Initial Environmental Examination

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IND: Tamil Nadu Urban Flagship Investment Program – Providing Comprehensive Sewerage Scheme to Manali, Chinnasekkadu, Karambakkam and Manapakkam in Chennai City

Prepared by Chennai Metropolitan Water Supply and Sewerage Board, Government of Tamil Nadu for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 11 May 2018)

Currency unit – Indian rupee (₹)

₹1.00 – $0.015

$1.00 = ₹67.09

ABBREVIATIONS

ADB	–	Asian Development Bank
ASI	–	Archaeological Survey of India
CMSC	–	Construction Management and Supervision Consultant
CMWSSB	–	Chennai Metropolitan Water Supply and Sewerage Board
CPCB	–	Central Pollution Control Board
CTE	–	consent to establish
CTO	–	consent to operate
DPR	–	detailed project report
DWC	–	double wall corrugated
EAC	–	expert appraisal committee
EHS	–	environmental, health and safety
EIA	–	environmental impact assessment
EMP	–	environmental management plan
IEE	–	initial environmental examination
MOEFCC	–	Ministry of Environment, Forest and Climate Change
NOC	–	no objection certificate
PIU	–	program implementation unit
PMU	–	program management unit
REA	–	rapid environmental assessment
ROW	–	right-of-way
SPS	–	Safeguard Policy Statement
STP	–	sewage treatment plant
TNPCB	–	Tamil Nadu Pollution Control Board
TNUFIP	–	Tamil Nadu Urban Flagship Investment Program
TNUIFSL	–	Tamil Nadu Urban Infrastructure Financial Services Limited
TWADB	–	Tamil Nadu Water and Drainage Board

WEIGHTS AND MEASURES

°C	degree Celsius
km	kilometer
m	meter
MLD	million liters per day
mm	millimeter
km^2	square kilometer

NOTE

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

CONTENTS

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 multitranche financing facility (MFF).

The Subproject. Chennai is the fourth largest Metropolitan city in India. In 2011, the Chennai City has been expanded to 426 square kilometer (km^2) from 176 km^2 by the annexure of 42 adjacent urban local bodies (ULBs). The entire erstwhile Chennai city had been provided with water supply and sewerage facilities. Hence, Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) has proposed to provide water supply and sewerage facilities in all the 42 added areas of Chennai city on par with erstwhile Chennai City. Of the 42 added areas, underground sewerage has already been implemented in four areas, and in another 15 areas it is under implementation. Now, under the ADB funded TNUFIP, it is proposed to provide sewerage schemes in another four areas namely Manali, Chinnasekkadu, Karambakkam and Manapakkam covering an extent of 27 km^2 having road infrastructures for a length of about 118 kilometers (km). The present proposal includes: (i) laying of sewerage collection system for a length of 113 km; (ii) construction of 11 sewage pumping stations; (iii) seven lift stations; (iv) sewage pumping main for a length of 28.8 km; and (v) house service connections - 25,974.

Project Implementation Arrangements. The Municipal Administration and Water Supply Department (MAWS) of Government of Tamil Nadu acting through the Tamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL) is the state-level executing agency. A program management unit (PMU) will be established in TNUIFSL headed by a Project Director and Deputy Project Director (senior official from CMWSSB), and comprising dedicated full-time staff from TNUIFSL for overall project and financial management. CMWSSB is the Implementing Agency for this subproject. A program implementation unit (PIU) will be established in CMWSSB headed by a Chief Engineer and comprising dedicated full-time staff of the CMWSSB for day-to-day implementation of the subproject. PIU is assisted by construction management and supervision consultant (CMSC) in implementation. Environmental and Social Safeguards (ESS) Managers in PMU/TNUIFSL will coordinate all the safeguard related activities of the subproject and will ensure the compliance with EMP and EARF. Environmental Specialist of the CMSC will assist PIU in implementation of subproject in compliance with EMP and EARF, and will carry out all necessary tasks.

Screening and Assessment of Potential Impacts. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement 2009. As per the Government of India Environmental Impact Assessment (EIA) Notification, 2006, this subproject do not require EIA study or environmental clearance. The potential environmental impacts of the subproject have been assessed using ADB rapid environmental assessment (REA) checklist for sewerage. The potential negative impacts were identified in relation to pre-construction, construction and operation.

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

Description of the Environment. Subproject components are located in Chennai City which are added to Chennai Corporation limit in 2011. Subproject components include sewer collection system, sewage pumping stations and lift stations. Sewer mains will be laid in the centre of public roads, within the road carriage way, and pumping/lifting stations will be constructed on identified government owned vacant lands which are located in residential areas. Since the Chinnasekkadu, Karambakkam and Manapakkam areas are in the status of Village Panchayats prior to merger with Chennai city, most of the roads and streets are narrow, and most of the areas are moderately populated. Adayar river is running adjacent to Manapakkam area. Providing sewerage scheme to Manapakkam area will prevents the discharge of untreated sewage from this area in to Adayar river. Manali is in the status of Municipality prior to merger with Chennai city and many industries and refineries are located in Manali area. Within the project area there are no sensitive areas like forest or protected areas or nationally important/protected monuments. No eco sensitive areas are located in or close to the subproject 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.

