Board (TNPCB), and therefore there is no air quality data available for Vellore City. Main source of air pollution in the city are vehicular traffic, road dust, construction and industrial activities. A 2016 air quality study at Green circle and old bus stand in the city has revealed that PM₁₀ and PM_{2.5} concentrations are higher than the prescribed NAAQ standards. Table below gives the concentration of different air pollutants. According to this study, the sampling was done continuously on an 8 hours for one day per month for period of three months (January 2016 to March 2016).

44. As part of the baseline environmental quality survey, ambient air quality of subproject area was monitored at various locations. The air quality monitoring data is summarized and presented in Table 13.

Table 12: Ambient Air Quality at Traffic Junctions, Vellore, 2016

Monitoring Location	Green Circle					Old Bus Stand				
Month	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)	CO (mg/m ³)	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)	CO (mg/m ³)
January	141.1	96.5	42.3	49.2	1.15	128.5	85.2	36.2	44.4	1.15
February	138.2	94.7	41.1	47.5	1.45	127.2	82.2	35.9	43.4	1.2
March	140.9	93.3	41.9	46.2	1.91	126.4	83	34.6	43.2	1.71
NAAQ Standard	100	60	80	80	4	100	60	80	80	4

Source: T. Peganvignesh and Sharpudin J. (2016), "Assessment of Ambient Air Quality Monitoring in Traffic Junctions, Vellore", International Journal of Research in Engineering and Technology, Vol. 5 (5), pp. 214 –217.

Table 13: Summary of Baseline Air Quality Monitoring at Subproject Area

Sl. No	Parameter	Unit	Observed Value					Standard (24 hour average)
			Viruthampettu (STP Site)	Alamelum angapura m (SPS3)	Vasantham Nagar (SPS4)	Sathuvachari (SPS5)	Navaneethuammal Street (SPS6)	
1	Particulate Matter (PM 10)	µg/m ³	56.78	49.00	41.00	65.00	40.00	100
2	Particulate Matter (PM 2.5)	µg/m ³	27.96	26.00	23.00	44.00	23.00	40
3	Sulphur dioxide (SO ₂)	µg/m ³	13.41	10.00	9.00	12.00	8.00	80
4	Oxides of Nitrogen (NO ₂)	µg/m ³	23.89	12.00	11.00	8.00	9.00	80

5	Carbon monoxides (CO)	µg/m ³	BDL	<114.50	<114.50	<114.50	114.50	2000 (8 hour average)
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Source: UGSS Vellore, Phase 2, Baseline Environmental Quality Monitoring Report, April 2019

45. Pre construction stage monitoring was conducted by the contractor during the month of April and May 2019 for Ambient Air at different locations such as STP, SPS LS and Vellor Fort. At proposed STP, ambient air quality monitoring on 22.04.2019 and other sites such as SPS, LS and Vellor fort conducted on 29.05.2019 to 30-05-2019. Based on the analysis results clearly depicts that the ambient air quality parameters comes within stipulated limits as per prescribed standards of NAAQS, 2009.

Table 13 A: Summary of Pre-construction stage Ambient Air Quality Results

S.No.	Station	Particulate Matter (PM 10)	Particulate Matter (PM 2.5)	Sulphur dioxide (SO ₂)	Oxides of Nitrogen (NO ₂)	Carbon monoxides (CO)
		Unit- µg/m ³				
1	Almelumangapuram Venkatapuram (SPS3)	62.1	10.2	4.85	7.90	BDL (DL1.15)
2	Vasanth Nagar (SPS4)	52.8	9.24	4.20	7.05	BDL (DL1.15)
3	Solid Waste Management (SPS5)	57.2	9.62	5.05	9.20	BDL (DL1.15)
4	Ponniammann Nagar (LS-7)	52.8	8.20	3.60	6.20	BDL (DL1.15)
5	Bu-rma Colony Phase -2 (pkg-2)	41.8	7.20	3.80	7.40	BDL (DL1.15)
6	Konavattam Bus Depot Opp. LS-11	84.8	15.4	5.80	11.2	BDL (DL1.15)
7	Shenbakkam Draupadiammann Kovil (LS-8)	40.8	6.05	3.2	5.05	BDL (DL1.15)
8	Vellor Fort Back Side	68.2	11.4	5.25	10.4	BDL (DL1.15)
9	Vellor Fort Front Side	74.5	12.0	5.8	11.05	BDL (DL1.15)
10	Vellapadi (SPS-6)	48.2	6.05	3.80	6.65	BDL (DL1.15)
11	STP	56.78	27.96	13.41	23.89	BDL (DL0.05)
NAAQS Standards (24 Hours)		100	60	80	80	2 for (1 hours)

(Source: Lab reports)

8. Ambient Noise Levels

46. There is noise data available for Vellore from TNPCB. Following table presents the noise level data across Vellore City from a research study conducted in 2016. Study monitored noise levels along different types of roads at nine locations. Noise levels at all location and at all times (day and night) exceeded the ambient noise standards¹. Further, due to heavy traffic volumes, noise levels along highways/expressways and arterial roads were much higher than the noise levels on local streets.

47. As part of the baseline environmental quality survey, ambient noise level of the subproject area was monitored at various locations. The noise monitoring data is summarised and presented in Table 14.

Table 14: Ambient Day-time Noise Levels in Vellore

Roadways	Area name	Measures of noise levels (dBA)	Morning Peak 9:00-9:30	Morning off Peak 11:30-12:00	Afternoon off peak 2:30-3:00	Evening peak 6:00-6:30	Night off-peak 9:30-10:00
TYPE I	Local Street Long	Lmax	78.18	79.23	81.74	78.32	75.33

¹day and night time noise standards for residential areas = 55 dBA and 45 dBA and for commercial areas = 65 dBA and 55dBA

Roadways	Area name	Measures of noise levels (dBA)	Morning Peak 9:00-9:30	Morning off Peak 11:30–12:00	Afternoon off peak 2:30-3:00	Evening peak 6:00-6:30	Night off-peak 9:30-10:00
	Bazar	Lmin	67.09	68.29	66.23	68.61	61.78
		Leq	72.16	72.68	71.81	74.08	72.33
	Arterial Roadway – Scudder Road	Lmax	81.45	82.33	78.81	77.48	79.72
		Lmin	74.44	71	70.8	70.53	70.42
		Leq	78.29	75.63	74.94	74.58	73.89
	Chittor Expressway	Lmax	81.51	79.94	81.58	82.7	78.73
		Lmin	65.24	70.55	68.63	70.16	65.37
		Leq	76.69	76.46	74.83	75.77	73.84
	TYPE II	Local Street Gandhi Road	Lmax	74.37	73.09	70.83	76.05
Lmin			62.93	62.47	62.47	64.94	64.35
Leq			70.08	69.36	67.46	71.25	70.43
Arterial Roadway Katpadi Road		Lmax	85.16	85.88	79.95	82.11	79.42
		Lmin	74.21	76.98	72.34	76.73	66.09
		Leq	79.77	79.79	76.13	79.12	75.29
Madras Expressway		Lmax	81.62	84.62	80.68	82.35	78.71
		Lmin	74.11	72.03	68.98	71.86	69.75
		Leq	78.15	77.54	76.66	76.77	75.42
TYPE III	Local Street Main Bazar	Lmax	80.22	74.95	71.10	78.75	75.49
		Lmin	67.83	66.28	65.3	68.79	61.11
		Leq	72.66	70.24	68.05	73.46	69.52
	Arterial Roadway Officer's Line	Lmax	87.39	84	82.37	90	82.95
		Lmin	72.47	72.81	71.29	73.63	68.1
		Leq	80.99	78.26	77.36	77.79	75.2
	Thiruvannamalai Arni Expressway	Lmax	85.78	84.99	80.72	82.89	80.83
		Lmin	70.95	63.27	65.95	69.96	66.4
		Leq	79.65	76.98	74.53	77.73	77.02
Noise standards (day time), dB(A), Leq			65 (commercial areas)				

Source: T. Pegavignesh and Sharpudin J. (2016), "Assessment Of Ambient Air Quality Monitoring In Traffic Junctions, Vellore", International Journal of Research in Engineering and Technology, Vol. 5 (5), pp. 214 – 217.

48. Pre construction stage monitoring was conducted by the contractor during the month of April and May 2019 for Ambient noise at different locations such as STP, SPS LS and Vellor Fort. At proposed STP, ambient noise quality monitoring on 22.04.2019 and other sites such as SPS, LS and Vellore fort conducted on 30-05-2019. Based on the analysis results clearly depicts that the ambient noise level comes within stipulated limits as per prescribed Noise standards.

Table 15: Ambient Noise Level at Subproject Area

Sl. No	Location	Unit	Observed Noise Level	
			Day Time	Night Time
1	STP Site, Viruthampettu	dBA	48.8	46.0
2	Vasantha Nagar (SPS 4)	dBA	61.8	55.4
3	Mandavellai Road	dBA	60.2	53.9
4	Vellore Fort backside	dBA	64.6	58.8
5	Vasantham Nagar (LS 12)	dBA	62.9	55.3
6	DKM College Road	dBA	59.2	52.4
	Standard (Commercial Area)	dBA	65.0	55.0

Source: UGSS Vellore, Phase 2, Environmental Quality Monitoring Report, 2019

C. Ecological Resources

49. Vellore city is located in the Eastern Ghats region and on the banks of Palar river basin. A part of the town (~103 ha, 8.90% of municipal area) forms part of the reserved forest. The Vellore and Palamathi reserved forest areas are located on the eastern side of the town. The southern and western sides of the town are mostly plain agricultural lands with a number of irrigation tanks. The southern bank of Palar river forms the northern boundary of the town. There are seven reserve forest areas in and around the Vellore municipal corporation, Punganur, Vilapakam, Palamathi, Kunjanur, Bagayam, Kannamangalam and Kavanur respectively.

50. These forests are devoid of any large wildlife. Small mammals, reptiles and ground birds are commonly found in the reserve forests. Common monkeys are also frequently sighted on the outskirts of the city. Trees such as tamarind, teakwood, neem and other avenue species are found within the city and along the roads. Lemongrass, known as 'manjampul,' is found in abundance on the surrounding hills.

51. The Palar River in Tamil Nadu, India is home to a variety of commercially important native fish, including:

- P. dubius;
- P. carnaticus;
- P. sarana;
- P. micropogon;
- Cirrhinus cirrhosis;
- reba;
- T. kudree;
- T. mussullah;
- Acrossocheilus hexagonolepis;
- Bagarius bagarius;
- Silondia silondia;
- S. children;
- Pangasius pangasius;
- Mystus aor;
- M. punctatus
- M. seenghala;
- Wallago attu;

(Source: Rani Palaniswamy, S Manoharan and UK Sarkar, Impact of introduction of non- native fishes on indigenous fish fauna in freshwater reservoirs of Tamil Nadu, 4 June 2017, International Journal of Fisheries and Aquatic Studies)

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

Sathuvachari hills in the eastern side of the city (Figure 21) are partly located in the city area, and are close to the project area. But none of the components are located in the forests.

53. The treated water was proposed to be disposed into Pandiyan Channel, which is an overflow channel of Kalinjur lake. Since lake is mostly dry, this channel seldom receives overflow. This channel meets River Palar, about 15-16 km downstream of Kalinjur lake. During its course, it collects wastewater from the surrounding areas (for about 4-5 km it flows through the habitation), and then it flows through agricultural lands, where its water, mostly wastewater, is used for irrigation. Channel is built in cement concrete within the municipal area, and after which it is of earthen section. The ecological value of this drain in the current situation is insignificant. Due to the lack of permission from the concerned authority, the proposal is dropped and it is decided to discharge the treated effluent directly into Palar River at Kangeyanallur near to the burial ground at about 2.127 km from the STP. The water quality at this location is highly contaminated with the disposal of untreated sewage from the city.

Figure 21: Vellore Forest Area Map

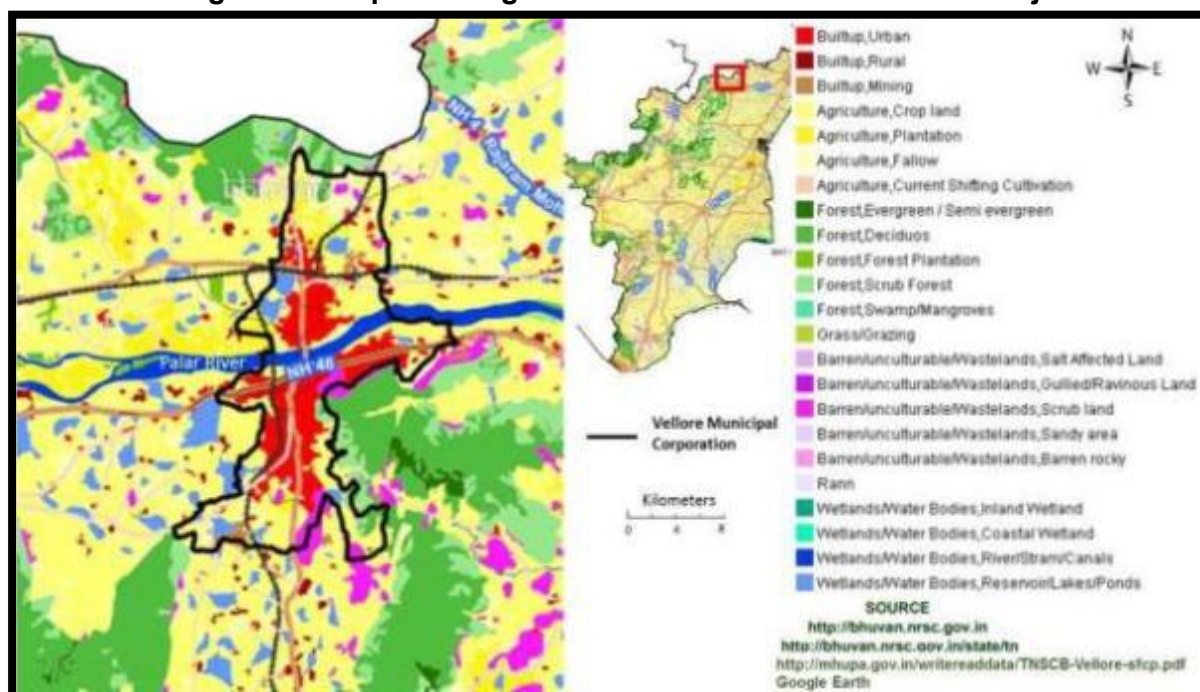


D. Economic Development

1. Land Use

54. The land area of the city is put to a variety of uses, like commercial, manufacturing, transportation, residential, recreational and administrative functions. According to existing master plan that gives details of land use pattern in the city and vicinity area residential areas occupies major percentage of the developed land in the city limits with 55.76% followed by public and semi-public with 16.46%, transport and communications with 14.49%, public and semi-public with 13.94% and commercial with 8.34%. Agriculture land in the undeveloped area is 26.9%. The thematic map below shows the general land use in the project area.

Figure 22: Map Showing Land Use and Land Cover in the Project Area



Source: Bhuvan.

2. Industry and Agriculture

55. The economy of Vellore city depends mostly on service sector and manufacturing sector than the primary sector. The city is host to India's two most premiere educational institutions

namely Vellore Institute of Technology and Christian Medical College. Tanneries, Chemicals and Greaves, Brakes, foundry, Explosives industries are some of the contributors to the cities economy.

56. Major employment in the city is provided by leather industry, agricultural trading and industries located in and around the city. Approximately 83.35 per cent of the workforce is employed in tertiary sector comprising transport, services and commerce. The secondary sector activities like manufacturing and household industries employ 13.52 percent of the total workforce in the city.

57. Vellore leather accounts for more than 37 percent of the country's export of leather and leather-related products. Tirumalai Chemicals and Greaves are among the international brands that have their manufacturing units in the city. Automobile and mechanical companies of global Brands, including SAME Deutz-Fahr, TVS-India, Mitsubishi, Greaves Cotton and MRF have their manufacturing units in the area. Brakes India Sholingur's division is located at Vellore-Sholingur and is a major employer in the area. Asia's biggest explosives manufacturing company, Tamil Nadu Explosives Limited (TEL), is located in Vellore at Katpadi. This is India's only government explosives company with more than a thousand employees. Kramski Stamping and Molding India Pvt Ltd, a German precision metal and plastic integrated-component manufacturing company with automotive, telecommunications, electronics and medical applications is located in Erayankadu, near Vellore. Major businesses in the city center are located on Officer's Line, Town Hall Road, Long Bazaar and Bangalore, Scudder, Arni, Gandhi and Katpadi Roads.

58. Agriculture is generally practiced along the Palar river banks and in the outskirts of the city. The workforce depending on agriculture is insignificant when compared to

secondary and tertiary sectors, so is the contribution to the city economy.

3. Infrastructure

59. **Water Supply.** The city has intermittent water supply and availability. Unaccounted water loss is less than 30%. Treated water supply from the Combined Water Supply Scheme (CWSS) with river Cauvery as source (Mettur dam, about 200 km from Vellore) has started recently. The combined water scheme has helped the city deliver water at a frequency of 2 days cycle from an earlier 5-9 day cycle. The city envisages to reach the National Standards of water supply per capita (135 LPCD) and NRW (15%) by FY2019.

60. The city does not measure all its supply. It does not recycle waste water to meet its requirements and rain water harvesting is not prevalent. Flooding often occurs due to storm water run-off.

61. **Solid Waste Management.** Rapid growth of population and urbanization has resulted in increasing the volume of solid waste generation. The corporation produces around 240 tons of waste per day. Day to day waste collection is done in 85% of the areas. But the collected waste is not segregated but dumped in the corporation dump yard. Decentralised segregation is practiced in 10 out of the 60 wards. The city municipal corporation took steps to move towards 100% resource recovery mechanism through a decentralized framework for waste management systems. Around 42 locations across VCMC have been identified for operations. Current source segregation efficiency has increased from 44.4% (FY13-14) to 62.5% (FY15-16).

62. **Transportation.** The N.H 46 from Ranipet to Krishnagiri (forming part of Madras – Bangalore corridor) and the State Highway No.1 (Cuddalore – Chittoor) cut across the Vellore town. The city has two bus terminals: Town Bus Terminus and the Central Bus Terminus. Other bus terminals are located at Chittoor Bus Stand, Bagayam and Katpadi (Junction bus stop). The Villupuram – Tirupathi metro gauge railway line passes through the town with Vellore Cantonment and Vellore town railway station located within the town. One of the major B.G. railway corridors in the country, Chennai – Bangalore/ Coimbatore/ Ernakulam runs about 5 km north of this town with Katpadi being the feeder railway junction to the town. The Vellore Katpadi Junction is a major railway junction on this BG railway corridor. The city has an airport near Abdullapuram used for aeronautical training programmes. The nearest international airports are Chennai International Airport (130 km) and Bengaluru International Airport (200 km); the nearest domestic airport is Tirupati Airport (100 km).

E. Socio Cultural Resources

1. Demography

63. As per Census of India (2011), population density of the city is 15949 persons per km². There are 48 wards in the city, among them Vellore (m. Corp) Ward No 06 is the most populous ward with a population of 7901 and Vellore (m. Corp) Ward No 27 is the least populous ward with a population of 1622.

64. Vellore has 38% (about 70 thousand) population engaged in either main or marginal works. 58% male and 18% female population are working population. 54% of total male population are full time workers and 4% are marginal (part time) workers. For women 16

% of total female population are fulltime and 3% are marginal workers. A total of about 1.4 lakh people in the city are literate, among them about 74 thousand are male and about 69 thousand are female. Literacy rate (children under 6 are excluded) of Vellore is 86%. 91% of male and 82% of female population are literate here.