Providing comprehensive sewerage system will comprise of 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, adverse 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 pump to a higher elevation pump station or Sewage treatment plant (STP), are likely to generate odor. Sub project included the construction of 11 sewage pumping station and 7 sewage lifting stations. Sewage pumping station is located within the project area and the sewage collected will be conveyed to the designated existing STPs immediately, and therefore no impact is anticipated. Lifting stations are comparatively small, handle low volumes of sewage, and therefore odor nuisance is limited. Utmost care is taken to locate these away from the houses. Due to design considerations and land constraints, many

sites are located in residential areas. Odor prevention and control measures are put in place – included in the design and operation.

No sewage treatment facility is included in the subproject as it is proposed to utilize the available excess capacity of existing STP. According to technical studies, existing capacity is adequate to meet the sewage generated from the subproject area. Three existing STPs will be utilized for treating the sewage generated from the subproject areas: Manali and Chinnasekkadu areas to Kodungaiyur sewage treatment plant (STP) of 110 million liter per day (MLD) capacity; Karambakkam area to Koyambedu STPs (120 MLD) and Manapakkam area sewage will be conveyed to the Nesapakkam STP (54 MLD). All the three STPs are functioning normally, and treating the sewage to discharge standards specified by Tamil Nadu Pollution Control Board (TNPCB).

Proper functioning of STP is critical for the sustainability of new sewer infrastructure and realization of intended purpose (removing the human waste from those areas served by the network rapidly and treated to an acceptable standard) and benefits (improved environmental conditions, public health, etc.). All the above STPs are equipped with inbuilt lab facilities and the quality parameters are analysed daily in addition to the quality parameters monitored by TNPCB on monthly basis. As per the monitoring data, the biochemical oxygen demand (BOD) of treated effluent ranges from 11 to 17 milligram per liter (mg/l), which is meeting the TNPCB discharge standard of less than 20 mg/l. The STPs at Koyambedu and Nesapakkam have valid consent to operate (CTO) from TNPCB, while for Kodungaiyur STP CTO renewal application submitted along with the applicable fee, and CTO renewal is awaited. Sludge generated from STPs is used to generate bio gas (methane CH_4) by way of sludge digestion, which then used has fuel to generate electricity. The generated electricity is used to operate the STPs. The above process reduces the carbon emissions to the atmosphere by way of methane capture from the raw sludge. The digested sludge is then fed into mechanical centrifuge for dewatering the sludge. The dewatered sludge cakes is then collected and disposed inside the STP premises by landfilling. In order to further improve and enhance the operation of STP, CMWSSB has taken various initiatives: (i) construction of 45 MLD capacity tertiary treatment plants - one each at Kodungaiyur STP and Koyambedu STP, to further treat the secondary treated sewage and to reuse it for industrial purpose; and (ii) appointed consultants to study the existing sludge management system at the STPs, and suggest reuse options. This will further improve the efficiency of the existing sewage treatment systems. As the subproject utilizes existing STPs that are functioning properly, no adverse impacts envisaged.

Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result significant measures have already been included in the designs for the infrastructure. Various measures suggested for odor control including: appropriately locating sewage wells within site as far as away from the houses; developing tree cover; closed 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, 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 and pumping stations) will be confined to the selected sites, and the interference with the general public and community around is minimal. In these works, the temporary negative impacts arise mainly from construction dust and noise, hauling of construction material, waste and equipment on local roads (traffic, dust,

safety etc.,), mining of construction material 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. Most of the Chennai city area has high density population, very narrow roads and congested with traffic, people and activities. Therefore sewer 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; 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 (iv) finding beneficial use of excavated materials to extent possible to reduce the disposal quantity. EMP will guide the environmentally-sound construction of the subproject. EMP includes a monitoring program to measure the effectiveness of EMP implementation and include observations on- and off-site, document checks, and interviews with workers and beneficiaries.

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

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

Monitoring and Reporting. Contractor will submit a monthly EMP implementation report to PIU. PIU will monitor the compliance of Contractor, prepare a Quarterly Environmental Monitoring Report and submit to PMU. The PMU will oversee the implementation and compliance, and will submit semi-annual monitoring reports to ADB. ADB will post the environmental monitoring reports on its website. Monitoring reports will also be posted on CMWSSB and TNUIFSL 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. In an environmental audit conducted on the safe reuse of digested sludge, a CTO has to be obtained from the TNPCB for Kodungaiyur to implement a CMWSSB initiated study on the beneficial purposes of digested sludge. This IEE shall be updated by CMWSSB during the implementation phase to reflect any changes, amendments and will be reviewed and approved by PMU.