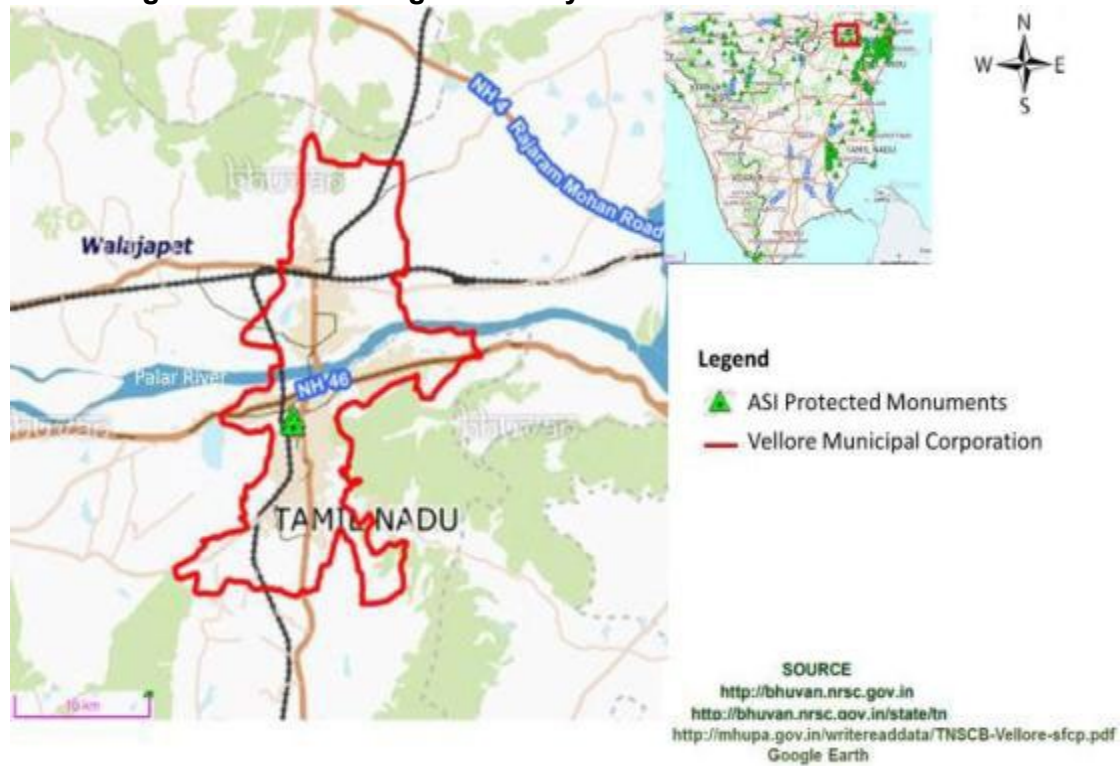
2. History, Culture and Tourism

65. Vellore city has a unique heritage base that traces its roots back to the Megalithic period (C, 2500 years). The city was ruled by Vijayanagara Kings, Bijapur Sultans to Marathas, the Carnatic Nawabs and the British and traces of each of their periods in terms of sculpture and art is scattered across the city. Vellore District was a part of the then North Arcot District. Vellore was the base of Lord Cornwallis in his campaign against Tippu Sultan. It was here the family of Tippu was kept under the arrest after his fall. In A.D. 1806, the Sepoys of Vellore rose heroically in mutiny against the British army officer which was promptly quelled.

66. The Vellore city and the periphery areas have several iconic spots for tourism such as Vellore Fort, Golden temple, Government museum, Science park, Vainu Bappu Observatory, Amirthi Zoological Park and Yelagiri hills.

67. The Vellore fort retains its past glory with its ramparts, barlements, turrets, posts, and sally gates and with perennial water supply. The fort houses a church, Jalakantesvara temple, and many buildings. Many Government offices are located in these buildings. The Fort, Mosque inside the fort and Jalakantesvara temple are protected by the Archaeological Survey of India (ASI). Vellore Fort is a large 16th-century fort built by Vijayanagara kings. The fort was at one time the headquarters of the Aravidu Dynasty of the Vijayanagara Empire. The fort is known for its grand ramparts, wide moat and robust masonry. The fort houses the Jalakanteswarar Hindu temple, the Christian St. John's Church and a Muslim mosque, of which the Jalakanteswarar Temple is famous for its magnificent carvings. The first significant military rebellion against British rule erupted at this fort in 1806. It consisted a deep wet ditch (moat) and huge double walls with bastions projecting irregularly. The fort was constructed in granite and it spreads over an area of 133 acres.

Figure 23: Archaeological Survey of India Protected Monument In Vellore



Source: Bhuvan.

F. Subproject Site Environmental Features

68. Features of the selected subproject sites are presented in Table 16.

Table 16: Site Environmental Features

Infrastructure	Location and Environmental Features	Photos	
Sewage treatment plant (STP)	Proposed STP site is located at Viruthampattu on the bank of River Palar in the northern part VCMC area. Site is not located in the flood plain. Site is located adjacent to a solid waste management (segregation) facility of the VCMC. Palar River, flowing west to east, almost bifurcates the VCMC area. Site is located adjacent to left bank (towards north) and there are agricultural lands between the river and the proposed STP site. Housing development is in the north of the proposed site, which is separated by a road, and the nearest house is at about 60 m from the closest boundary of the STP site. There are about 10-15 houses in 100 m distance from STP boundary. Area of the site is 4-5 acres and owned by VCMC. Site is vacant and covered with shrubs and bushes. Site is accessible by an existing road. It was proposed to dispose treated wastewater into Pandiyan channel, which is the overflow/surplus flow channel of Kalinjur Lake. Channel flows at about 2.4 km from the STP site, and an outfall sewer will be laid from STP to Pandiyan channel. Subsequently, it was decided to dispose the treated sewage into Palar River directly at Kangeyanallur near to the burial ground at about 2.127 km from the STP. The sewer conveying the treated sewage from STP to the disposal point at Kangeyanallur is proposed through the bank of Palar River mainly through Government Land.		
			 
		Kalinjur lake	

Infrastructure	Location and Environmental Features	Photos
	Land through which the pipeline proposed is Palar river bank owned by the Government. Not much vegetative covers on the proposed alignment. No private property is impacted.	Pandiyan channel  Revised Disposal Point at Kangeyanallur  17-Apr-2023 5:18:32 pm

Infrastructure	Location and Environmental Features	Photos
Sewage pumping stations (SPS)	Sewage Pumping Station – 3 at Alamelumangapuram Site is located adjacent to a small drain/stream, and along a road. This is newly developing residential area in the city outskirts. Nearest house is at about 25-30 m however, vacant housing plots are just adjacent to the site, and in near future the SPS will become adjacent to the houses. Site is vacant and covered with shrubs and bushes. Total area of the site is 0.53 acres and land is owned by Revenue Department (GOTN). Construction of SPS-3 will require total area of 226 sq. m. and adequate land is available.	
	Sewage Pumping Station – 4 at Vasantham Nagar, Sathuvachari SPS-4 is located at Vasantham Nagar, Sathuvachari and the land belongs to Vellore Corporation. Site is located in the outskirts of the city close to River Palar. Site is adjacent to a small stream/drain. Houses and a school is located at about 50 m; adequate land area is available along the drain, and therefore the SPS will be constructed maintaining buffer from the school. An old septic tank constructed by Tamil Nadu Housing (THB) board is just adjoining the proposed site. Total area of the site is 0.97 acres and land is owned by VCMC. Construction of SPS-4 will require total area of 1,034 sq. m. and adequate land is available.	

Infrastructure	Location and Environmental Features	Photos
	Sewage Pumping Station – 5 SWM Shed at Sathuvachari Proposed site is located within a solidwaste segregation yard operated by the VCMC on the bank of River Palar. A grave yard is located close (~ 50 m) to the site. Site is vacant. There are no houses closes to the site (<100 m). Total area of the site is 0.8 acres and land is owned by VCMC (Ward No-1; Block No-37; TS No-3038/3B, 3037/3A, 3040, 3068, 3069, 3071/1, and 3081/1). Construction of SPS-5 will require total area of 1,821 sq. m. and adequate land is available.	
	Sewage Pumping Station – 6 at Shenabakkam SPS-6 is located near Kural theatre Shenbakkam along the drain. Site is located within in the western part of the city surrounded by large expanse of government owned vacant lands. A low-income residential area (slum), developed on the government land is located close to the site (10 – 15 m). However, adequate land is available, and SPS will be constructed by maintaining buffer from the slum. Site is low-lying and located adjacent to a stream/drain. Site is filled partly with water, and there are few palm trees on the site. An Archaeological Survey of India (ASI) protected monument (Vellore Fort) is located at about 250-260 m from the boundary. Total area of the site is 0.95 acres and land is owned by Revenue Department, Government of Tamil Nadu (Ward No-5; Block No-14; TS No-613, 614, and 621). Construction of SPS-6 will require total area of 1,462 sq. m. and adequate land is available.	

Infrastructure	Location and Environmental Features	Photos	
Sewer network	Sewer lines will be laid in the center of road by cutting black top, within the road right of way. In wider roads, like SH, NH, divided 2-way roads etc., sewers will be laid in the service roads, and where service roads are unavailable, will be laid along the edge of the road, but mostly within the black top portion. For the roads where adequate land in the road shoulder is available along the blacktop and is clear of any structures or activities, pipes will be laid in this earthen shoulder. There are trees along the roads, which will be mostly avoided by slightly changing the alignment locally where required. Some of the sewer lines, which are to be laid within the road right of way, are located within the 300m distance of ASI protected monument (Vellore Fort). Large diameter pipes will be laid mostly on main roads (300 – 1300 mm), while the tertiary sewers of small size (200 mm to 300 mm dia) that collect wastewater from each house will be laid in all streets in the subproject area. Trench size to bury the sewer will be of 0.8 m to 1.5 m wide and 1.2 m to 6 m deep.	  	  

Infrastructure	Location and Environmental Features	Photos	
	Some sewage pumping stations (e.g. SPS 6) is located inside a residential area and accessible by only a narrow road. There will be two pipelines (incoming and outgoing pumping mains) in the narrow road. Sections of the alignment (around 7.86km) and SPS5 have been identified to involve hard rock and management measures for carrying out controlled blasting for excavation have been identified and included in the updated IEE.		
			

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

69. 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.

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

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

71. 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).

72. 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.

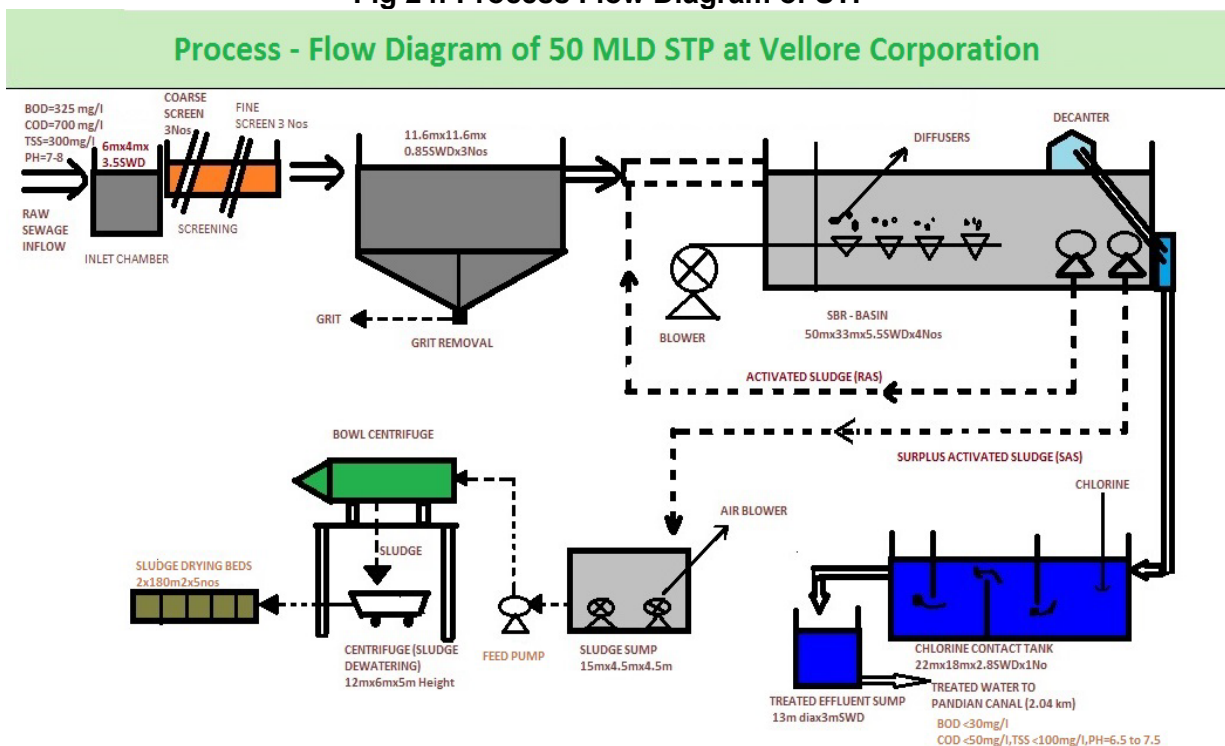
73. The ADB Rapid Environmental Assessment Checklist in http://www.adb.org/documents/guidelines/environmental_assessment/eaguidelines002.aspx has been used to screen the project for environmental impacts and to determine the scope of the IEE.

74. In the case of this project (i) most of the individual elements involve simple construction and operation, so impacts will be mainly localized and not greatly significant; (ii) negative impacts associated with sewage facilities such as odour 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

75. **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.¹
76. **Design of Sewage Treatment Plant.** A 50 MLD STP is being constructed at Viruthampattu on the bank of River Palar to treat the sewage generated from the subproject areas. The treated wastewater was proposed to dispose into Pandiyan Channel, the surplus/overflow channel of Kalinjur Lake, and will be utilized for irrigation in the lake command area. STP is being implemented under design-build mode of contract, and therefore the STP has been designed by the contractor to meet the treated effluent standards specified in the Consent to Establish (CTE) issued by the TNPCB dt 12/12/2019. Since the concerned authority had denied permission to discharge treated effluent into Pandiyan Channel, it is decided to change the disposal location to Palar River directly at Kangeyanallur near to the burial ground at about 2.127 km from the STP. Application for renewal of Consent to Establish is initiated incorporating the change in location of disposal site.
77. To comply with the standards, design-build contractor selected a suitable process and agreed by PIU. Final Design Report evaluated various treatment options such as: waste stabilization ponds, aerated lagoons, conventional activated sludge process, extended aeration, Sequential Batch Reactor (SBR), Moving Bed Bio-film Reactor (MBBR), Membrane Bio-Reactor (MBR) and Up flow Anaerobic Sludge Blanket (UASB) Process, with criteria and of “(i) to meet the required effluent standards for the discharge of treated sewage, (ii) less area requirement, (iii) process flexibility, (iv) easy operation and maintenance, (v) economic viability, and (vi) aesthetics with surroundings.” Considering the above, it is decided to adopt SBR technology for the Sewage Treatment Plant at Vellore. The STP consists of (i) Receiving Chamber, (ii) Screen chambers with coarse screens and fine screens, (iii) Detritors, (iv) Parshall flume, (v) Flow dividing Chamber, (vi) SBR tanks, (vii) UV disinfection channel, (viii) Treated effluent sump, (ix) sludge sump, and (x) filter press. The process flow diagram is furnished in Fig 24 below.

Fig 24: Process Flow Diagram of STP



78. **Description of SBR Technology.** SBR technology is the same as the Activated

Sludge Process (ASP) with Extended Aeration. The only difference is in the ASP, the sewage flows through an aeration tank and then through the settling tank continuously whereas in the SBR, the aeration and settling phases are carried out in batch mode one after other in the same tank. SBRs are typically configured and operated as multiple basins in order to provide optimum process and equipment performance, in built redundancy, and include a Program Logic Control (PLC) system for regulating automatically the timed sequences for filling, reaction, settling and effluent decanting operations (termed a cycle). A cycle is typically referred as the time duration between successive decant sequencing during which the liquid level moves from lower water depth (bottom water level) to its full depth (top water level) and back to its lower depth. Hence each basin will process number of batches depending upon the cycle time. Since the sewage aerated for extended period the organic solids are stabilized in the reactor and the sludge does not require separate digestion.

79. The reactor is portioned initially for the selector zone. In the selector zone with high F/M ratio ensures growth of floc forming microorganisms while suppressing filamentous growth. Further the selector zone helps in removing phosphorous without chemical addition. In the SBR nitrification and denitrification also occurs to remove ammonia nitrogen. The design details of the SBR of 50 MLD STP for Vellore UGSS are:

- Number of basins: 4 Nos
- Size of each basin: 45.0m x 33.0m x 5.70m SWD
- Cycle time operation of each batch: 3 hours
- Details of operations in each batch: Filling and aeration = 1.5h, Settling = 0.75 h, and Decanting = 0.75 h
- No. of cycles per basin per day: 8 Nos
- Average flow rate to each basin: 1041.67 m³/h
- Decant flow rate: 2083.3 m³/h
- Decanting volume per batch operation: 1562.5 m³/h
- No. of blowers for aeration: 6Nos (4W + 2S) of 6200 Nm³/h
- Sludge wasted per day: 8186 kg/d
- Design MLSS: 4500 mg/L and F/M ratio: 0.135

80. The expected raw sewage and the treated sewage effluent characteristics are furnished below.

Table 17: Expected Raw Sewage and Treated Effluent Characteristic

Parameter	Unit	Expected characteristics	
		Raw sewage	Treated sewage effluent
pH		7.0 – 8.0	5.5 – 9.0
BOD	mg/L	325	10
TSS	mg/L	300	20
COD	mg/L	700	50
Nitrogen (Total)	mg/L	45	10
Phosphorus (Total)	mg/L	10	1
Fecal coliforms (FC)	MPN/100mL	1 x 10 ⁶	100

**Consent to Establishment (CTE)
Compliance to conditions**

S.No	Comments of TNPCB	Compliance Report
1	The Sludge drying beds shall be replaced with Mechanical Filter Press in the proposed STP	The Sludge drying beds shall be replaced with Mechanical Filter Press. Accordingly, STP process design revised
2	The Corporation shall propose Ozonation /UV Disinfection for the disinfection of treated sewage instead of chlorination	Ultraviolet disinfection is proposed for disinfection of treated sewage instead of chlorination. The process design is revised accordingly.
3	The Corporation shall explore the possibility	The Possibility of utilizing the treated

	of utilizing the treated sewage for industrial use other than using it for irrigational purpose as per the Hon'ble NGT order dated:27.11.2018 in O.A No.148/2018	sewage for industrial use other than using it for irrigational purpose, have been explored as per the Hon'ble NGT order dated:27.11.2018 in O.A No.148/2018. The requirement of Raw water (Treated water) for the needy industries will be sent separately.
4	The Corporation shall comply with the Hon'ble NGT order dated:30.04.2018 in O.A No. 1069/2018, regarding the discharge standards of treated sewage prescribed from time to time.	The Corporation Will comply with the Hon'ble NGT order dated:30.04.2018 in O.A No. 1069/2018, regarding the discharge standards of treated sewage prescribed from time to time

81. The STP will require uninterrupted power supply for operation of all the units from inlet to SBR, 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:

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

82. One of the critical aspects in STP operation is, change in raw sewage characteristics at inlet of STP which 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:

- No industrial wastewater shall be allowed to dispose into municipal sewers;
- No domestic wastewater from industrial units shall be allowed into municipal sewer. 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 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 be checked to ensure proper functioning of STP

83. Proposed STP site is located at Viruthampattu on the bank of River Palar in the northern part VCMC area. Site is located adjacent to a solid waste management (segregation) facility of the VCMC. Site is located adjacent to left bank (towards north) of Palar River and there are agricultural lands between the river and the proposed STP site. Housing development is in the north of the proposed site, which is separated by a road, and the nearest house is at about 60 m from the closest boundary of the STP site. Except in the north where there are houses from 60 m distance, proposed site is surrounded by agricultural and vacant land and Palar River. SBR

process being an aerobic process and conducted in a compacted and a closed system with automated operation, odour nuisance will be very minimal. Limited bad odours may be generated from wet well, primary treatment units and sludge treatment. Adequate buffer around the plant, that is within the boundary of the STP site and with better planning of layout away from the houses in the north is to be followed. Besides operating the plant as per the standard operating procedures, which will further minimize the odour potential, the following measures are also included in the site planning and design:

- Develop the STP layout plan within the identified site such that maximum buffer space be provided towards the houses in the north, in the layout develop, office or other such facilities towards to houses, so that they will act as buffer;
- Providing 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;
- Provide odor control/treatment system. Dewatering units shall be located in enclosed building vented to odor control unit, and health and safety precaution shall be put in place to minimize H₂S build up;

84. **Sewage sludge** generally consists of organic matter, pathogens, metals and micro pollutants. The concentration of parameters such as metals can be influenced by input to the sewers system from industry. Since no industrial wastewater is allowed into sewers, it is unlikely that sludge contains heavy metals. The sludge from reactors will be collected in sludge sump and dewatering is done through filter press. Dewatering units will be in enclosed building vented to odour control unit, and health and safety precautions shall be put in place to minimize H₂S build up. 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. Sludges 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.

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

Table 18: 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/cm ³)		<1	Less than 1.6
Total Or organic Carbon, per cent by weight, minimum		12	7.9
Total Nitrogen (as N), per cent by weight, minimum	percent by weight	0.8	0.4
Total Phosphate (as P ₂ O ₅) percent by weight, minimum	percent by weight	0.4	10.4
Total Potassium (as K ₂ O), percent by weight, minimum	percent by weight	0.4	-
Color			
Odor		Absence of foul Odor	
Particle size		minimum 90% material should pass through 4.0 mm is sieve	minimum 90% material should pass through 4.0 mm is sieve

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)
Conductivity, 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.

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

87. Accumulation of silt in sewers in areas of low over time, overflows, blockages, power outages, harmful working conditions for the workers cleaning sewers etc. are some of the issues

that are taken into consideration during the sewer system design. Measures such as the following are included in sewer system design to ensure that the system provides the benefits as intended:

- Limit the sewer depth where possible;
- Sewers shall be laid away from water supply lines and drains (at least 1 m) if not possible, sewer lines shall be laid below the waterlines;
- 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);
- 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)
- For shallower sewers and especially in narrow roads, use small inspection chambers in lieu of manholes;
- Controlled blasting would be undertaken in some stretches where hard rock is encountered based on the site conditions. ; For the safety of humans and the structures within the area influenced by the blasting, the vibrations related impacts would be addressed by designing the blast charge by complying with the provisions elaborated in the applicable Indian regulations and standards. All records shall be maintained by the Contractors and PIU. Training related to controlled blasting activity will be included in the overall safeguards training programme meant for PIUs and Contractors
- Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize silt/garbage entry;
- Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity main to prevent buildup of solids and hydrogen sulfide generation.

88. **Sewage Pumping stations and lift stations.** It is proposed to construct seven sewage lift stations, and five sewage pumping stations, which will receive sewage from the catchment area via the sewer network and pump to higher level manholes or pumping stations 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.

89. Lift stations will cater to small area, and will be located at lowest point where the sewage from catchment area will be collected, and then pumped to a higher level manhole for further gravity flow 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 dia 2 m to 2.5 m and 5 m to 7.5 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.

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

- Inlet chamber - length (2 – 3.5 m), width (1.5 m) and depth (2.3 – 4.3m);
- Screen chamber - length (4 – 4.5 m), width (2 - 3.5 m) and depth (2.3 – 5.3m)
- Grit well - Dia (4.5 – 8 m) and depth (3.3 – 6.3)m);
- Suction well - Circular at SPS 3 - Dia (5.5 – 6 m) and depth (6.6 – 8.7m)
- Suction well - Rectangular at SPS 4, 5 and 6 - length (9.5 – 15.5 m), width (6 -12m) and depth (8.4 – 9.6 m);
- DG set platform; and

▪ Pumproom.

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

and pumping frequency will be high. The sewage retention time in the suction well therefore varies throughout the day, with very high retention periods during the nights and mid-days.

92. **Odor from pump stations.** In the suction wells, the sewage emits gases, which accumulated in the air above water surface. The gas may include odorous compounds like hydrogen sulphides (H_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 depends on quantity of accumulated sewage and sewage retention time that create anaerobic conditions. Both increase in quantity of sewage accumulation and retention time will increase the H_2S generation. Design considerations are included to minimize the both as much as possible. Pumping stations cater to large area and will have high capacity of suction wells and pump sets, while lift stations are small with lower capacity of suction wells and pump sets. The retention time is kept to its lowest possible so that there is no stagnation of sewage for long time which could create anaerobic conditions.

93. Given that lifting stations and pumping stations are to be located at technically feasible

locations (e.g., lowest point to where sewage can be conveyed from households by gravity) within or close to the residential areas which are being served by respective pumping/lifting station.

Given the very limited land availability in urban areas like the project area, that too of government owned lands, locating the pumping stations ideally about 50-100 m away from the houses is not practical. In Vellore, sites for pumping stations were identified based on the technical suitability and availability of government owned land parcels to avoid land acquisition. Given the comparatively higher potential of odor generation, priority has been given to accommodate pumping stations at more suitable locations away from houses and mostly in sparsely populated areas. Sites which are located close have been selected only in cases where there are no other alternative lands available.

94. Following design related measures are included in the sewage pumping and lifting station design. As presented in the baseline profile, few lifting stations are located along the road 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 a buffer area around the facility may not be feasible. Odor potential of lifting stations is very minimal given small scale operation, however, given close location to houses, design related measures as given below are included.

95. Layout planning related measures.

- Siting of wells within the identified site at an internal location as far as possible from adjoining residential buildings;
- 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; and
- Provision of high compound wall.

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

- Proposed wells to be closed using RCC slabs. Design of RCC slab to consider both superimposed loads (human and equipment loads) and severe corrosion risk from sewer gas from within wells.
- 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.
- Since human intervention is involved and safety shall be primary and critical consideration, additional protection by way of a metal 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.
- 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/draw if required for maintenance purposes is not compromised.
- 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.
- 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.
- 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.
- 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.
- Develop standard operating procedures/operational manual for operation of lifting and pump stations; this shall include measures for emerge situations.
- Provide training to the staff in SOPs and emergency procedures.
- Periodically monitor H2S levels at sewage pumping and lifting stations using handheld H2S meters 7.

97. **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 facilities located very close to the houses/properties.

- For sewage pumping stations SPS3, SPS4 and SPS6 which are located adjacent to houses (within 50m), 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
- For lifting stations, the above arrangement should be provided where the buffer distance between sewage well and nearest house/property is less than 50m.

98. Noise from pumping operations. Operation of pumps and motors and diesel generator 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 at acceptable levels.

- Procure good quality latest technology high pressure pumps that guarantee controlled noise at a level of around 80 dB(A) at a distance of 1m;⁸
- Use appropriate building materials and construction techniques for pump houses which can absorb sound rather than reflect noise;
- Use acoustic enclosures – manufacturer specified, for all pumps, motors;
- Procure only CPCB approved generators to meet air emission and noise level requirements;
- Provide sound mufflers for ventilators in the plant rooms; and sound proof doors; and
- Provide ear plugs designated for noise reduction to workers.

⁷ 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.

⁸ 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.

99. 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 to the STP on the outskirts of the city. It necessitates 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.

100. 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:

- Using low-noise and energy efficient pumping systems;

- Efficient Pumping system operation;and
- Installation of Variable Frequency Drives(VFDs).

101. Tree cutting at selected projects sites. As presented in the baseline profile of subproject sites, few trees are on the selected SPS sites at SPS 4, and SPS 6. 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.

- Minimize removal of trees by adopting to site condition and with appropriate layout design of pumping stations, specifically at SPS 4, and SPS 6;
- Obtain prior permission for tree cutting;and
- Plant and maintain 10 trees for each tree that is removed.

102. Utilities. Telephone lines, electric poles and wires, water lines, drains, if exists within the proposed project locations may require to be shifted. All these selected projects sites are vacant and unused government lands, there are no notable existing utilities. Sewer lines are proposed within the road way, where there are no utilities. In the outer areas where there is adequate earthen shoulder along the road carriageway, 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:

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

103. Site selection of construction work camps, stockpile areas, storage areas, and disposal areas.

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

104. Site selection of sources of materials. Significant quantities of coarse aggregate and fine aggregate will be required for construction works. Contractor should procure these materials only from the quarries permitted/licensed by Department of Geology and Mining. Contractor should procure material from existing quarries. Contract should not create / use any new borrow pits / quarries.

105. Social and Cultural Resources. 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. Vellore has very rich history and heritage and is a house to three nationally important protected monuments: Fort, Jalakanteshwara Temple and Old Mosque. The Temple and Old Mosque both are situated within the Fort. Fort is located within the city, surrounded by a wide moat. No components are proposed within the Fort area,

however, there are houses located within the 300 m regulated distance from the fort boundary. SPS 6 is located at about 260 m from the fort boundary, which is within the 300 m regulated boundary. The main sewers leading to and coming out of SPS 6, will also fall within the 300 m regulated boundary (Figure 25). These works would be implemented obtaining permission, prior to construction. Project sites may contain archaeological or historical remains, and therefore there is a risk of uncovering them. Following measures are to be implemented, and City Corporation will also follow chance find protocol to ensure that any chance finds are recognised and measures are taken to ensure they are protected and conserved.

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

- Obtain prior permission from ASI/NMA for the works to be conducted within the regulated zone of monument; submit detailed construction drawings clearly indicating the details of proposed excavations and works, use of equipment and machinery, etc., to ASI for their review; incorporate any suggestions/recommendations of ASI in project design and implementation;
- Consult ASI and local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals;
- Excavation and construction methodology to be used near the monuments (within the regulated area of 300 m of any monument) shall be in line with the ASI recommendations;
- Dust control measures shall be put in place; all work areas to be barricaded and enclosed with dust screens; and
- Conduct air quality and noise monitoring weekly throughout construction phase in the 300 m regulated area.

105 Measures for Chance finds. 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 local ASI office if a find is suspected, and taking any action they require to ensure its removal or protection in situ.

Figure 25: Project Components in 300 m Boundary of ASI Monument



B. Construction Impacts

107. 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, 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.

108. 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.

109. 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.

110. Subproject also include linear works (laying of 181.163km sewers along the roads). This covers entire project area comprising Alamelumangapuram, Sathuvachari, Shenpakkam, Konavattam, Vasanthapuram, and Velapadi (Zone 3 to Zone 7) 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 sewer 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. SPS 6 at Shenbakkam is connected by a narrow road to the main road. Each SPS will be connected with two sewers (incoming and outgoing); and therefore at SPS 6, two sewers will need to be laid in narrow road. SPS 3, and SPS 4 are located in residential areas, and for a short distance from main road to sites, sewers will need to be laid in the internal roads.

111. 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. Diameter of sewer ranges from 200mm to 1300mm, of which 85% of these sewers are of 200 mm. According to the design the sewers will be laid at a depth of 1 to 6 m. The width of the trench excavation along the roads will vary from 0.6 m to 1.8 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 or less. The design is optimized to restrict the sewer depth to a maximum of 6 m with an optimal combination of sewer depth and pumping requirements.

112. 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.

As trenches are deep (upto 6m), there is risk of collapse of trenches and/or damage to surrounding buildings, safety risk to pedestrians and traffic. Necessary precautions such as bracing/shoring in the trench will be provided for trenches of more than 1.2m deep. The normal working hours will be 8 hours daily, the total duration of each stage depends on the soil condition and other local features. Excavated soil will be used for refilling the trench after placing the sewer and therefore residual soil after pipe laying and refilling is not significant. Total earthwork excavation will be over 375,000m³, of which nearly 95% of excavated soil will be reused, and the remaining 18,750 m³ of excess soil needs to be disposed safely. 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.

113. 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.

114. Situated around the old core city of Vellore, the project area is well developed, and has dense population, except in the outskirts and along the banks of Palar River. Agriculture and vacant lands can be observed in the outskirts. There are large vacant lands in the eastern part of the city. Two National highways (NH 46 and NH 234) pass through project area. Besides there are several important roads, Bangalore Road, Arcot Road, Old bypass road, SH 207, Vellore- Thoothkudi highway that pass through the project area. The next level roads are internal main roads providing connectivity within the city. These include: Azad road, Fort round road, Pillayar koil street, Shenabakkam road, Shankarapalayam road, south avenue road, main bazaar road, Vasanthapuram road, etc.

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

116. **Sources of Materials.** Significant amount of sand and coarse aggregate will be required for this project, which will be sourced from quarries. Quarries inevitably cause extensive physical changes; as construction materials are excavated from the ground, leaving large cavities, or levelling hillsides, etc. The physical damage caused by quarries is controlled by allowing them to operate within specific limited areas only, so the damage is restricted in extent and not allowed to spread indiscriminately. New quarries are subject to a rigorous process of environmental assessment to ensure appropriate siting and adequate environmental controls on the operation. It is therefore important to ensure that construction materials for this project are obtained from existing government approved licensed quarries only, to ensure these controls are in place. In Vellore, construction materials are normally obtained from government licensed suppliers. Contractors 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:

- Obtain construction materials only from government approved quarries with prior approval of PIU;
- PIU to review, and ensure that proposed quarry sources have all necessary clearances/ permissions in place prior to approval;
- Contractor to submit to PIU on a monthly basis documentation on material obtained from each source (quarry/ borrow pit);
- 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.

117. **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 in an air shed that appears to already be degraded for dust. Significant quantities of earthwork will be conducted in the subproject, spread all over the project area. 95% of the excavated soil will be reused for filling the trenches. Also emissions from construction vehicles, equipment, and machinery used for excavation and construction will induce impacts on the air quality. Anticipated impacts include dust and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides,

and hydrocarbons. Dust generation from construction work in individual and confined work sites like STP, pumping stations etc., will be mainly during the initial construction phase of earth work, as the site is confined, dust can be effectively controlled with common measures. STP is located outside the city, away from habitation area. Dust generation will be significant during sewer laying along the roads. Increase in dust/particulate matter in ambient air is detrimental, and may have adverse impacts on people and environment. To mitigate the impacts, construction contractors will be required to:

118. For all construction works.

- 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;
- 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;
- 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;
- Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process;
- Cover the soil stocked at the sites with tarpaulins and surround by dust screens.
- Control access to work area, prevent unnecessary movement of vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation
- Use tarpaulins to cover the loose material (soil, sand, aggregate etc.,) when transported by open trucks;
- 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;
- Clean wheels and undercarriage of haul trucks prior to leaving construction site
- Ensure that all the construction equipment, machinery are fitted with pollution control devices, which are operating correctly, and have a valid pollution under control (PUC) certificate; and
- No vehicles or plant to be left idling at site generators to be at placed maximum distance from properties.

119. For sewer works.

- 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.
- 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;
- 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;
- Barricade the construction area using hard barricades (of 2 m height) on both sides;
- Initiate site clearance and excavation work only after barricading of the site is done;
- Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes

etc.), to the barricaded area;

- Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area;
- 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;
- 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;
- 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;
- 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);
- Conduct work sequentially - excavation, sewer laying, backfilling; testing section-wise (for a minimum length as possible) so that backfilling, stabilization of soil can be done;
- Remove the excavated soil of first section to the disposal site; as the work progresses sequentially, by the time second section is excavated, the first section will be ready for back filling, use the freshly excavated soil for back filling, this will avoid stocking of material, and minimize the dust; and
- 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.

120. Immediate road restoration after refilling the trench. Excavation and refilling activities disturb the top soil, and under the influence of wind, traffic, pedestrians, and other activities etc., produces dust. There is large potential to generate significant quantities of dust after refilling the trench, and prior to road relaying. It is a common practice not to restore the road immediately after refilling the trench so as to allow sufficient time for the refilled material to stabilize naturally. Given the dry and windy conditions, and heavy traffic and other activities along the roads, the refilled trenches with loose top soil along the roads will generate maximum dust, and create very unhealthy conditions. Moreover, as the barricades/dust screens will be removed after the trench is refilled, there will be absolutely nothing to control the dust generation. Dust control activities like wetting of top soil will not be effective given the site conditions. It is therefore necessary to restore/relay the road surface immediately or take suitable steps to arrest the dust. Soil consolidation technique shall be used so that road can be restored immediately. Immediately consolidate the backfilled soil and restore the road surface; if immediate road restoration is not possible, provide a layer of plain cement concrete (PCC) of suitable mix on the backfilled trench so that dust generation, erosion is arrested and it will also provide a smooth riding surface for the traffic until the road is properly restored. Backfilled trench without any road restoration is a major source of dust.

121. **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, with major share of its annual 1000 mm rain in northeast (October to December). River Palar flowing through the city forms northern boundary of project areas. River runs mostly dry

throughout the year; it rarely flows. Velavadi eri (lake) is situated in the western part of the City. Besides, there are other small water bodies in and around the project area. Project area mostly drains into Palar River. It is important that runoff from the construction areas, which may contain silt and chemical traces do not enter the river and the water bodies. Impact will be temporary, and but needs to be mitigated. Construction contractor will be required to:

- All earthworks be conducted during the dry season to prevent the problem of soil/silt run-off during rains;
- Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; do not stock earth/material close to water bodies (at least 100m);
- Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, only designated disposal areas shall be used;
- Install temporary silt traps, oil traps or sedimentation basins along the drainage leading to the water bodies;
- 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;
- Store fuel, construction chemicals etc., on an impervious floor, also avoid spillage by careful handling; provide spill collection sets for effective spill management;
- Dispose any wastes generated by construction activities in designated sites; and
- Conduct surface quality inspection according to the environmental management plan (EMP).

122. To reach the STP located on the northern part from the project area located in the south, the pumping main sewer will be laid over a bridge across River Palar. Construction of bridge in the river may pollute river water, and degrade the river bed. Although river is mostly dry, following measures to be implemented by the contractor:

- Schedule and complete the bridge works prior to onset of monsoon, and ensure that works are conducted during low flow time, when the river bed is dry;
- Works shall be conducted with minimum disturbance to river bed; implement best construction methods to minimize disturbance/consolidation of river bed; as far as possible avoid using heavy equipment mobilization;
- No labour camps or material storage camps shall be located in or near the river (500 m distance from river shall be maintained);
- Ensure no spillage of construction chemicals, fuels, oil etc.,
- Ensure that construction site is cleared off of all the material and debris immediately after completion of works;
- Submit a site clean-up and restoration report to PIU for approval; and
- Conduct environmental monitoring as per the EMP.

123. **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 implement the following measures:

- 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;

- Pump out the water collected in the pits/excavations to a temporary sedimentation pond; dispose of only clarified water into drainage channels/streams after sedimentation in the temporary ponds; and
- Consider safety aspects related to pit collapse due to accumulation of water.

124. Generation of Construction Wastes. Solid wastes generated from the construction activities are excess excavated earth (spoils), discarded construction materials, cement bags, wood, steel, oils, fuels and others 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 water courses and could negatively impact the landscape. Total earthwork excavation will be over 375,000 m³, of which nearly 95% will be reused, and the remaining 18,750 m³ of excess soil needs to be disposed safely. The following mitigation measures to minimize impacts from waste generation shall be implemented by the contractor:

- Prepare and implement a Construction Waste (Spoils) Management Plan (format is given in Appendix 3);
- As far as possible utilize the debris and excess soil in construction purpose, for example for raising the ground level or construction of access road etc.;
- Avoid stockpiling any excess spoils at the site for long time. Excess excavated soils should be disposed at approved designated areas immediately;
- If disposal is required, the site shall be selected preferably from barren, infertile lands; sites should locate away from residential areas, forests, water bodies and any other sensitive land uses;
- 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 worker's camp sites for disposal of biodegradable waste; non-biodegradable/recyclable materials shall be collected separately and sold in the local recycling material market;
- Residual and hazardous wastes such as oils, fuels, and lubricants shall be disposed off via licensed (by TNPCB) third parties;
- Prohibit burning of construction and/or domestic waste;
- 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; and
- 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.

125. Noise and Vibration Levels. Except one pumping station, and STP, which are located close to Palar River, and slightly away from habitations, all other components are located within the developed area of the city, where there are houses, schools and hospitals, religious places and businesses in the surrounding area. 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. This impact is negative short-term, and reversible by mitigation measures. The construction contractor will be required to:

- Plan activities in consultation with PIU so that activities with the greatest potential

to generate noise and vibrations such as controlled blasting are conducted during periods of the day which will result in least disturbance, especially near schools and other sensitive receptors;

- Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and use portable street barriers to minimise sound impact to surrounding sensitive receptors;
- Maintain maximum sound levels within the limits as prescribed by the prevailing Indian regulations and standards;
- Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach;
- 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;
- 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;
- All controlled blasting activities are to be carried out through an approved and licensed Explosive contractor following the mitigation measures detailed in para 136;

126. Besides the above, works in the regulated buffer zone of protected monuments requires special precautions to avoid any potential disturbance / damage to the monuments.

Noise, dust and vibration emanating from the works, if not properly planned or executed may disturb/damage the monument. Following measures are to be implemented:

- Obtain prior permission from ASI/NMA for the works to be conducted within the regulated zone of monument; submit detailed construction drawings clearly indicating the details of proposed excavations and works, use of equipment and machinery, etc., to ASI for their review; incorporate any suggestions/ recommendations of ASI in project design and implementation;
- Excavation and construction methodology to be used near the monuments (within the regulated area of 300 m of any monument) shall be in line with the ASI recommendations;
- Dust control measures shall be put in place; all work areas to be barricaded and enclosed with dust screens; and
- Conduct air quality and noise monitoring weekly throughout construction phase in the 300 m regulated area.

127. 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:

- NH46 Bangalore-Chennai highway;
- NH 234 Mangalore-Villupuram;
- SH 207 – Krishnagiri –Vellore;
- Old Bangalore Road;
- Old Arcot Road;
- Old bypass road; and
- Vellore-Thoothkudi highway.

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

within the city. These include: Azad road, Fort round road, Pillayar koil street, Shenabakkam road, shankarapalayamroad,southavenueroad,mainbazaarroad,Vasanathapuramroadetc.,The se roads also carry considerable flow of traffic and are centers of commercialactivities.

129. Internal roads in the project area are narrow, and in outer areas roads are comparatively wide. 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 mostlydisrupted.

130. Sewers leading to and coming out of SPS 6 at Shenabakkam will be laid through a very narrowroadconnectingtheSPS6sitewithamainroad.Onesewer willbelaidatatime,sothat pedestrian access is maintained to the houses. For construction of manholes, an area of 1.5 mx1.5mto2.5mx2.5mwillbeexcavatedatregularinterval'sdependingonthedesign-minimum distance between manholes of 30 m is adopted for sewer size up to 400 mm and larger spacing up to 100m for large diameter sewers. This will be kept open for longer duration (15- 20days).

131. 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 andaccessibility.

132. Haulingofconstructionmaterial,equipment,constructionwaste,etc.,toandfromthewor k site may increase the road traffic on local roads. This will further inconvenience the local communityandroadusers.Potentialimpactisnegativebutshorttermandreversiblebymitigatio n measures. The construction contractor will be requiredto:

133. Sewer works.

- Prepareasewerworkimplementationplanineachzoneseparatelyandundertake the work accordingly; ensure that for each road where the work is being undertakenthereisanalternativeroadforthetrafficdiversion;takeuptheworkin sequential way so that public inconvenience isminimal;
- Plan the sewer work in coordination with the traffic police; provide temporary diversions, where necessary with clear signage and effectively communicate with generalpublic;
- Avoiding conducting work in all roads in a colony at one go; it will render all roads unusabledue toexcavationsatthesametime,creatinglargescaleinconvenience
- 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 differentzones;
- Confineworkareasintheroadcarriagewaytotheminimumpossibleextent;allthe 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 theas and whenrequired;
- 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 constructionperiod;
- 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.

- 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;
- 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.
- Inform the affected local population in advance about the work schedule, a week before, and a day before start of work;
- Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum;
- Keep the site free from all unnecessary obstructions;
- Notify affected public by public information notices, providing signboards 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; and
- At work site, public information/caution boards shall be provided including contact for public complaints.
- For sections where the controlled blasting is proposed, the residents shall be provided with the schedule of blasting at least three days in advance and the residents are explained about the preventive, precautionary, mitigation and emergency response measures being taken to address their concerns.

134. 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.

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

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

inconvenience and disturbance to the public. Resettlement and social issues are being studied in a parallel resettlement planning study of this subproject.

- Inform all businesses and residents about the nature and duration of any work well in advance so that they can make necessary preparations;
- 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;
- 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;
- Control dust generation;
- 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;
- 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;
- Consult businesses and institutions regarding operating hours and factoring this in work schedules; and
- Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.

136. **Socioeconomic – 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.

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

- Follow all national, state and local labour laws (indicative list is in Appendix 2);
- 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 activity, which shall include measures such as: (a) safe and documented construction procedures to be followed for all site activities; (b) ensuring all workers are provided with and use personal protective equipment; (c) OHS Training⁹ 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;¹⁰
- Ensure that qualified first-aid is provided at all times. Equipped first-aid stations shall be easily accessible throughout the sites;
- Secure all installations from unauthorized intrusion and accident risks
- 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;
- 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;
- 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;

⁹Some 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 foundation 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.

¹⁰ International Finance Corporation. Sustainability Webinar Series. [World Bank Group Environmental, Health and Safety Guidelines 101](#).

- Ensure moving equipment is outfitted with audible back-up alarms;
- 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;
- 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;
- Provide supplies of potable drinking water; and
- Provide clean eating areas where workers are not exposed to hazardous or noxious substances.

138. 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:

- Confine work areas; prevent public access to all areas where construction works are on-going through the use of barricading and security personnel;
- Attach warning signs, blinkers to the barricading to caution the public about the hazards associated with the works, and presence of deep excavation;
- 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;
- Control dust pollution – implement dust control measures as suggested under air quality section;
- Ensure appropriate and safe passage for pedestrians along the worksites;
- Provide road signs and flag persons to warn of on-going trenching activities;
- Restrict construction vehicle movements to defined access roads and demarcated working areas (unless in the event of an emergency);
- Enforce strict speed limit (20 kmph) for plying on unpaved roads, construction tracks;
- Provide temporary traffic control (e.g. flagmen) and signs where necessary to improve safety and smooth traffic flow;
- 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;
- 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;
- All drivers and equipment operators will undergo safety training; and
- Maintain regularly the construction equipment and vehicles; use manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.

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

- 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
- The contractor shall submit a blasting plan in advance to PIU; and implement in accordance to the plan.
- Permission shall be obtained from The District Collector for controlled blasting for excavation and the conditions issued shall be complied with during implementation.
- Blasting shall be done 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 UGSS activity works Schedule
- 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.
- 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.
- 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.
- Minimum explosive will be used for Control Blasting for 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.
- 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, Vellore.
- For the diversion of traffic in the blasting area, the contractor shall prepare a traffic management plan and obtain permission from Vellore Corporation and traffic police.

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

- Consult PIU before locating project offices, sheds, and construction plants;
- 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;
- Avoid tree cutting for setting up camp facilities;

- Provide a proper fencing/compound wall for campsites;
- Camp site shall not be located near (100 m) water bodies, flood plains flood prone/lowlying areas, or any ecologically, socially, archeologically sensitive areas
- Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit;
- 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 galvanized iron sheets, tarpaulins, etc., shall not be used as accommodation for workers;
- Camps shall be provided with proper drainage, there shall not be any water accumulation
- 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;
- Prohibit employees from cutting of trees for firewood; contractor should provide cooking fuel (cooking gas); fire wood not allowed;
- Train employees in the storage and handling of materials which can potentially cause soil contamination;
- 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 (100m away from surface water body or groundwater well)
- Recover used oil and lubricants and reuse or remove from the site;
- 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;
- Remove all wreckage, rubbish, or temporary structures which are no longer required; and
- 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

141. Operation and maintenance (O&M) of the sewerage system will be carried out by Vellore City Municipal Corporation. Operation will involve collection and conveyance of wastewater from houses to nearest lifting/pumping stations; operation of lifting/pumping stations to pump accumulated sewage main pumping stations; operation of main pumping stations to pump accumulated sewage to STP; treatment of sewage at STP to meet the disposal standards; and final disposal of treated wastewater, and treatment and disposal of sludge. STP is awarded under design-build modality, and the contractor has prepared detailed designs for STP including the outfall sewer and disposal arrangements.

142. Treated wastewater disposal from Sewage Treatment Plant. It is proposed to dispose treated wastewater from STP into an irrigation canal (Pandiyan Channel), that flows at about 2.4 km from the STP site. This channel originates from Kalinjur lake and carries its overflow for irrigation needs and discharges surplus into Palar River after flowing 15-16 km through outer areas of Vellore city (for about 4-5 km) and through agricultural lands (for about 10-12 km). Water from the channel is used for irrigation purposes along its course. The treated effluent discharge point is now finalized into Palar River directly at Kangeyanallur near burial ground about 2.127 km from STP.

143. The design-build contractor has completed the design of STP and discharge arrangements and the study of capacity adequacy of channel to safely

discharge the treated water is being assessed. TNPCB has examined the design of STP and disposal arrangements and accorded Consent to Establish to the STP and permission to discharge treated sewage at 2.127 km from STP. A copy of the Consent to Establish is attached as Appendix 12. Application for renewal of Consent to Establish is being processed by TNPCB. Following measures are being carried out by the Contractor.

- Conduct a detailed baseline assessment of receiving water body capacity considering worst case scenario – highest rainfall, lean flow condition, and including extreme weather events like intense rainfall etc.
- Conduct a detailed water quality assessment of receiving water body (Palar river at discharge point including a control point on upstream); monitor water quality periodically during operation phase as per the environmental monitoring plan;
- Design the treated effluent outfall arrangement in such a way to have proper dilution of the effluent;
- Obtain Consent variation order for the changes in location of disposal point.

144. River Palar is mostly dry, and in last two decades as per the local information it flown only couple of times. There was no flow and River was completely dry during the project preparation phase as well. Baseline water quality studies of River Palar shows that the quality water in Palar River is highly polluted. As the wastewater is treated to set standards its discharge into Palar River will not cause any adverse impact to the quality of water; instead the treated effluent will dilute the river water and improve its quality. Considering the existing status of the Palar River, and the degree of treatment and self-purification of the river, no significant impacts envisaged. Proper systems should be put in place at the proposed STP to ensure that treated wastewater at all times meet the stipulated standards prior to its disposal into this channel.

145. **Treatment efficiency and Compliance with Disposal Standards.** As discussed above, as per the revised proposal, the treated wastewater will be disposed into Palar River.

Any change/lowering of treatment efficiency during operation may lead to poor quality of wastewater and affect the river water quality. It is therefore critical that STP treats the sewage to meet the effluent discharge standards. Sewage treatment facility has been designed to meet the effluent standards specified in the CTE issued by TNPCB which is presented in Table 13. Operation and maintenance of STP with SBR technology is controlled by Program Logic Control (PLC) system with sensors to assess the quality at various points including inlet and outlet of the STP and the operation will be automatically adjusted to maintain the effluent quality.

146. **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. For ensuring uninterrupted power supply, back-up facility is included in the design of STP. The capacity of the DG is being worked out. Standard Operating Procedures and Operation Manual is being prepared by the design-build contractor incorporating the detailed operating procedures and preventive maintenance schedules, monitoring parameters and schedules etc. 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, has been taken into consideration in the project design. Manual will also include safety awareness and mock drills for workers safety.

147. **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 sewage, which does not include industrial effluent. Characteristics of industrialeffluentwidelyvarydependingonthetypeofindustry,andthereforedisposalofeffluent 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.

148. Use of treated wastewater for irrigation. In Vellore, the sewer system will collect only domestic sewage, and it will not cater to industrial wastewater. STP will treat wastewater to disposal standards. The flow of the treated effluent in the open channel will further improve the quality of water. If the wastewater with bacteriologicalcontaminantsareusedforfoodcropslikelettuce,tomato,whichareeatenwithou t peeling or cooking, it will present a greater health risk if precaution such as such washing with chlorinatedwaterorstoringforadequatetimeinnormaltemperaturebeforeuse(atleast10days) . According to the WHO, effluent which is used to irrigate trees, industrial/commercial (not food, likecotton)andfoddercrops,fruittrees,andpastureshouldhavelessthanoneviablenematode eggperliter.Effluentusedfortheirrigationoffoodcrops,sportsfields,publicparks,shouldhave and less than one viable nematode egg per liter and less than 100 faecal coliforms per 100 milliliters. In the areas around Vellore, all types of crops are cultivated, including vegetables, thereforethisstandardshallbemetpriortogiving treated effluent for irrigation.Propermonitoringof water is required for use in irrigation, and is proposed in the environmental monitoring plan. this will be further studied based on final design and disposal arrangement.

149. Sewage sludge. Expected sludge generation from STP is about 8186 kg/day. Sewage sludge contains harmful substances such as bacteria and pathogens, and nutrients like nitrogen,phosphates.Improperhandlinganddisposalofthesludgewillhaveadverseimpactso n health and environment. Sludge regularly accumulates in the treatment units during the process. 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, mixed with polyelectrolyte and pumped to filter press unit for dewatering and thickening. This unit will be enclosed in a building and vented to odour control unit. The sludge in the form of a wet cake will be further air-dried in the sludge dewatering system. 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. A sludge management plan is being prepared by the contractor incorporating testing of treated sludge, details of disposal site etc.The reuse of sludge should be preceded by rigorous bacteriological tests to confirm that the treatment methods render all dried sludge and effluent freefromentericbacteriaandpathogens,sothatitisafetohumans,animalsandcrops.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

150. STP design has been completed under design-build contract modality, following measures were considered and included in the detailed design of theSTP:

- Process design to meet the discharge standards;
- Regular monitoring to ensure that treated wastewater always meets the design disposal standards;
- Conduct a detailed baseline assessment of receiving water body capacity considering worst case scenario – highest rainfall, overflow of Kalinjur lake, and including extreme weather events like intense rainfall etc.,

- Conduct detailed water quality assessment of receiving water body as per the Environmental Monitoring Plan; obtain TNPCB consent for disposal of treated wastewater into Palar River.
- Sludge management to collect, treat and dispose the accumulated sludge safely; sludge will be treated in a mechanical filter press which will separate the liquid and sludge which will be used as a soil conditioner in fields; Sludge will be tested periodically for heavy metal concentration;
- Install sludge dewatering system in an enclosed building and vented to odour control system;
- Designing the entire system to maintain optimal flow and terminal pressure, and optimising the overall energy usage in sewer system, including STP;
- Using low-noise and energy efficient pumping systems;
- Installing the noise-producing pumps and motors etc., in enclosed buildings with noise-reducing walls, and also maintaining a adequate buffer to the nearby inhabited areas;
- DG set will be provided as standby power for uninterrupted operation of STP and
- Provision of appropriate personal protection equipment to the workers and staff.

151. The O & M of the STP for 10 years is the responsibility of the design- build contractor. Following measures will be incorporated in the O & M Manual being prepared by the Contractor.

- Ensure proper knowledge transfer, hands-on training to municipal staff engaged in STP operation has been provided by contractor prior to handover of facility;
- Ensure continuous uninterrupted power supply;
- Operate and maintain the facility following standard operating procedures of operational manual;
- Undertake preventive and periodic maintenance activities as required;
- Maintain the mechanical/electrical parts as per the maintenance plan to avoid any hazards;
- Conduct periodic training to workers;
- 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;
- Implement sludge management plan at the STP;
- No wastewater from industrial premises (including domestic wastewater) shall be allowed to dispose into municipal sewers;
- Monitor regularly and ensure that there is no illegal discharge through manholes or inspection chambers; conduct public awareness programs; in coordination with TNPCB;
- Conduct regular wastewater quality monitoring (at inlet and at outlet of STP) to ensure that the treated effluent quality complies with design standards;
- 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.

152. **Odour and Noise from Sewage lifting and pumping stations.** Various measures are included in the design of these facilities giving utmost importance to odor and noise. Therefore, it is anticipated there will not be any significant generation of odor or noise that will impact the surrounding households. Following measures are to be implemented during the operation:

- Strictly follow standard operating procedures/operational manual for operation and maintenance of lifting and pump stations;

- Ensure that operating staff is properly trained, and have clear understanding of odor issues vis-à-vis its related with operational practices;
- Ensure that pumping cycles are properly followed; and there is no buildup of sewage beyond design volume in the wells;
- Conduct H₂S monitoring (periodically at pumping stations and lifting stations);

153. **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.

154. There are also certain environmental risks from the operation of the sewer system, most notably from leaking sewer pipes as untreated faecal 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:

- 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 or sewer line blockages).
- 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;
- 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;
- 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;
- Develop an Emergency Response System for the sewerage system leaks, burst and overflows, etc.;
- Provide necessary health and safety training to the staff in sewer cleaning and maintenance;
- Provide all necessary personnel protection equipment; and
- Do not conduct manual cleaning of sewers; for personnel engaged in sewer maintenance work, there is a risk due to oxygen deficiency and harmful gaseous emissions (hydrogen sulphide, methane, etc.); provide for adequate equipment

(including oxygen masks) for emergency use.

VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Overview

155. 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 ADB Policy.

156. 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 business people who live and work near sites where facilities are being built (sewer network, pumping/lifting stations and STP), government and utility agencies responsible for provision of various services in project area. Secondary stakeholders are: NGOs and CBOs working in the area, community representatives, beneficiary community in general, government agencies, TNUISL, Government of Tamil Nadu and the ADB.

B. Public Consultation

157. 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

158. The subproject proposal is formulated by Vellore City Municipal Corporation in consultation with the public representatives in the project area to suit their requirements.

159. 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. The general public and the people residing along the project activity areas were also consulted. A project area level consultation workshop was conducted in Vellore on September 28, 2017, with the public representatives and prominent citizens.

160. It was observed that people were 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 safety, traffic issues, disturbance utilities during construction. Stakeholder suggested that road restoration works to be taken up immediately after laying the sewers to minimize the public inconvenience. Few stakeholders also suggested to ensure meeting treated wastewater disposal standards prior to disposal into Kalinjur lake. 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

161. Prior to start of construction, PIU conducted information dissemination sessions at

various places and solicit the help of the local community, leaders/prominent for the project work. Focus group meetings will be conducted to discuss and plan construction work (mainly pipeline work) with local communities to reduce disturbance and other impacts and also regarding the project grievance redress mechanism. Project information and construction schedule are being provided to the public via mass media (i.e., newspapers, VCMC website). Constant communication is established with the affected communities to redress the environmental issues likely to surface during construction phase. Contractor is providing prior public information (in Tamil and English) about the construction work in the area, 7 days prior to the start of work and again a day before the start of work via pamphlets (a sample public information template is provided in Appendix 4). At the work sites, public information boards will also be provided to disseminate project related information. The IEE will be made available at public locations and will be disclosed to a wider audience via the ADB, VCMC and TNUISL websites.

C. Information Disclosure

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

163. 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.

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

VII. GRIEVANCE REDRESS MECHANISM

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

166. Affected persons will have the flexibility of conveying grievances/suggestions by dropping grievance redress/suggestion forms in complaints/suggestion boxes or through telephone hotlines at accessible locations, by e-mail, by post, or by writing in a complaints register in ULB or PIU or VCMC 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.

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

168. 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).

169. In case of grievances that are immediate and urgent in the perception of the complainant, the contractor, and supervision personnel of the CMSC and PIU will resolve the issue on site, and any issue that is not resolved at this level will be dealt at PIU head level for immediate resolution. Should the PIU fail to resolve any grievance within the stipulated time period, the unresolved grievances will be taken up at VCMC level. In the event that certain grievances cannot be resolved even at VCMC level, particularly in matters related to land purchase/acquisition, payment of compensation, environmental pollution etc., they will be referred to the district level 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.

170. 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.

171. **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.

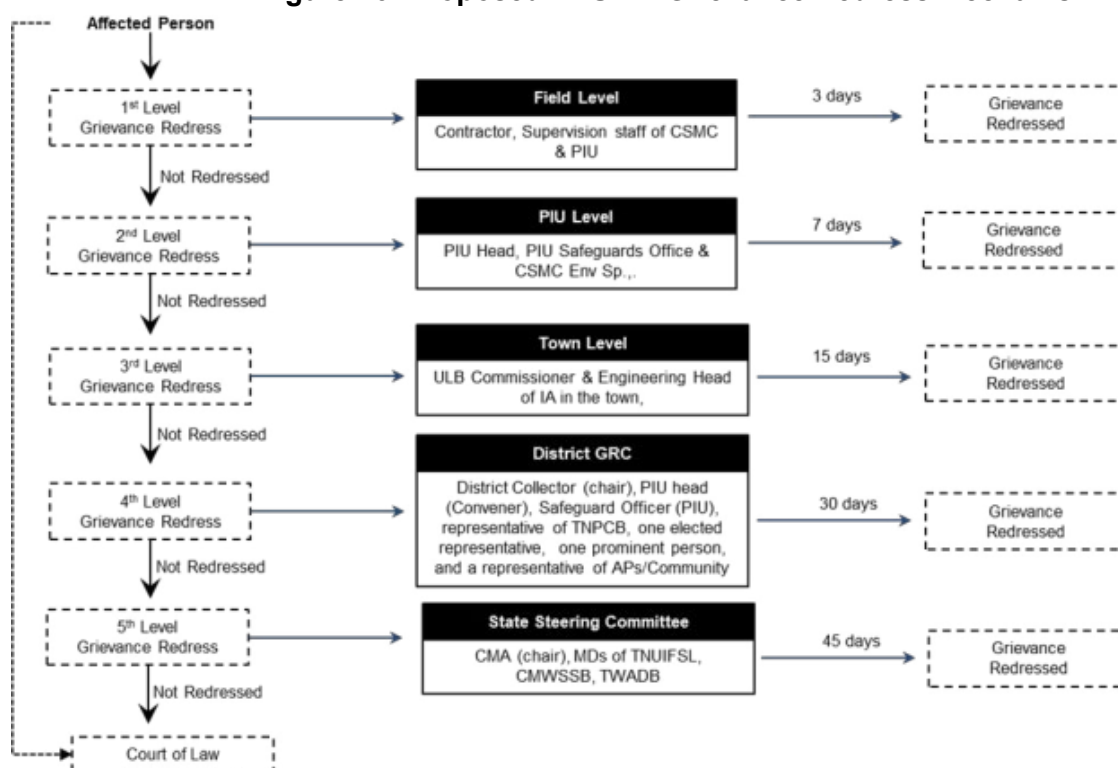
172. **State level steering committee** will include Commissioner of Municipal Administration as chair, member include managing directors of TNUIFSL, CMWSSB, TWAD Board and others as necessary.

173. **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 steering committee will have jurisdictional authority across the state (i.e., areas of influence of subproject facilities

beyond district boundaries, if any).

174. The multitier GRM for the project is outlined below (Figure 16), each tier having time-bound schedules and with responsible persons identified to address grievances and seek appropriate persons' advice at each stage, as required. The GRC will continue to function throughout the project duration. The implementing agencies/ULBs shall issue notifications to establish the respective PIU level grievance redress cells, with details of composition, process of grievance redress to be followed, and time limit for grievance redress at each level.

Figure 26: Proposed TNUFIP Grievance Redress Mechanism



CMA = Commissioner of Municipal Administration, CMSC = construction management and supervision consultant, CMWSSB = Chennai Metropolitan Water Supply and Sewerage Board, GRC = grievance redress committee, PIU = program management unit, TNUIFSL = Tamil Nadu Urban Infrastructure Financial Services Limited, TWADB = Tamil Nadu Water and Drainage Board.

175. **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.

176. **Information dissemination method of the Grievance Redress Mechanism.** The PIU, assisted by CMSC will be responsible for information dissemination to affected persons and general public in the project area on grievance redress mechanism. Public awareness campaign will be conducted to ensure that awareness on the project and its grievance redress procedures is generated. The campaign will ensure that the poor, vulnerable and others are made aware of grievance redress procedures and entitlements per agreed entitlement matrix including whom to contact and when, where/how to register grievance, various stages of grievance redress process.

s, 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.

177. **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.

178. **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.

179. **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.

180. **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

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

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

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

184. A copy of the EMP/approved SEMP will be kept on site during the construction period at all times. The EMP included in the bid and contract documents. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance. For civil works, the contractor will be required to (i) carry out all of the mitigation and monitoring measures set forth in the approved EMP; and (ii) implement any corrective or preventative actions set out in safeguards monitoring reports that the employer will prepare from time to time to monitor implementation of this IEE, EMP and SEMP. The contractor shall allocate budget for compliance with these IEE, EMP and SEMP measures, requirements and actions.

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

Table 19: Design Stage Environmental Impacts and Mitigation Measures (Sewage Treatment Plant)

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, included in the design a back- up facility (such as generator). Dyke wall will be provided around the fuel storage yard to avoid the contamination of soil. (ii) Providing operating manual with all standard operating procedures (SOPs) for operation and maintenance of the facility, which is being prepared by the contractor. (iii) Necessary training to urban local body (ULB) staff dealing with STP. (iv) Extended contractor period for operation and maintenance (O&M), proper transfer of facility to ULB with adequate technical know-how on O&M and hands-on training to ULB staff (v) Provision for online monitoring of crucial wastewater quality parameters at the inlet and outlet of the plant (biochemical oxygen demand or BOD, potential of Hydrogen or pH, ammonia etc.)	Design-build (DB) Contractor and program 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), in case of any change in raw effluent quality due to illegal discharge or activities of the people. The details of the awareness program will be planned and executed in consultation with TNPCB (v) Conduct regular wastewater quality monitoring (at inlet and at outlet of STP) to ensure that the treated effluent quality complies with the applicable standards	PIU/VCMC	PIU Costs
Discharge of treated wastewater into Pandiyan	Channel capacity adequacy and water quality impacts	(i) Conduct a detailed baseline assessment of receiving water body capacity considering worst case scenario – highest rainfall, overflow of Kalinjur lake, and including extreme weather events like intense rainfall etc., (ii) Conduct detailed water quality assessment of receiving water	DB Contractor and PIU	Project cost - DB Contractor

channel		bodies (Palar River at the discharge point including a control point onupstream). Detailed water quality assessment of Palar River will be carried out on receipt of permission from PWD. (iii) Monitor water quality periodically during operation phase asper the environmental monitoring plan; Obtained TNPCB consent for disposal of treated wastewater into Pandiyan channel. Applied for variation to Consent to Establish to change the discharge point as Palar River.		
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Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
	Odour nuisance	(i) Develop the STP layout plan within the identified such that maximum buffer space be provided towards the houses in the north; in the layout develop, office or other such facilities towardsto houses, so that they will act asbuffer (ii) Provided a green buffer zone of 10 meters (m) wide all around the STP with trees in multi-rows and land scaping. This will act asa visual screen around the facility and will improve the aesthetic appearance. The vacant land around the STP site is owned by the Government and will be kept as buffer zone (iii) provide odor control/treatmentsystem (iv) Dewatering units shall be located in enclosed building vented to odor control unit, and health and safety precaution shall be put in place H ₂ S build up. (v) Locate sludge drying beds maintaining maximum distance fromthe residential areas in the north	DB Contractor and PIU	Project cost - DB Contractor
	Sludge disposal	(i) Sludge management plan (collection, treatment, drying, disposal and periodic testing) is being prepared.	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 pump houses which can absorb sound rather than reflect noise (iii) Use acoustic enclosures – manufacturer specified, for all pumps, motors (iv) Procure only CPCB approved generators with low emission and low noise fitted with acoustic enclosures (v) Provide sound mufflers for ventilators in the plant rooms; and sound proof doors (vi) Provide ear plugs to workers	DB Contractor and PIU	Project cost - DB Contractor
STP	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
STP	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 ten trees for each tree that is removed (iv) Design of STP finalized without affecting any trees at the site.	DB Contractor and PIU	Project cost - DB Contractor

Table 20: Design Stage Environmental Impacts and Mitigation Measures (Sewer network including SPS and LS)

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
Sewer network	Nuisance due to leaks, overflows, contamination of water supplies, occupation health and safety of workers, etc.	(i) Limit the sewer depth wherepossible (ii) Sewers shall be laid away from water supply lines and drains (at least 1 meter or 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 millimeters ormm) (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 beavoided) (v) For shallower sewers and especially in narrow roads, use small inspection chambers in lieu ofmanholes; (vi) Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize silt/garbageentry (vii) Ensure sufficient hydraulic capacity to accommodate peak flows andadequateslopeingravitiymainstopreventbuildupofsolidsand hydrogen sulfidegeneration (viii) Ensure to conduct a pre-blasting survey through videography and photography of residential properties and other structures falling within the zone of influence of vibrations along the sewerage alignment to ascertain the structural stability and prevailing conditions of the structures likely to be impacted by the vibrations controlled blasting and take adequate measures to minimize such impacts.	Program implementation unit (PIU)	PIU costs

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 (iii) Provision of high compound wall Design measures (i) Proposed wells to be closed using reinforced concrete cement (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.	PIU	PIU costs
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Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(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. (ix) Diesel Generators shall be provided for all pump stations and in cases of lift stations with space for control room. In cases of lift manholes (road-side or road-center type structures with only provision of kerb-side kiosk), an electrical cut-out provision shall be made for connecting an Emergency Mobile / Skid Mounted Diesel Generator for pumping out during long period of electricity supply interruption. (x) Develop standard operating procedures / operational manual for operation and maintenance of lifting and pump stations; this shall include measures for emergency situations (xi) Provide training to the staff in SOPs and emergency procedures		
	Sewage pumping and lifting stations located close to houses	(i) For sewage pumping stations SPS 3, SPS 4, and SPS 6, which are located adjacent to houses (within 50 m), a suitable arrangement so as to capture the gaseous emissions from the wells and treat via scrubber/activated carbon filter before letting out into	PIU	PIU costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		the ambient air; such system should be designed appropriately to meet the likely emissions/flow rate of respective pumping stations (ii) For lifting stations, the above arrangement should be provided as per site requirement.		
	Noise	(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 (ii) Use appropriate building materials and construction techniques for pump houses which can absorb sound rather than reflect noise (iii) Use acoustic enclosures – manufacturer specified, for all pumps, motors (iv) Procure only CPCB approved generators to meet air emission and noise level requirements (v) Provide sound mufflers for ventilators in the plant rooms; and sound proof doors (vi) Provide ear plugs designated for noise reduction to workers. (vii) 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	PIU	PIU costs
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	(i) 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. (ii) All records shall be maintained by the Contractors and PIU. (iii) 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.	Contractor and PIU	Contractor costs

		Training related to controlled blasting activity will be included in the overall safeguards training program meant for PIUs and Contractors. (iv) The project staff from the PIU, consultants and contractors would undertake a pre-blasting survey of structures (including videography and/or photography) lying within the area of influence of blasting from the vibrations related impacts (preferably in the presence of the owners of the said structures) to assess and/or ascertain regarding the prevailing conditions of the structures prior to blasting activities. Based on the assessment, the Project staff would consider necessary measures to avoid, minimize or mitigate such impacts..		
Location of project components near ASI monument	Potential damage/disruption	(i) Obtain prior permission from ASI/NMA for components located within the regulated zone of monument; incorporate any suggestions/ recommendations of ASI in project design and implementation (ii) Consult ASI and local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals. (iii) Excavation and construction methodology to be used near the monument (within the regulated area of 300 m) shall be finalized in consultation with ASI; dust control measures shall be put in place (iv) Construction contractor to follow these measures in conducting any excavation work	PIU	PIU costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		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 local ASI office if a find is suspected, and taking any action they require to ensure its removal or protection in situ.		

Table 21: Pre-Construction Stage Environmental Impacts and Mitigation Measures (Applicable for All Components)

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Cost and Source of Funds
Submission of updated environmental management plan (EMP)/site environmental plan (SEP); EMP implementation and reporting	Unsatisfactory compliance to EMP	a.Appoint environmental, health and safety(EHS)Supervisor to ensure EMP implementation b.Submission of updated EMP/SEP c. 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. The contingency plan is being prepared.	Contractor in coordination with program implementation unit (PIU)	PIU contractor 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.	Contractor to finalize locations in consultation and approval of PIU	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Cost and Source of Funds
		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 meters (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 waterbodies.		
Sources of Materials	Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and waterlogging, and water pollution.	(i) Obtain construction materials only from the existing government approved quarries with prior approval of PIU (ii) PIU to review, and ensure that proposed quarry sources have all necessary clearances/ permissions in place prior to approval (iii) Contractor to submit to PIU on a monthly basis documentation on material obtained from each source (quarry/ borrow pit) (iv) No new borrow areas, quarries etc., shall be developed for the project;	Contractor to prepare list of approved quarry sites and sources of materials with the approval of PIU	PIU costs
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;	CC and PIU	Contractor Costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Cost and Source of Funds
		Inform State Archaeological Department if a find is suspected, and taking any action they require to ensure its removal or protection in situ.		
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

Table 22: Construction Stage Environmental Impacts and Mitigation Measures (applicable for all components)

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
EMP Implementation Training	Irreversible impact to the environment, workers, and community	(i) Project manager and all key workers will be required to undergo training on EMP implementation including spoils/waste management, Standard operating procedures (SOP) for construction works; occupational health and safety (OH and S), core labor laws, applicable environmental laws, etc.	Contractor	Project cost / PMU cost
Air Quality	Dust, emissions from construction vehicles, equipment, and machinery used for installation of pipelines resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons.	(i) For all construction works (ii) 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 (iii) 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; (iv) 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 (v) Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process (vi) 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	Contractor	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(vii) Use tarpaulins to cover the loose material (soil, sand, aggregate etc.,) when transported by open trucks; (viii) Control dust generation while unloading the loose material (particularly aggregate, sand, soil) at the site by sprinkling water and unloading inside the barricaded area; minimize the drop height when moving the excavated soil. (ix) Clean wheels and undercarriage of haul trucks prior to leaving construction site (x) Ensure that all the construction equipment, machinery are fitted with pollution control devices, which are operating correctly, and have a valid pollution under control (PUC) certificate (xi) No vehicles or plant to be left idling at site generators to be placed at maximum distance from properties For sewer works (i) Barricade the construction area using hard barricades (of 2 m height) on both sides (ii) Initiate site clearance and excavation work only after barricading of the site is done (iii) Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes etc.), to the barricaded area (iv) Ensure that adequate cover is provided to the trenches to prevent emission of dust during controlled blasting. (v) Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area (vi) Undertake the work section wise: a 500 m section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones (vii) In the roads that connect to SPS sites, which need to accommodate two main sewers (inbound 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;		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(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. (x) Immediately consolidate the backfilled soil and restore the road surface; if immediate road restoration is not possible, provide a layer of plain cement concrete (PCC) of suitable mix on the backfilled trench so that dust generation, erosion is arrested and it will also provide a smooth riding surface for the traffic until the road is properly restored. Backfilled trench without any road restoration is a major source of dust. (xi) 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. (xii) 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;		

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 least 100m) (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 100m 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	Contractor	Contractor costs
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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(vii) Dispose any wastes generated by construction activities in designated sites; (viii) Conduct surface quality inspection according to the Environmental Management Plan (EMP).		
	Pollution of Palar River due to construction of pipe bridge	(i) Schedule and complete the bridge works prior to onset of monsoon, and ensure that works are conducted during low flow time, when the river bed is dry (ii) Works shall be conducted with minimum disturbance to river bed; implement best construction methods to minimize disturbance / consolidation of river bed; as far as possible avoid using heavy equipment mobilization (iii) No labor camps or material storage camps shall be located in or near the river (100 m distance from river shall be maintained) (iv) Ensure no accidental spillage of construction chemicals, fuels, oils etc., by using spill traps / metal basins (v) Ensure that construction site is cleared off of all the material and debris immediately after completion of works (vi) Submit a site clean-up and restoration report to PIU for approval (vii) Conduct environmental monitoring as per the 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 (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	Contractor	Contractor costs
Noise Levels and vibration	Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people	a. 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 b. 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 c. Maintain maximum sound levels not exceeding 70 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s.	Contractor	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		d. 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 e. Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach; f. 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. Works near the ASI monument (i) Obtain prior permission from ASI/NMA for the works to be conducted within the regulated zone of monument; submit detailed construction drawings clearly indicating the details of proposed excavations and works, use of equipment and machinery, etc., to ASI for their review; incorporate any suggestions/recommendations of ASI in project design and		

		implementation. (ii) Excavation and construction methodology to be used near the monuments (within the regulated area of 300 m of any monument) shall be in line with the ASI recommendations (iii) Dust control measures shall be put in place; all work areas to be barricaded and enclosed with dust screens (iv) Conduct air quality and noise monitoring weekly throughout construction phase in the 300 m regulated area		
Removal of rock during excavation for sewer works	Increase in vibration due to the controlled blasting and associated activities	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. (i) Carryout controlled blasting in consultation with PIU so that blasting activities with the least potential to generate vibration are conducted during periods of the day which will result in least disturbance; especially near schools and other sensitive receptors. (ii) Permission shall be obtained from The District Collector, Vellore for controlled blasting for excavation. Conditions stipulated in the permission issued by the District Collector shall be complied with during implementation. (iii) The contractor shall submit a blasting plan in advance to PIU; and implement in accordance to the plan. (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) Proper information will be Given to Police Officials (ix) Workers (Flagman) shall be stationed on both end of roads to warn people before firing any blasts and not to permit the traffic. (x) When blasting, ample warning shall be given to all persons within the vicinity prior to blasting. Warning signs shall be erected a minimum of 24 hours prior to the blast time. The warning signs will	Construction Contractor	Cost for implementation of mitigation measures responsibility of contractor.

		state the time and date of each blast. (xi) Contractor shall ensure necessary precautions / protection (like excavated earth, sand-filled bags, etc) to reduce Ground Vibrations, Reduce noise levels, , etc., Sites shall be provided with necessary shields all around. (xii) Minimum Explosive will be used for Controlled 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 damage to property or injury to persons resulting from blasting or accidental or premature explosions that may occur in connection with his use of explosives. (xv) The contractor shall do the activities after obtaining the blasting permission from District Collector, Vellore. (xvi) For the diversion of traffic in the blasting area, the contractor shall prepare a traffic management plan and obtain permission from Vellore Corporation and traffic police. (xvii) Ensure to conduct a pre-blasting survey through videography and photography of residential properties and other structures falling along the sewerage alignment to ascertain the prevailing conditions of the structures likely to be impacted by the controlled blasting and take adequate measures to minimize such impacts.		
Landscape and aesthetics – waste generation	Impacts due to excess excavated earth, excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items.	(i) Prepare and implement a Construction Waste Management Plan (refer 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 be located away from residential areas, forests, water bodies and any other sensitive land uses (v) Domestic solid wastes should be properly segregated in biodegradable and non-biodegradable for collection and disposal to	Contractor	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		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 soils, 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 (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 barricades should be provided; avoid material/surplus soil stocking	Contractor	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		in congested areas – immediately removed from site/ or brought to the as and when required (vi) Limit the width of trench excavation as much as possible by adopting best construction practices; adopt vertical cutting approach with proper shoring and bracing; this is especially to be practiced in narrow roads and deeper sewers; if they deep trenches are excavated with slopes, the roads may render completely unusable during the construction period (vii) Leave spaces for access between mounds of soil to maintain access to the houses/properties; access to any house or property shall not be blocked completely; alternative arrangements, at least to maintain pedestrian access at all times to be provided (viii) Provide pedestrian access in all the locations; provide wooden/metal planks with safety rails over the open trenches at each house to maintain the access. (ix) Inform the affected local population in advance about the work schedule, a week before, and a day before to start of work (x) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum. (xi) Keep the site free from all unnecessary obstructions; (xii) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints. Provide information to the public through media – newspapers and local cable television (TV) services (xiii) At work site, public information/caution boards shall be provided including contact for public complaints Controlled Blasting (xiv) The contractor shall submit a blasting plan in advance to PIU; and implement in accordance to the plan. (xv) Proper prior notice will be issued to the Residents before Commencing UGSS activity works Schedule (xvi) Proper information will be Given to Police Officials (xvii) Workers (Flagman) shall be stationed on both end of roads to warn people before firing any blasts and not to permit the traffic. (xviii) 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. (xix) For the diversion of traffic in the blasting area, the contractor shall prepare a traffic management plan and obtain permission from VCMC 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 a.m. and 4 to 7 p.m.); (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.		
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Controlled blasting	Ground vibrations Noise (airblast) Flying debris Dust	(i) Carryout controlled blasting in consultation with PIU so that blasting activities are conducted during periods of the day which will result in least disturbance; especially near schools and other sensitive receptors. (ii) The contractor shall submit a blasting plan in advance to PIU for approval; and implement in accordance to the plan once approved. (iii) 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. (iv) Blasting shall be carried out through a licensed Explosive Contractor only. (v) For controlled blasting, explosives including blasting caps, shall be transported to the blasting site only through exclusive vehicle in safe manner in accordance with the requirements of the blasting license. After blasting is over, the balance explosives shall be returned to the licensed storage. (vi) Cost for implementation of mitigation measures and liability are the responsibility of contractor. (vii) Proper prior notice will be issued to the residents before commencing 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. (viii) For sections where the controlled blasting is proposed, the residents shall be provided with the schedule of blasting at least three days in advance and the residents are explained about the preventive, precautionary, mitigation and emergency response measures being taken to address their concerns. (ix) Prior information will be given to Police Officials (x) 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 non-motorized 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 VCMC and traffic police. (xi) When blasting, ample warning shall be given to all persons within the	Contractor and PIU	Contractor cost
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		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. (xii) Sites shall be provided with necessary shields all around; (xiii) Minimum explosive will be used for Controlled Blasting specifically within residential areas. (xiv) 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. (xv) 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. (xvi) 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); (xvii) 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. (xviii) 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. (xix) 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. (xx) 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. (xxi) Training related to controlled blasting activity will be included in the overall safeguards training programme meant for PIUs and Contractors.		
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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
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 materials and machinery, and providing footbridges so that people can crossover opentrenches (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 dustgeneration (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 constructionwork. (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, andschools; (vii) Consultbusinessesandinstitutionsregardingoperatinghours and factoring this in work schedules;and (viii) Provide sign boards for pedestrians to inform nature and durationofconstructionworksandcontactnumbersfor concerns/complaints.	Contractor	Contractor costs
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 seekingto avoid,minimizeandmitigaterisk,whichshallincludemeasures	Contractor	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		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 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		
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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians during material and waste transportation	(i) Consult PIU before relocating 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 sites shall not be located near (100m) 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 camp 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-	Contractor	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		biodegradable/recyclablewasteshallbecollectedandsoldinlocal market (xv) Remove all wreckage, rubbish, or temporarystructures which are no longer required;and (xvi) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to PIU; PIU to review and approve camp clearance and closure of worksite		
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 STPorlargepumpingstationsites);ifanycamptobeestablished outsidethese,thenselectacampsiteawayfromresidentialareas (at least 100 m buffer shall bemaintained) (ii) Avoid tree cutting for setting up campfacilities (iii) Ensure that a proper compound wall is provided, and erect a wind/dust screenaround (iv) Camp site shall not be located near (100 m) water bodies, flood plains flood prone/low lying areas, or any ecologically, socially, archeologically sensitiveareas (v) Separate the workers living areas and material storage areas clearly with a fencing and separate entry andexit (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 alltimes; (vii)Consult PIU before locating project offices, sheds, and construction plants; (viii) Minimize removal of vegetation and disallow cutting oftrees (ix) Ensureconditionsoflivabilityatworkcampsaremaintainedatthe 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 (x) Camp shall be provided with proper drainage, there shall not be any wateraccumulation (xi) Provide drinking water, water for other uses, and sanitation facilities foremployees	Contractor	Contractor costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(xii) Prohibit employees from cutting of trees for firewood; contractor should 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 worksite		
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; (ii) All excavated roads shall be reinstated to original condition. (iii) All disrupted utilities restored (iv) All affected structures rehabilitated/compensated (v) The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up. (vi) All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be top soiled and regrassed using the guidelines set out in the revegetation specification that forms part of this document. (vii) The contractor must arrange the cancellation of all temporary services. (viii) Request PIU to report in writing that worksites and camps have been vacated and restored to pre-project conditions before acceptance of work.	Contractor	Contractor costs

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. (ix) (ii) No works can be commenced unless 100% shifted in sections ready for implementation.	CC and PIU	Contractor / PIU
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^a IFC Sustainability Webinar Series. [World Bank Group Environmental, Health and Safety Guidelines 101](#).

Table 23: Operation Stage Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
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 powersupply (iii) Operate and maintain the facility following standard operating procedures of operationalmanual (iv) Undertake preventive and periodic maintenance activities asrequired (v) Maintain the mechanical / electrical parts as per the maintenancplan to avoid anyhazards (vi) Conduct periodic training toworkers (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 emergencysituations (viii) Implement sludge management plan at theSTP (ix) No wastewater from industrial premises (includingdomestic wastewater) shall be allowed to dispose into municipalsewers (x) Monitor regularly and ensure that there is no illegal discharge through manholes or inspection chambers; conduct public awareness programs; in coordination withTNPCB (vii) Conduct regular wastewater quality monitoring at inlet and at outletof 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	PIU / VCMC	Operating costs
Operation of sewage lifting and pumping stations	Odor nuisance	(i) Strictly follow standard operating procedures / operational manual for operation and maintenance of lifting and pumpstations (ii) Ensure that operating staff is properly trained, and have clear understanding of odor issues vis-à-vis its related with operationalpractices (iii) Ensure that pumping cycles are properly followed; and there isno buildup of sewage beyond design volume in thewells (iv) Conduct monitoring (periodically at pumping stations and lifting stations);	PIU/VCMC	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 removegrease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problemareas - Inspection of the condition of sanitary sewer structures andidentifying 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; andsuspected	PIU/VCMC	Operating costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		infiltration or exfiltration; and • Monitoring of sewer flow to identify potential inflows and outflows • Conduct repairs on priority based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages); (ii) Maintain records; review previous sewer maintenance records to help identify "hot spots" or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed; (iii) When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system. (iv) Prohibit/prevent disposal of wastewater/effluent from industrial units in the sewers; ensure regular checking to ensure no illegal entry of industrial wastewater into sewers (v) Develop an Emergency Response System for the sewerage system leaks, burst and overflows, etc. (vi) Provide necessary health and safety training to the staff in sewer cleaning and maintenance (vii) Provide all necessary personnel protection equipment (viii) Do not conduct manual cleaning of sewers; for personnel engaged sewer maintenance work, there is a risk due to oxygen deficiency and harmful gaseous emissions (hydrogen sulphide, methane, etc.); provide for adequate equipment (including oxygen masks) for emergency use		

Table 24: Construction Stage Environmental Monitoring Plan (STP)

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
Construction disturbances, nuisances, public and worker safety,	All work sites	Implementation of construction stage EMP including dust control, noise control, traffic management, and safety measures. Site inspection checklist to review implementation is appended at Appendix 7.	Weekly during construction	Supervising staff and safeguards specialists of CMSC	Staff and consultant costs are part of incremental administration costs
Ambient air quality	1 location (STP, at the boundary of the site downwind direction)	PM ₁₀ , PM _{2.5} NO ₂ , SO ₂ , CO	Once before start of construction Quarterly (yearly 4-times) during construction (3 year construction period)	DB Contractor	Cost for implementation of monitoring measures responsibility of DB contractor (13 samples x 5000 per sample =65,000)
Ambient noise	2 location s (STP, at the boundary of the site downwind direction and nearest properly)	Day time and night time noise levels	Once before start of construction Quarterly (yearly 4-times) during construction (3 year construction period)	DB Contractor	Cost for implementation of monitoring measures responsibility of DB contractor (26 samples x 1500 per sample =39,000)
Surface water quality	2 sampling locations (- Palar River, upstream and downstream of pipe bridge work site)	pH, Oil and grease, Cl, F, NO ₃ , TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalinity	Once before start of construction Half yearly during construction (3 year construction period)	DB Contractor	Cost for implementation of monitoring measures responsibility of DB contractor (14 samples x 4000 per sample =56,000)
Baseline water quality of receiving water body (Pandiyar Channel)	4 points (1 at outfall discharge point in Palar river; 2 points in Palar river – upstream and downstream of discharge point and 1 at end of city limit)	pH, TDS, TSS, DO, BOD, COD, E-coli, Total coliform, Nitrate, Total Phosphates, Oil and grease, Total hardness, Sulphate, Fluoride, Chloride, Ammonia, Aluminum, Manganese, Iron, Zinc, Nickel, Magnesium, Phenolic compounds, Chromium, Arsenic, Mercury, Cadmium, Lead, Pesticides	Once before start of construction Twice (Pre monsoon and post monsoon during design phase)	DB Contractor	Cost for implementation of monitoring measures responsibility of DB contractor (12 samples x 8000 per sample =96,000)
Baseline sediment quality in channel	2 points (1 at STP discharge Location in Palar River, 1 at U/s of discharge location into Palar River)	EC, pH, calcium, magnesium, % of total organic matter, Total organic carbon, N,	Once before start of construction	DB Contractor	Cost for implementation of monitoring measures

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
		P, K, Aluminum, faecal coliform, As, Cu, Cd, Cr, Pb, Fe, Mn, Hg, Zn, Ni.	Once during construction (pre monsoon)		responsibility of DB contractor (4 samples x 10000 per sample = 40,000)

Table 25: Construction Stage Environmental Monitoring Plan (Sewer network including SPS and LS)

Monitoring Field	Monitoring Location	Monitoring Parameters	Frequency	Responsibility	Cost and Source of Funds
Construction disturbances, nuisances, public and workersafety,	All work sites	Implementation of construction stage EMP including dust control, noise control, traffic management, and safety measures. Site inspection checklist to review implementation is appended at Appendix 7	Weekly during construction	Supervising staff and safeguards specialists of CMSC	Staff and consultant costs are part of incremental administration costs
Ambient air quality	4 locations (4 monitoring locations 50 m downwind direction near sewer and pumping station work sites in the city, one location must be near the Fort);	PM₁₀, PM_{2.5}, NO₂, SO₂, CO	Once before start of construction Quarterly (yearly 4-times) during construction (3 year period considered)	Contractor	Cost for implementation of monitoring measures responsibility of contractor (52 samples x 5000 per sample = 260,000)
	1 location at Vellore Fort	PM₁₀, PM_{2.5}, NO₂, SO₂, CO	Once prior to start of the works within 300 m of monument fortnightly once during the works within 300 m of monument	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (12 samples x 5000 per sample = 60,000)
Ambient noise	4 locations (4 monitoring locations 50 m downwind direction near sewer and pumping station work sites in the city, one location must be near the Fort);	Day time and night time noise levels	Once before start of construction Quarterly (yearly 4-times) during construction (3 year period considered)	Contractor	Cost for implementation of monitoring measures responsibility of contractor (52 samples x 1500 per sample = 78,000)
	1 location at Vellore Fort	Day time and night time noise levels	Once prior to start of the works within 300 m of monument	Construction Contractor	Cost for implementation of monitoring measures

Monitoring Field	Monitoring Location	Monitoring Parameters	Frequency	Responsibility	Cost and Source of Funds
			fortnightly once during the works within 300 m of monument		responsibility of contractor (12 samples x 1500 per sample = 18,000)
Surface water quality	3 sampling locations (1 - Palar River, downstream work sites, 2 – Velavadi Tank, 3-sample from fort moat)	pH, Oil and grease, cast iron, F, NO ₃ , TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalinity	Once before start of construction Half yearly during construction (3 year construction period considered)	Contractor	Cost for implementation of monitoring measures responsibility of contractor (21 samples x 4000 per sample = 84,000)

Table 26: Operation Stage Environmental Monitoring Plan (STP)

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	Vellore City Municipal Corporation (VCMC)	VCMC Operating Cost
Water quality of receiving water body	2 points in Palar River –upstream and downstream of discharge point	pH, Cl, F, NO ₃ , TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalinity, coliform heavy metals and pesticides ml).	Monthly once during operation Yearly twice (pre & post monsoon)	VCMC	O&M costs (water quality will be tested at the internal laboratory part of STP)
Odor monitoring at STP	2 points (downwind direction) with in STP and at nearest house	Hydrogen sulphide (H ₂ S)	Half yearly (yearly twice) and as and when based on public complaints	VCMC	O&M Costs

Monitoring Field	Monitoring Location	Monitoring Parameters	Frequency	Responsibility	Cost and Source of Funds
			(throughout the operation phase)		
Ambient noise	two locations (STP, at the boundary of the site downwind direction and nearest properly)	Day time and night time noise levels	Monthly once during operation	VCMC	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	VCMC	O&M costs (testing to be done at an accredited external laboratory)

Table 27: Operation Stage Environmental Monitoring Plan (Sewer network including SPS and LS)

Monitoring Field	Monitoring Location	Monitoring Parameters	Frequency	Responsibility	Cost and Source of Funds
Odor monitoring at pumping stations	three points (downwind direction) at all pumping stations: near inlet/suction well; outside the pumping station and at nearest house	Hydrogen sulphide (H ₂ S)	Half yearly (yearly twice) and as and when based on public complaints (throughout the operation phase)	VCMC	O&M Costs
	one point (at each SPS (downwind direction) at the boundary wall of the pumping stations	H ₂ S	Periodically	VCMC	O&M Costs
Odor monitoring at lifting stations	three points (downwind direction) at all lifting stations: near inlet/suction well; outside the pumping station and at nearest house	H ₂ S in ambient air	Half yearly (yearly twice) and as and when based on public complaints (throughout the operation phase)	VCMC	O&M Costs
	one point at each lift station (downwind direction) at the boundary wall of the pumping stations	H ₂ S in ambient air	Periodically.	VCMC	O&M Costs

B. Implementation Arrangements

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

187. The implementing agency for this subproject is Vellore City Municipal Corporation (VCMC). A program implementation unit (PIU) is established in VCMC headed by full-time a Project Manager (a senior official of VCMC) and comprising dedicated full-time staff from engineering and other departments of VCMC. PIU under the VCMC is responsible for planning, implementation, monitoring and supervision, and coordination of all activities of subproject. A construction, management and supervision consultant (CMSC) has been appointed to assist PIU in day-to-day implementation of the subproject.

188. **Safeguards Compliance Responsibilities.** Environmental and Social Safeguards (ESS) managers in the PMU, TNUIFSL having overall responsibility of safeguard compliance with ADB SPS 2009. ESS Managers report to Vice President in the Projects Wing. At PIU level, a Safeguards Officer has been appointed, who coordinates safeguard tasks at PIU. As expert support is available to PIU via CMSC, and the role of SO is mainly coordination, overseeing the implementation of safeguard tasks, grievance redress and reporting.

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

190. Detailed Project Report finalization and Bidding stage.

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

191. Construction stage.

- 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;
- Oversee and provide guidance to the PIU to properly carry out the environmental monitoring as per the EMP;
- Oversee grievance redress mechanism to address any grievances brought about in a timely manner; ensure that records are properly maintained;
- Consolidate quarterly environmental monitoring reports from PIU and submit semi-annual monitoring reports to ADB; and
- Oversee site closures to ensure that all work/facility sites are restored properly prior to issuing work completion certificate to the contractor.

192. Operation stage.

- Ensure that all clearances as required for operation of project are in place prior to operation, such as consent to operate (CTO) for STP from TNPCB.
- PIU Safeguard Responsibilities. Key tasks and responsibilities of the PIU assisted by CMSC for this subproject include the following:
 -
 - DPR finalization and Bidding stage:
 - Include design related measures of the EMP in the project design and DPR.
 - Include EMP in the bidding documents and civil works contracts, including requirement of staff (EHS supervisor) with contractor for EMP implementation.
 - Provide necessary budget in the project as IEE for EMP implementation.
 - Ensure that the bid/contract documents include specific provisions requiring contractors to comply with all applicable labor laws and core labor standards including:
 - Labour welfare measures and provision of amenities
 - prohibition of child labor as defined in national legislation for construction and maintenance activities;
 - equal pay for equal work of equal value regardless of gender, ethnicity, or caste;
 - elimination of forced labor;
 - the requirement to disseminate information on sexually transmitted diseases, including HIV/AIDS, to employees and local communities surrounding the project sites.
 - In the pre-bid meeting, provide insight into EMP measures, and overall compliance requirements to the bidders
 - 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.

193. Construction stage:

- 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.;

- 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;
- Ensure contractor compliance with staff resources as per the IEE/EMP/Bid;
- Guide contractor on updating EMP/preparing site environmental plan at the start of the project;
- Update IEE and EMP; ensure that IEE reflects the final design being implemented by contractor;
- Conduct public consultation and information disclosure as necessary
- Take necessary action for obtaining rights of way;
- Supervise day-to-day EMP implementation on site by contractor, including the environmental monitoring plan;
- Supervise ambient environmental monitoring by contractors;
- Take corrective actions when necessary to ensure no environmental impacts
- Submit quarterly environmental monitoring reports to PMU;
- Conduct continuous public consultation and awareness;
- Address any grievances brought about through the grievance redress mechanism in a timely manner as per the EMP;
- 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;
- Implement corrective or preventative actions in case of non-compliance or new/unanticipated impacts;
- 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;
- 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;
- Review and approve monthly progress reports submitted by Contractor on EMP compliance;
- Prepare quarterly environmental monitoring reports and submit to PMU/TNUIFSL
- Provide any assistance in environmental safeguard related tasks as required by PMU to ensure compliance and reporting to ADB.

194. Operation stage.

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

195. Contractor's Responsibilities:

196. Bidding stage.

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

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

C. Training Needs

197. The following Table 22 presents the outline of capacity building program to ensure EMP implementation. These capacity building and trainings will be conducted at the offices of PMU and PIU by the environmental safeguard 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 28: 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	All staff and consultants involved in the project At program management unit (PMU) (combined program for all program implementation unit or PIU)	-	Included in the overall program cost

Description	Target Participants and Venue	Estimate (₹)	Cost and Source of Funds
contracts - Monitoring, reporting and corrective action planning			
2. EMP implementation (1/2 day) - EMP mitigation and monitoring measures - Roles and responsibilities - Public relations, - Consultations - Grievance redress - Monitoring and corrective action planning - Reporting and disclosure - Construction site standard operating procedures (SOP) -- Chance find (archeological) protocol - Work near 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 CSMC at the PIU office; part of project implementation cost
3. Contractors Orientation to Workers (1/2 day) - Environment, health and safety in project construction - 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 CMSC

D. Monitoring and Reporting

198. 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.

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

200. Based on PIU quarterly monitoring reports and oversight visits to subproject work sites, PMU will submit semi-annual environmental monitoring report (SEMR). Once concurrence from the ADB is received the report will be disclosed on TNUIFSL, PMU and VCMC websites.

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

E. Environmental Management Plan Implementation Cost

202. Most of the mitigation measures require the contractor 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 29: Cost Estimates to Implement the Environmental Management Plan

	Particulars	Stages	Unit	Total Number	Rate (₹)	Cost (₹)	Costs Covered By
A	Mitigation Measures						
1	Providing gas capture and treatment system selected pumping and lifting stations	Design	Lump sum provision	-	-	5,000,000	Provisional sums of contract (PIU)
2	Consent for establishments and consent for operation from Tamil Nadu Pollution Control Board (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 (A)					7,520,000	
B.	Monitoring Measures						
1	Air quality monitoring	Construction	per sample	77	5,000	385,000	
2	Noise levels monitoring	Construction	Per sample	90	1,500	135,000	
3	Surface water monitoring	Construction	Per sample	35	4,000	140,000	
4	Baseline water quality of Pandiyan Channel/Palar River	Design	Per sample	12	8000	96,000	
5	Channel sediment quality	Design	Per sample	4	10000	40,000	
	Subtotal (B)					826,000	
C.	Capacity Building						
1.	Training on environmental management plan (EMP) implementation	Pre-construction				-	Part of PIU and PMU ,

	Particulars	Stages	Unit	Total Number	Rate (₹)	Cost (₹)	Costs Covered By
							consultant tasks
2.	Contractors Orientation to Workers on EMP implementation	Prior to dispatch to worksite				-	Civil works contractor cost
	Subtotal (C)						
	Total (A+B+C)				₹	9,012,000	

Contractor Cost -4,306,000
PIU Cost -5,300,000

IX. CONCLUSION AND RECOMMENDATIONS

203. The process described in this document has assessed the environmental impacts of all elements of the proposed underground sewerage subproject in Zones 3, 4, 5, 6 and 7 of Vellore City Municipal Corporation. All potential impacts were identified in relation to pre-construction, construction, and operation phases. Planning principles and design considerations have been reviewed and incorporated into the site planning and design process wherever possible; thus, environmental impacts as being due to the project design or location were not significant. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result significant measures have already been included in the designs for the infrastructure. This means that the number of impacts and their significance has already been reduced by amending the design. Various design related measures suggested for: 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.

204. Vellore is an historical city, and there are three nationally important (ASI protected) monuments in the city. Vellore Fort, located in the center of the city, and temple and a mosque located inside the Fort are the protected monument. Although there are no components located in the monument area, there are residential areas developed around the Fort (especially in the north) within its regulated zone (300m), and provision of sewer system in these areas will require permission of NMA. Permission from ASI for the implementation of work has been obtained.

205. Palar River flows through the municipal corporation area dividing it into two parts. The subproject area, comprising zones 3 to 7, is situated on the southern side of the river.

Proposed STP site is selected on the northern side of the river and treated wastewater from STP is proposed for disposal into a Palar River. Since the STP is proposed under design-build contract, at present, the treatment and disposal system design is preliminary. Since the No Objection Certificate for discharging treated effluent into Pandian Channel not obtained from concerned authority, the treated effluent outfall is now shifted to Palar River at Kangeyanallur near burial ground at about 2.127 km.

206. The site selected for STP is located on the banks of River Palar, next to a solid waste segregation facility of VCMC. Land is owned by VCMC, and the site is covered three sides by vacant and agricultural lands and river, and while the city development is in the north of the site. Nearest house is located at about 50m from the site boundary. Considering the current and future development, various measures are included in the subproject design, including: design of a compact, superior process with low odor potential; sensitive layout design by maintaining adequate distance from the boundary, so that STP is inside the campus with a tree cover around, etc. All the lifting and pumping station sites are situated on government owned vacant land parcels, and sewers will be laid on the public roads. Therefore, subproject do not involve any private land acquisition.

207. 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 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. Odor monitoring is proposed at pumping and lifting stations periodically.

208. 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 MoEF&CC, 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 safely will be developed and followed. Periodic monitoring of dried sludge to check suitability as a manure is suggested.

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

210. 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.

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

211. 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, VCMC 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 describe the informal and formal channels, time frame, and mechanisms for resolving complaints about environmental performance.

212. 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.

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

214. Therefore, as per ADB SPS, the project is classified as environmental category B and does not require further environmental impact assessment. However, to conform to government guidelines STP requires consent to establish (CTE) and consent to operate (CTO) from Tamil Nadu Pollution Control Board. STP is proposed under design-build contract modality with ten years of O & M responsibility, and therefore various suggested measures are to be included during the detailed design. Detailed design of STP is completed by contractor, CTE has been obtained from TNPCB and the application for renewal is under processing. For the project components located within the regulated zone of protected monument (Vellore Fort), prior permission of ASI will be required. ASI permission shall be obtained prior to construction.

215. This IEE has been updated incorporating the approved design details of STP, the change in treated effluent outfall location and mitigation measures to be followed during controlled blasting and found that the measures suggested in the EMP are adequate to mitigate the environmental impacts, if any, arise during the implementation of the subproject.

Appendix 1: RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

Sewerage

Instructions:

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

Country/Project Title: India / Tamil Nadu Urban Flagship Investment Program – Underground Sewerage Subproject in Zone 3, 4, 5, 6 and 7 of Vellore City Municipal Corporation

Sector Division: Urban Development

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area...			
Densely populated?	√		Subproject activities are located in Vellore City, some parts of which are densely populated. However, the core city area, which is highly dense, is not part of the project area. Newly developing residential areas have low density and well planned layouts. Agriculture is still practiced in the outer areas.
Heavy with development activities?	√		It is a developing area; urban expansion is considerable
Adjacent to or within any environmentally sensitive areas?		√	No environmentally sensitive area near the project area
Cultural heritage site	√		Vellore is an historical city, and there are three nationally important (ASI protected) monuments in the city. Vellore Fort, located in the center of the city, and temple and mosque located inside the Fort are the protected monument. No components are proposed in the monument. However, some components are located within 300m regulated boundary of monument, therefore permission from the competent authority (NMA) will be required.
Protected Area		√	In Tamil Nadu State, there are 5 national parks, 15 wildlife sanctuaries (including four tiger reserves), 15 bird sanctuaries, and two conservation reserves. The subproject areas are not in these protected areas.
Wetland		√	-
Mangrove		√	-
Estuarine		√	-
Buffer zone of protected area		√	-
Special area for protecting biodiversity		√	-
Bay		√	-

Screening Questions	Yes	No	Remarks
B. Potential Environmental Impacts Will the Project cause...			
Sewerage			
impairment of historical/cultural monuments/areas and loss/damage to these sites?		√	No impairment envisaged as no components are located in the monument. The components which are located within 300 m will be implemented with prior ASI permission and duly implementing any recommendations of ASI. Therefore, no impairment envisaged.
interference with other utilities and blocking of access to buildings; nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.?	√		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?		√	Do not involve land acquisition or resettlement as subproject activities are proposed in Government land
disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		√	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?		√	Adequate capacity sewage treatment facility is being developed 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?		√	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?		√	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?	√		Anticipated but temporary, site-specific and can be mitigated. Nuisance/disturbance due to elevated noise may be experienced by sensitive receptors during construction. Noise will be minimized with mitigation measures specified in the EMPs. 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, Covering the excavation with MS sheet + Excavated earth + sand filled gunny bags, are deployed. Controlled blasting shall be carried out after obtaining necessary permission from District Collector, Vellore.
risks and vulnerabilities related to occupational health and safety due to physical, chemical, and biological hazards during project construction and operation?	√		Anticipated but temporary, site-specific and can be mitigated. EMPs and contract provisions include requirement for contractors' Health and Safety (H&S) plan. The contractors' H&S plans will be reviewed and cleared by PIUs prior to commencement of works.
discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?		√	Not anticipated. The sewerage collection systems are designed to only allow flow of domestic sewage by direct connections to households. The designs ensure no industrial

			effluent will be allowed into the sewer network.
inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?		√	Not anticipated. STP, pump and lifting stations will include buffer zones as required and condition in the Consent to Establish by the Tamil Nadu State Pollution Control Board will be implemented
road blocking and temporary flooding due to land excavation during the rainy season?	√		Complete road blocks are not envisaged; in narrow roads, traffic may be diverted but access will be ensured 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?	√		Anticipated during construction but temporary, site-specific and can be mitigated. As the sewers will be laid on the road surface, cutting open of road surface using pneumatic drills will produce noise and dust. Temporary nuisance/disturbance due to noise and dust may be experienced by sensitive receptors. These impacts will be minimized with mitigation measures specified in the EMPs
traffic disturbances due to construction material transport and wastes?	√		Anticipated during construction but temporary, site-specific and can be mitigated. EMPs and contract provisions include requirement for contractors' Traffic Management Plan which will be reviewed and cleared by PIUs prior to commencement of workers
temporary silt runoff due to construction?	√		Anticipated during construction but temporary, site-specific and can be mitigated. EMPs and contract provisions include requirement for contractors to provide silt control measures.
hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?		√	Not anticipated. O&M Manuals will be developed as part of the contracts. Necessary equipment and training to workers will be provided under TNUIFP. The ULBs will be trained on standard operating procedures and maintenance to ensure facilities are functioning according to the designs
deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?		√	Not anticipated. The STP designs include sludge handling and treatment facilities. Necessary equipment and training to ULBs/workers on sludge handling and effluent monitoring will be provided under TNUIFP;
contamination of surface and ground waters due to sludge disposal on land?		√	Not anticipated. The STP designs include sludge handling and treatment facilities. O&M Manual will include testing procedures, parameters and restriction on re-use of treated sludge. Only if it meets the Government of India standards for soil conditioner and fertilizer then will be allowed for re-use and strictly for non-food crops only..
Health and safety hazards to workers from toxic gases and hazardous materials which may be contained in confined areas, sewage flow and exposure to pathogens in untreated sewage and unstabilized sludge?	√		Anticipated during operation but temporary, site-specific and can be mitigated. Workers may be exposed during cleaning of blockages in sewerage network. However, O&M Manuals will include standard operating procedures. All necessary health and safety training and personal protection equipment will be given to workers and staff during operation of sewerage system. Implementation of contractors' H&S will be strictly enforced by the PIUs. annual 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)?		√	Not anticipated.
Social conflicts between construction workers from other areas and community workers?		√	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?	√		Anticipated but can be mitigated. Appropriate mitigation measures have been identified which shall be complied with during implementation. During operations, chemicals such as pH adjusters, flocculants, or coagulants may be used. The EMPs in the current IEEs already include measures and monitoring requirements conforming with IFC EHS Guidelines. O&M Manuals will include health and safety requirements for managing chemicals
community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		√	Not anticipated. Work area will be clearly demarcated. Pump houses and lifting stations will be secured and locked. Only workers and project-concerned members will be allowed to enter the sites. PIUs, in coordination with water and sanitation committees, will disseminate information on community health and safety.

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

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

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

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

- The Spoil Management Plan should be site specific and be part of the monthly Construction Management Plan.
- The contractor, in consultation with the PIU, has to find out appropriate location/s for the disposal of the excess soil generated. The spoils should be deposited only at thesesites.
- Further precautions need to be taken in case of the contaminatedspoils
- The vehicle carrying the spoil should be coveredproperly.
- Thespoilsgeneratingfromeachsiteshouldberemovedonthesamedayorimmediately after the work is complete. The site/road should be restored to the originalcondition.

I. Spoilsinformation

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. Spoilsmanagement

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, (e) Suggested reuse of disposal of the spoil

III. Documentation

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

Appendix 4: PUBLIC INFORMATION NOTICE TEMPLATE

Public Announcement
Providing Underground Sewerage System in Vellore City
Vellore City Municipal Corporation

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

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

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

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

Inconvenience caused is regretted.

PIU - Contact No.

Contractor – Contact no.

Appendix 5: SAMPLE GRIEVANCE REGISTRATION FORM
(To be available in Tamil and English)

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

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

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

FOR OFFICIAL USE ONLY

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

Appendix 6: SAMPLE OUTLINE TRAFFIC MANAGEMENT PLAN

A. Principles for TMP around the Water Pipes Construction Sites

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

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

B. Operating Policies for TMP

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

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

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

C. Analyze the impact due to street closure

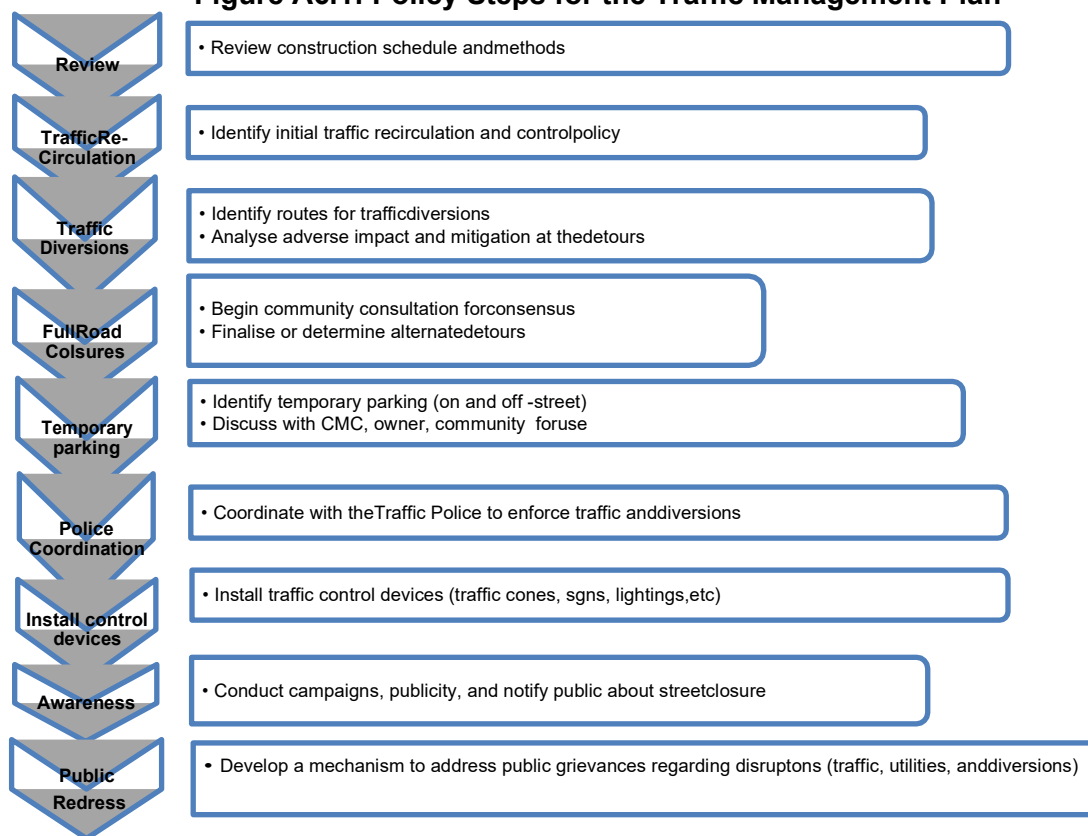
4. Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

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

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

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

Figure 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

thisistoallowsufficienttimeforthe publicandresidentstounderstandthechangestotheirtravel 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 electedrepresentatives.

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

- (i) trafficcontroldevicesinplaceattheworkzones(signs,trafficcones,barriers,etc.);
- (ii) defensive driving behaviour along the work zones;and
- (iii) reduced speeds enforced at the work zones and trafficdiversions.

8. Itmaybenecessarytoconducttheawarenessprograms/campaignsonroadsafetyduring construction.

9. The campaign will cater to all types of target groups i.e. children, adults, and drivers. Therefore,thesecampaignswillbeconductedinschoolsandcommunitycentres.Inaddition,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 theunexpected;
- (iii) educate the public about the various traffic control devices and safety measures adopted at the workzones;
- (iv) educate the public about the safe road user behaviour to emulate at the work zones;
- (v) tellthepublichowtostayinformedorwheretoinquireaboutroadsafetyissuesat the work zones (name, telephone, mobile number of the contact person;and
- (vi) indicate the office hours of relevantoffices.

E. Install traffic control devices at the work zones and traffic diversionroutes

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 workzones:

- Signs
- Pavement Markings
- ChannelizingDevices
- ArrowPanels
- WarningLights

11. Procedures for installing traffic control devices at any work zone vary, depending onroad 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 shouldbe

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

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

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

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

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

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

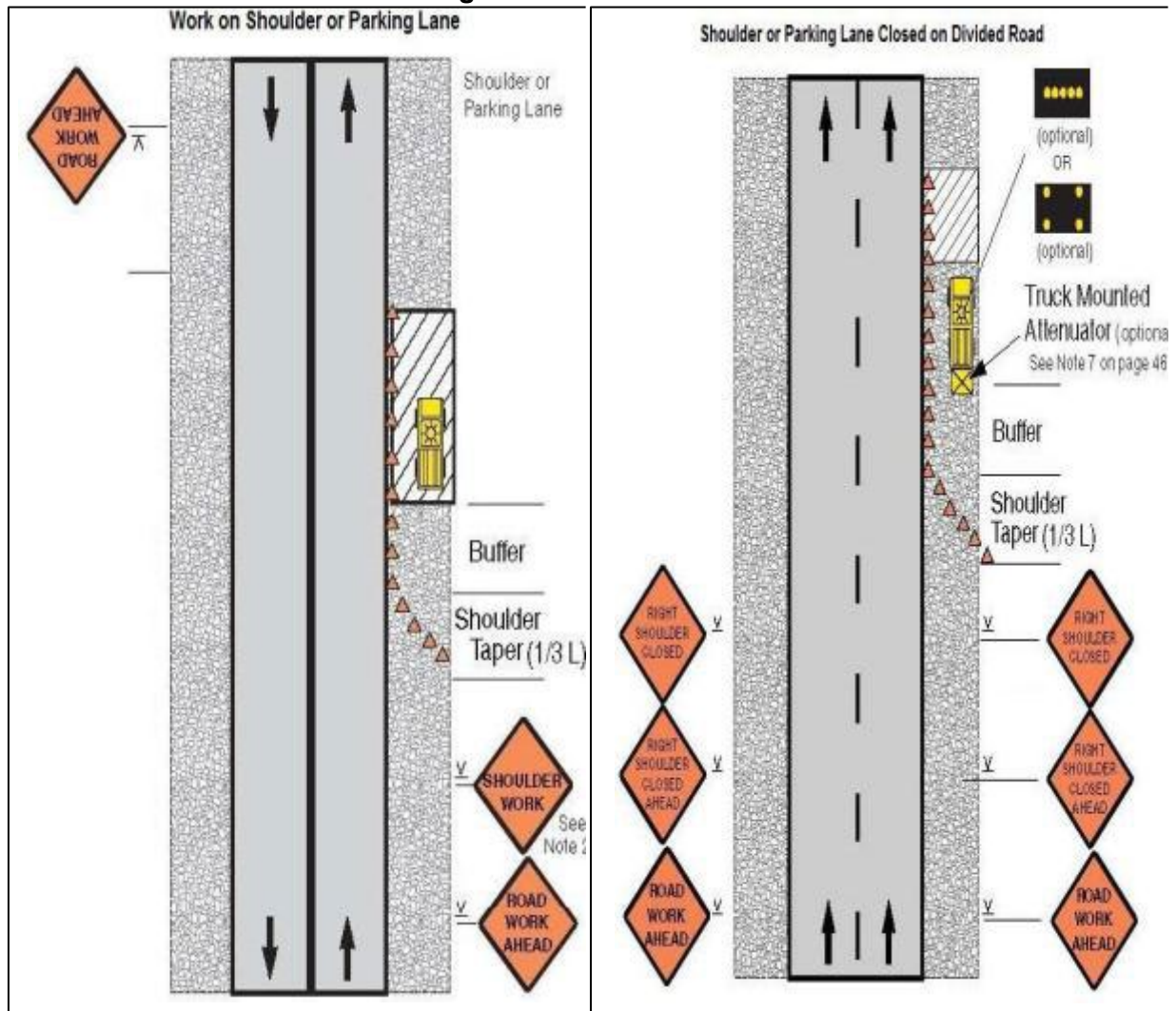


Figure A6.4 and A6.5: Work in Travel Lane and Lane Closure on Road with Low Volume

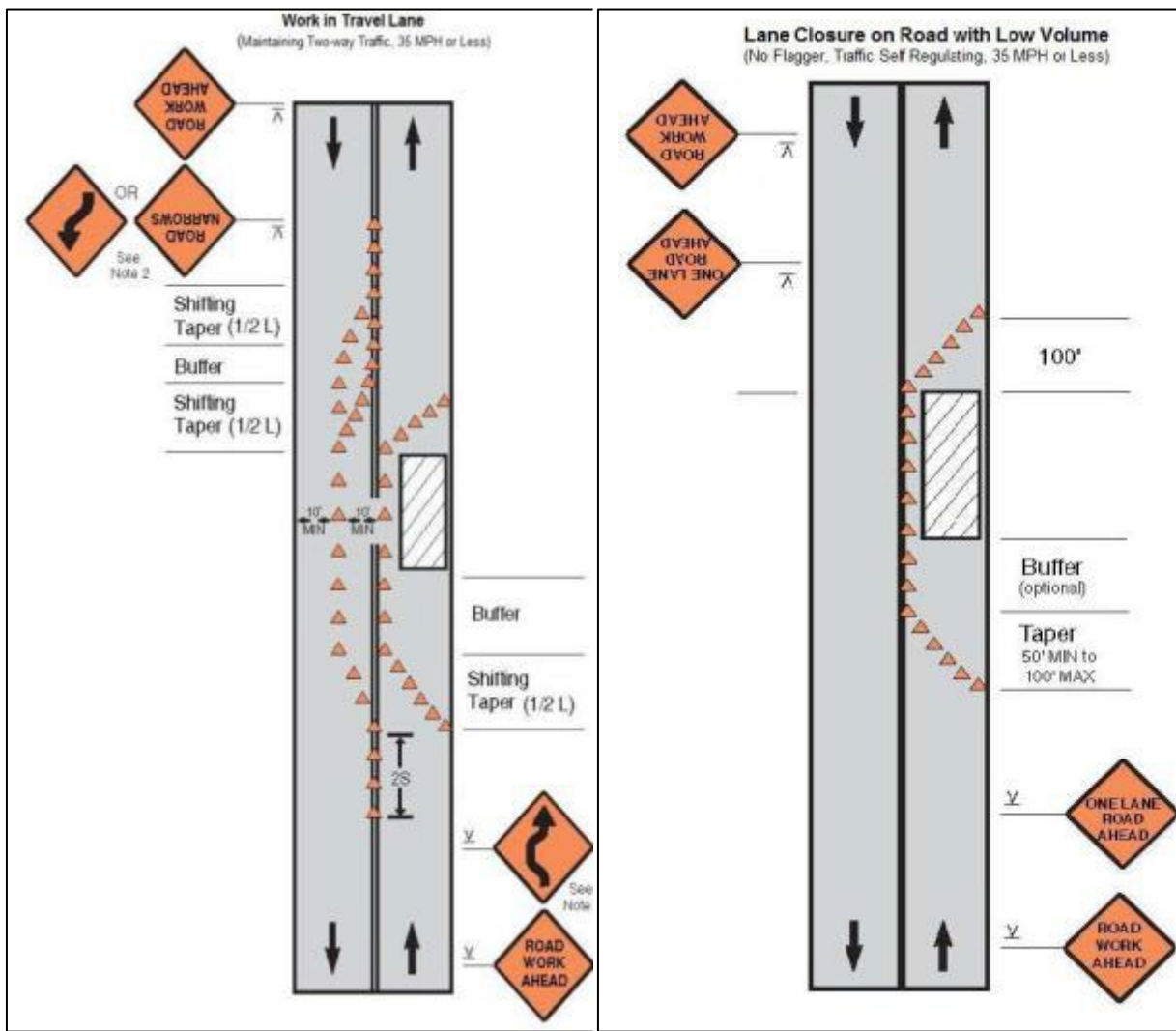
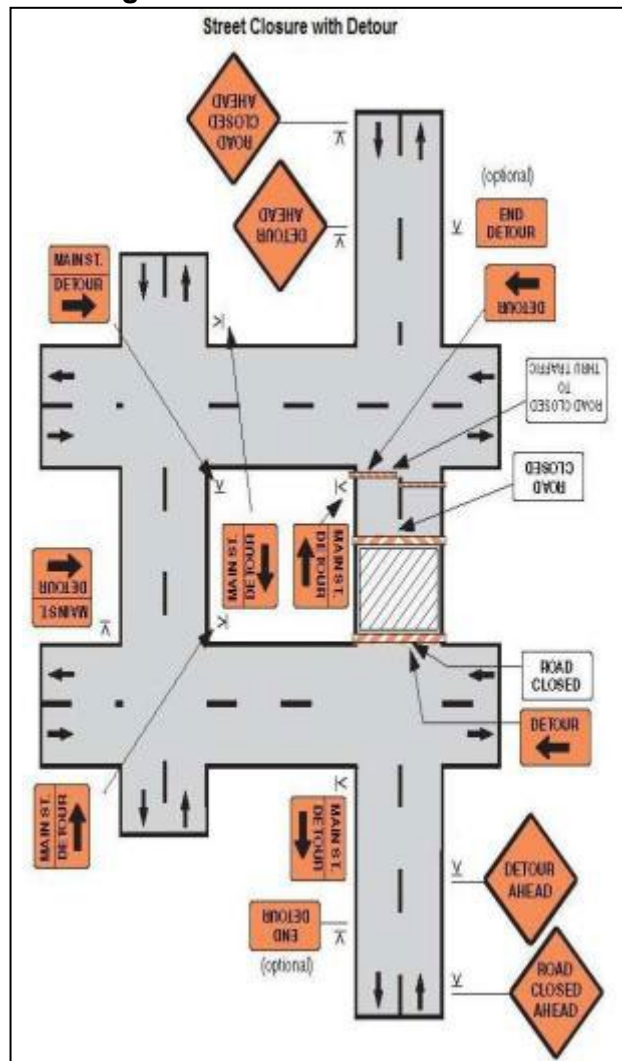


Figure A6.6: Street closure with detour



Appendix 7: SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name
Contract
Number

NAME: _____ DATE: _____ TITLE: _____

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

Signoff

Name
Position

Name
Position

Appendix 8: 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 subproject progress and status
- Description of subprojects (package-wise) and status of implementation (preliminary, detailed design, on-going construction, completed, and/or O&M stage)

[illegible]

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

Compliance status with National/State/Local statutory environmental requirements

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

^a 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.

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

^c Specify if obtained, submitted and awaiting approval, application not yet submitted.

^d 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 if 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 undertaken out of working hours and how that is being managed.

Summary of Environmental Monitoring Activities (for the Reporting Period)

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
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/m ³	SO ₂ µg/m ³	NO ₂ µg/m ³

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

Water Quality Results

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

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

Noise Quality Results

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

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

VI. SUMMARY OF KEY ISSUES AND REMEDIAL ACTIONS

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

VII. APPENDICES

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

Appendix 9: SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name
Contract
Number

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

WEATHERCONDITION: _____

INITIAL SITECONDITION: _____

CONCLUDING SITE CONDITION:

Satisfactory _____ Unsatisfactory _____ Incident _____ Resolved
_____ Unresolved _____

INCIDENT:

Nature of incident: _____ Intervention Step _____

Incident Issues

Resolution

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

Inspection

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

Site Restored to Original Condition Yes ☐ No ☐

Signature

Signoff

Name _____
Position _____

Name _____
Position _____

Appendix 10:STAKEHOLDER CONSULTATION

Conducted in Vellore on 28-Sep-2017 by VCMC

The administrative sanction has given by Principal Secretary for Municipal Administration and water supply (MC.6) Department vide GO (2D) No 52 date : 17.08.2107 to ULB for Underground sewerage scheme for Vellore Corporation – Phase –II – Scheme No : Estimate cost **Rs. 343.69** with following funding pattern:

Sanctioned Project Cost	Rs. 343.69 Crore
GOI share 50 %	Rs.171.84 Crore
GOTN Share 20 %	Rs. 68.74 Crore
ULB share 30 %	Rs.103.11 Crore
Total	Rs. 343.69 Crore

UnderAMRUTscheme,theundergroundsewerageschemetoVelloreCorporationPhase–IIhas got Administrative sanction and the technical sanction is under processing. The stakeholders meeting has arranged by the commissioner and the Municipal Engineer, Vellore City Municipal Corporation on 28.9.2017 after 3.00pm.

During the stakeholder meeting the Commissioner and Municipal Engineer has explained about theSchemedetailsofareacoverageandwardscoverage,the locationofSub-SewagePumping station(5nos.),Pumpingmainroutes,Treatmentplantlocations(50MLD,atViruthampattu)and discharge location.

List of stakeholders attended in Meeting: Presentation given by Vellore City Corporation, Vellore

S. No.	Presentation Given by Vellore City Corporation, Vellore
1	Mr. T. Balasubramanian, Municipal Engineer, Vellore City Municipal Corporation, Vellore
	Presentation given by UGSS Consultant
2	Mr. P.M. Saravanan, Senior Design Engineer, Voyants Solutions Pvt. Ltd, Chennai
	Answers given regarding Pumping station locations and land details
3	Mr. M. Kannan, Town Planning Officer, Vellore City Municipal Corporation, Vellore
	List local residents and welfare associations attendees
1	B.P Ravindra Kumar, 41, Thiagarapuram, Vellore-1.
2	R. Anbarasan, 102, Fifty Feet School Road, Sripadmarathy Nagar, Vasanthapuram, Vellore.
3	M.R. Madhavan, 19, First Street, Sripadmavathy Nagar, Vasanthapuram, Vellore
4	B. Kothandapani, 29th Ward, 102, E.S.M Street, Ajosandrapet, Vellore.
5	C. Shanmugam, No. 5/2 A, EB Nagar Phase III, Sathuvachani, Vellore-9.
6	K. kuppusamy, No. 25, EB Nagar Phase III, Sathuvachari, Vellore-9
7	A. Khader, No. 18 P3,SVC
8	S. Vinoth, No.26, EB Nagar Phase III, Sathuvachari, Vellore-9
9	N. Harish, Ward-19, Vallalar, Sathuvachari, Vellore-9.

10	A.M. Saisethuraman, Vellore
11	K. Purushothaman, Vellore
12	A. Kotti, Vellore
13	S. Vijaykumar, Vellore
14	A. Pitchimuthu, Vellore
15	K. Shanmugam, Vellore
16	R. Kothandapani, Vellore
17	S. Sriraghkumar, Vellore
18	N. Elavarasan, Vellore
19	S.A. Subbarayan, Vellore
20	K. Suriya Achare, Sainathapuram, Vellore.
21	CNR. Srinivasan, Vellore.

Details of Discussion

1. Gothandapani, ex. Member of Council, Engineer Subraianstreet

S. No.	Questions	Answers
1	Kindly select qualified contractor. The contractor should not give sub-contract.	Both experience-wise and financial-wise qualified contractor only will consider for this works.
2	Definition of sewage? Whether it mean only night soil/toilet or kitchen and both room waste also.	Wastewater from your shower, bathtub, washing machine, dishwasher, kitchen sink and toilet is all considered sewage .it isn't just from the toilet

2. Mr. Kuppusamy,Sankaranpalayam

S. No.	Questions	Answers
1	What is duration of the scheme and when it will start?	The execution period is 3 years and Operation and Maintenance is 5 years.
2	The House service connection, from outlet of building toCompoundwall (inside premises) has to consider under contract work.	From Phase –II scheme, inside premises pipe line also will be laid under contractor.
3	What is the basis fixing of HSC tariff?	Based on built-up area , the HSC tariff will be fixed.

3. Mr. Surya Achari, Ex. Member of Council ,Allapuram

S. No.	Questions	Answers
1	What is the basis fixing of HSC tariff?	Based on built-up area , the HSC tariff will be fixed.
2	The construction quality should be maintainedproperly.	Corporation arranging Project Management Consultancy for this Phase –II scheme. So Corporation and PMC will closely monitor the quality of the works.
3	Safety measures to be considered while executing the works	While execution, the traffic diversion and safety measures like keeping Barricading system will consider to minimize the disturbance of local residents.
4	The treated sewage should meet the effluent standards.	The appropriate modernize technology is proposed considering techno-economic analysis and meeting out latest effluent standards (CPCB).

4. Mr.Jai Sankar, Ex. Member of Council ,Thottapalayam

S. No.	Questions	Answers
1	The stone-ware pipes shall not be used for sewerage scheme.	The stone-ware pipes and RCC pipes are not chosen for this scheme.
2	Manhole cover should be strong.	As per IS code the manhole covers (Heavy Duty) quality will be maintained and which will resist the heavy traffic flow also.
3	The quality of pipe line should be double checked.	Including pipeline, manhole cover and other material will be checked in factory test and Third party inspection party also will be arranged for material testing.
4	Once pipe line works has over, the excavated trench in the road has to be closed.	Afterhydraulic test of the laid pipeline, the excavated trench will be closed immediately by contractor.

5. CNR. Srinivasan,Vellore

S. No.	Questions	Answers
1	While doing sewerage scheme, the other utilities like potable water supply works, side storm water drain, telephone cables etc.	Before the starting the excavation works , contractor will do trail pit and enquire to local resident about other utilities are passing through road. Accordingly contractor will do the work. Even the utilities got damaged, the contractor will restore the utilities.
2	The road restoration has to finish once works has finished and the manhole cover has to be leveled with road surface level.	Contractor will do similar way and PMC and Corporation will monitor road restoration works also.

6 C. Shunmugam.EB Nagar,Phase –III,Sathuvacheri

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

7 B.P.RavindraKumar

S. No.	Questions	Answers
1	Manholes has to locate in the middle of the road	Yes. Manhole will be located in the middle of the road. From there house service connection will be connected.
2	scheme to has to be finished within stipulated time	Corporation arranging Project Management Consultancy for this Phase –II scheme. So Corporation and PMC will closely monitor the works and will complete within period (3 Years).

8. A. Kotti , Nethaji Road ,Shenbakkam,Vellore

S. No.	Questions	Answers
1	While execution of works, the traffic diversion and safety measures has to be considered.	While execution, the traffic diversion and safety measures like keeping Barricading system will consider to minimize the disturbance of local residents.

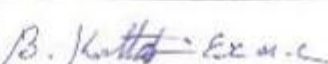
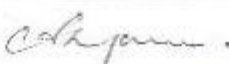
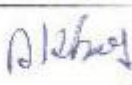
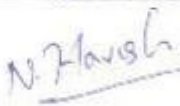
Consultation Workshop Photographs



வேலூர் மாநகராட்சி

பாதாள சாக்கடை திட்டம் பகுதி-2 சத்துணர்ச்சாரி, கோணவட்டம்,
பேண்டாக்கம் ஆகிய பகுதிகளில் செயல்படுத்துதல்

சுருத்துகு கட்ட நாள்: 28.09.2017

வ.எண்.	பெயர் / முகவரி	தொலைபேசி எண். / திமெயில்	கையொப்பம்
1	B. P. RAVINDRA KUMAR 41, Thirugerepuzha, Vellore	98432 26297 navindra_vk@ g-ba.com	
2	R. Anbarasan 102, Fifty feet School Sripadma rathay nagar, Vadavathur, Vellore	80150 22847 anbarasan_rathay@ g-p.mail.com	
3	M. R. Raghavan 19, Fifty feet School Sripadma rathay nagar, Vadavathur, Vellore	97870 23640	
4	B. KOTHANDAPANI E.M.C. 29th Ward 102 E.S.M.S. Ajaynagar, Vellore	9367119417	
5	C. Shanmugam E.M.C. No 3/4 A, EB Nagar Phase III Sathuvachan, Vellore	9443625298	
6	K. Kuppusamy No 25, EB Nagar Phase III Sathuvachan, Vellore	9994613677	
7	AKHADEE No 18 P.S. SVC	9894439992	
8	S. Vinodh No: 26, EB Nagar, Phase 3 Sathuvachan, Vellore	8122643602	
9	N. Harish Ward - 19, Vallalar, Sathuvachan, Vellore	9566746425	

வ.எண்.	பெயர் / முகவரி	தொலைபேசி எண். / திமேயில்	கையொப்பம்
10.	A.M.SAISETHURAMAN	9003389662	A.M. S. SETHUR
11.	K. PURUSHOTHAMAN	9894941490	K. Purushothan
12.	AKOTHI	9894671083	Akothi
13.	S.V. Vayakumar	9994293810	S.V.
14.	A. Pitchimuttu	9486057045	A. Pitchimuttu
15.	K. Shanmugam	9043068932	K. Shanmugam
16.	R. KATHARAJAN	9443365597	R. Katharajan
17.	M. Sundaraman	9788028862	M. Sundaraman
18.	S. Sankaranarayanan	9488170004	S. Sankaranarayanan
19.	N. Elavarasan	9444622119	N. Elavarasan
20.	S. a Subbaraj	9447642992	S. a Subbaraj

**News Item Related to Consultation Workshop in Tamil
Newspaper (Dinamalar, dated 1 October 2017)**

பேட்டரி பள்ளியில், விஜயதசமிவை
தலைநகர நடந்தது அருகில் தாளாளர்
வந்தது. மேலாளர் துர்காதேவி.

பண குடுமிக்குத் தொடங்கி
உள்ளது. இதிலேயில் உரிவ
அனுமதி பெறாமலும், பாது
காப்பு நடவடிக்கை இன்றியபி

தும், பட்டா கடைகளில்
தேவனைப்பு உருவிகள் உள்
னதா? தண்ணீர், மணல் பக்
கெட்டுகள் தயார் திளையில்

யாளர்கள் மீது கடும நடவடி
க்கை எடுக்கப்படும். இவ்
வாறு போலீசார் தெரிவித்த
னர்.

பாதாள சாக்கடை திட்ட 2வது கட்டப்பணிகள் வேலூரில் செயல்படுத்த மக்கள் கருத்துக்கேட்பு

வேலூர், அக.1-
வேலூர் மாநகராட்சியில்
பாதாள சாக்கடைத் தி
ட்டம் பகுதி-2, செயல்ப
டுத்துவது தொடர்பாக
மக்கள் கருத்துக்கேட்பு
கட்டம் நடத்தி.

வேலூர் மாநகராட்சியின்
மேலதிக பரப்பளவு 87.913
அடர் கி.மீ. ஆகும். மக்க
ள்தொகை (2011ம் ஆண்டு
கணக்கெடுப்பின்படி) 5 லட்ச
த்து 4 ஆயிரத்து 79 பேர்
ஆகும். மாநகராட்சி நிர்வாக
யறிக்கை 8 மண்டலங்களாக
பிரிக்கப்பட்டு, ஒவ்வொரு

மண்டலத்துக்கும் 15
வார்டுகள் வீதம் உள்ளன.
தமிழ்நாடு நகர்ப்புற
வளர்ச்சி திட்டம் 3, திட்டத்
தின் கீழ் பண்டிய வேலூர்
நகராட்சியில் 48 வார்டுகளில்
24 வார்டுகள் (இப்போதைய
வேலூர் மாநகராட்சியில்
உள்ள 60 வார்டுகளில் 14
வார்டுகள்) பாதாளசாக்கடைத்
திட்டப்பணிகள் முடிந்து
ள்ளது. இவையடுத்து, பாதாள
சாக்கடைத் திட்டம் பகுதி-2ன்
கீழ் அவ்மேலாமங்காபுரம்,
சத்துவாச்சாரி, சேன்பாக்கம்,
கொண்டட்டம், கன்பா, மத்
றம் வேலப்பாடி பகுதிகளில்

பாதாள சாக்கடை திட்டப்ப
ணிகள் மேற்கொள்ள 343.89
கோடி மதிப்பீடு தொகைக்கு
அம்சுட் திட்டம், ஆசிய
வளர்ச்சி வங்கி மூலமாக
வழங்கப்படும் தொகையை,
தமிழ்நாடு நகர்ப்புற உட்கட்
டமப்படி நிதி நிறுவனம்
மற்றும் தமிழ்நாடு உட்கட்ட
டமப்படி நிதி சேவை நிறுவனம்
வாயிலாக நிர்வாக அனுமதி
பெறப்பட்டு, தொழிற்சூட்டப்
அனுமதி பெறும் நிலையில்
உள்ளது.

இதற்காக, 6 கழிவுநீர்
உந்து திளையம், 7 கழிவுநீர்
இறைப்பு திளையம், 8 ஆலி

ரத்து 652 மேன்ஜேரல்கள்
மற்றும் 80.00 எம்எம்டி
கொள்ளளவு கொண்ட கத்தி
கரிக்கும் திளையம் ஆய்வகம்
அமைக்கப்பட உள்ளன.

இதைத்தொடர்ந்து, பகு
தி-3ன் கீழ் காட்பாடி, தாரா
படவேடு, காந்தி நகர்,
கழிவுநீர், தொரப்பாடி, சித்
தேர் மற்றும் சின்ன அல்ல
புரம் பகுதியில் பாதாள
சாக்கடைத் திட்டப்பணிகள்
மேற்கொள்ள 400.00 கோடி
மதிப்பீட்டில் விலையில் திர்
வாக அனுமதி வழங்கப்படும்
நிலையில் உள்ளது.

இதற்கான கருத்துக்கேட்பு
கட்டம், வேலூர் மாநகராட்சி
அலுவலகத்தில் கடந்த 28ம்
தேதி நடத்தது. இதில்,
யாராலும் ஆட்சேபனை
தெரிவிக்கப்படாமல் கட்டம்
நடத்து முடிந்தது.

Appendix 12: CONSENT TO ESTABLISH FOR STP

Category of the Industry :

RED

CONSENT ORDER NO. 1901121969000 DATED: 12/12/2019.

PROCEEDINGS NO.T1/TNPCE/F.1476VLR/RL/VLR/W/2019 DATED: 12/12/2019

SUB: TNPC Board-Consent for Establishment-M/S VELLORE CITY MUNICIPAL CORPORATION SEWAGE TREATMENT PLANT - II S.F No. 60/8, VIRUDHAMPATTU Village, Katpadi Taluk, Vellore District - for the establishment or take steps to establish the industry under Section 25 of the Water (Prevention and control of Pollution) Act, 1974, as amended in 1988 (Central Act 6 of 1974)- Issued- Reg.

REF: 1. Unit's Application for CTE (new) dated: 13.06.2019
 2. IR.No : F.1476VLR/RL/DEE/VLR/2019 dated 03/07/2019
 3. Board's (Consent Clearance Committee) Resolution No.264-11 dated:03.12.2019

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

The Commissioner,

VELLORE CITY MUNICIPAL CORPORATION SEWAGE TREATMENT PLANT - II

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

S.F. No.60/8,

VIRUDHAMPATTU Village,

Katpadi Taluk,

Vellore District.

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

G. Gopalakrishnan

For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai

To

The Commissioner,

M/s. VELLORE CITY MUNICIPAL CORPORATION SEWAGE TREATMENT PLANT - II,

1, Infantry Road, Corporation Main Building, Near Vellore Cantonment, Vellore.,

Pin: 632001

Copy to:

1. The Commissioner, VELLORE-Corporation, Katpadi Taluk, Vellore District .
2. The District Environmental Engineer, Tamil Nadu Pollution Control Board, VELLORE.
3. The JCEE-Monitoring, Tamil Nadu Pollution Control Board, Vellore.
4. File

SPECIAL CONDITIONS

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

SL. No.	Description	Quantity	Unit
Product Details			
1.	Treatment of Sewage generated from Zone no. 1 - 8 of Vellore Corporation	50.0	MLD

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

a Sewage Treatment Plant:			
Treatment status: Individual STP			
SL. No.	Name of the Treatment Unit	No. of Units	Dimensions in metres
1.	Inlet Chamber	1	7.0 x 3.2 x 3.5
2.	Manual Bar Screen Chamber - Coarse	1	4.0 x 1.8 x 1.65
3.	Mechanical Bar Screen - Coarse	2	4.0 x 1.5 x 1.35
4.	Manual Bar Screen Chamber - Fine	1	4.5 x 1.8 x 1.55
5.	Mechanical Bar Screen Chamber - Fine	2	4.5 x 1.5 x 1.25
6.	Detritus Tank	2	10.0 x 10.0 x 0.85
7.	Parshall Flume Channel	1	10.5 x 1.5 x 0.6
8.	Dividing Chamber (Distribution Chamber)	1	5.0 x 7.4 x 3.5
9.	SBR Tank	4	45.0 x 33.0 x 5.7
10.	UV Treatment Channel	1	10.0 x 1.5 x 1.5
11.	Treated Effluent Sump	1	12.0 x 6.0 x 2.5
12.	Sludge Sump	2	7.0 x 3.5 x 3.5
13.	Filter Press	2	0.63x0.63-70 Plates
14.	Filtrate Sump	1	3.0 Dia x 3.0
b Effluent Treatment Plant:			
Treatment status: No trade effluent and hence does not arise			
SL. No.	Name of the Treatment Unit	No. of Units	Dimensions in metres
1.			

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

Outlet No.	Description of Outlet	Maximum daily discharge in KLD	Point of disposal
Effluent Type : Sewage			
1.	Sewage	50000.0	Pandian Channel at Dharapadavedu of Vellore Corporation which leads to River Palar after travelling a distance of 12 KM
Effluent Type : Trade Effluent			

4. **Additional Conditions:**

1. The STP shall not commence its operation without obtaining CTO of the Board.
 2. The Corporation shall construct the sewage treatment plant as per the proposals submitted to the Board.
 3. The Corporation shall install UV treatment system for the disinfection of the treated sewage instead of chlorination.
 4. The Corporation shall install Mechanical filter press instead of sludge drying beds.
 5. The Corporation shall declare the lands which are located within a radius of 100 m from the STP as no development zone in consultation with DTCP and develop green belt
 6. Electromagnetic flow meters with computer recording arrangement shall be provided at inlet and outlet of STP to measure the quantity of sewage.
 7. Closed pipeline should be laid from the outlet of STP to the Pandian Channel where the treated sewage is proposed to be disposed.
 8. Provision for standby electricity power shall be made to operate the STP continuously in case of power failure.
 9. The Corporation shall provide necessary storm water drain in and around the proposed STP area and ensure that there will not be any water logging in and around the proposed STP.
 10. The Corporation shall obtain NOC from PWD to install the pipeline carrying bridge across the River Palar for carrying the sewage generated from Zone 3 to Zone 9 to the proposed STP.
 11. The Corporation shall obtain and furnish NOC from PWD for the discharge of the treated sewage into the Pandian Channel at Gandhi Nagar.
 12. The STP shall follow the "Action plan for usage of treated waste water from Sewage Treatment Plants" prepared by Municipal Administration and Water Supply Department, Government of Tamil Nadu.
 13. The Corporation shall comply with the Hon'ble NGT order dated 30.04.2019 in O.A. No. 1069/2018 regarding the discharge standards of treated sewage prescribed from time to time.
 14. The unit shall furnish proposal for the construction of underground Sewerage system (pipelines) for carrying raw sewage from collection points to the proposed STP.
 15. The unit shall furnish proposal for the construction of pumping station to collect the sewage and pump the same via pipeline to STP.
 16. The STP shall be designed to achieve the STP standards prescribed by the Hon'ble NGT(PB) in order dt. 30.04.2019 in O.A. No.1069/2018 which are as follows:
S.No. Parameter Standards
(Applicable to all mode of disposal)
1. pH 5.5 – 9
 2. BOD 10
 3. TSS 20
 4. COD 50
 5. Nitrogen – Total 10
 6. Phosphorus-Total(for discharge into ponds, lakes) 1
 7. Fecal Coliform (FC)(Most probable Number per 100 milli litre, MPN/100 ml) Desirable – 100
Permissible – 230
- Note :
- i. All value in mg/l except for pH and Fecal Coliform
 - ii. These standards will be applicable for discharge into water bodies as well as for land disposal/applications.
 - iii. Reuse/Recycling of treated effluent shall be encouraged.

G. Gopalakrishnan

For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai

Digitally signed by G. Gopalakrishnan
DN: cn=G. Gopalakrishnan, o=Tamil Nadu Pollution Control Board, ou=Member Secretary,
email=g.gopalakrishnan@tnpcb.gov.in, c=IN
Date: 2019.08.28 14:42:00 +05'30'