I. INTRODUCTION

A. Background

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

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

3. TNUFIP is aligned with the following 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, Tirupur, 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 meters 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;2 (ii) new Coimbatore sewage collection system and 30 MLD STP, with a 2-megawatt solar photovoltaic system, constructed;3 (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. Chennai city is the capital of Tamil Nadu and is the fourth largest metropolitan city in India. The water supply and sewerage facilities are existing in Chennai city for more than a century. In 2011, the Chennai City has been expanded to 426 km^2 from 176 km^2 by the merger of 42 adjacent Urban Local Bodies having a population of 67.27 Lakhs (as per 2011 Census). The entire erstwhile Chennai city had been provided with water supply and sewerage facilities. Hence, Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) has proposed to provide water supply and sewerage facilities in all the 42 added areas of Chennai city on par with erstwhile Chennai City. In the expanded Chennai city, at present providing underground sewerage system (UGSS) scheme had been completed in 4 added areas and in 15 added areas sewerage schemes are under implementation. Now, under the ADB funded TNUFIP, it is proposed to provide sewerage schemes in four added areas namely Manali, Chinnasekkadu, Karambakkam and Manapakkam covering an extent of 27 km^2 having road infrastructures for a total length of about 118 km. The present proposal includes: (i) laying of sewerage collection system for a length of 113 km, (ii) construction of 11 sewage pumping stations, (iii) seven lift stations, (iv) sewage pumping main for a length of 28.8 km, and (v) 25,974 house service connections. It is proposed to treat the sewage generated from these areas in the existing STPs located at Kodungaiyur, Nesapakkam and Koyambedu. By providing the sewerage system the environmental and health condition of about 120,000 population residing in the subproject area will be improved. The map showing the current sewerage coverage, proposed coverage under the project and the uncovered areas is shown below.

B. Purpose of this Initial Environmental Examination Report

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

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

[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

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

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

II. DESCRIPTION OF THE PROJECT

A. Project Area

9. Chennai City, capital of Tamil Nadu, has been expanded from 176 km^2 to 426 km^2 by annexing the 42 adjacent local bodies during the year 2011. Since then CMWSS Board has initiated action to provide water supply schemes and underground sewerage schemes in all the newly added 42 (erstwhile) local bodies on priority basis as well as to other areas within Chennai Metropolitan Area. The population of the expanded Chennai city is about 6.73 million as per 2011 census. Under the present project proposal it is proposed to provide sewerage schemes to Manali, Chinnasekkadu, Karambakkam and Manapakkam covering an extent of about 27 km^2. The total length of road in the project area is about 118 km. The present proposal includes: (i) laying of sewerage collection system for a length of 113 km, (ii) construction of 11 sewage pumping stations, (iii) seven lift stations, (iv) sewage pumping main for a length of 28.8 km, and (v) 25,974 house service connections.

B. Existing Sewerage System

10. At present, the entire core Chennai city covering an area of 176 km^2 has been provided with underground sewer system. The sewerage system of core Chennai City has been divided into five drainage zones. These five zones of macro systems covering the entire City had independent zonal collections, conveyance, treatment and disposal facilities. The sewage generated from these five drainage zones are treated in the STPs located at Kodungaiyur (Zone-I), Kodungaiyur (zone-II), Koyambedu, Nesapakkam and at Perungudi.

11. Zone–I of sewerage system forms the oldest part of the City and is in the North eastern portion of the City bounded by Bay of Bengal to the East, the City limits to the North, the Buckingham Canal to the West and Pycrafts Road to the South. It covers the areas of Tondaiarpet, Washermenpet, Royapuram, George Town, Chindadripet etc. The sewage collected from this Zone–I is drained to the treatment plant located at Kodungaiyur (Zone–I Plant) which was commissioned in 1991 having a capacity of 80 MLD.

12. Zone–II is the largest of the five macro systems and serves the Central and Northern portions of the City. It is bounded by the Buckingham Canal in the East and the erstwhile Corporation limits in the North. The area served are Nungambakkam, Chetpet, Kilpauk, Egmore, Purasaiwalkam, Ayanavaram, Perambur, Vyasarpadi, Sembium, Kolathur, Periyar Nagar,

Jawahar Nagar and Kodungaiyur etc. The wastewater generated in this Zones is drained into the treatment plant at Kodungaiyur (Zone–II Plant) which was commissioned in the year 1989 having a capacity of 80 MLD. To cater the need of growing population, in Kodungaiyur Zone-II another treatment unit with a capacity of 110 MLD has been commissioned in the year 2006.

13. Zone–III lies between Zone–II and Zone–IV to the West. It comprises Thyagaraya Nagar, Kodambakkam, Arumbakkam, Anna Nagar and Koyambedu. The sewage generated from this Zone is conveyed to the treatment plant at Koyambedu (Zone–III Plant), which was commissioned in the year 1978 having a capacity of 34 MLD. At Koyambedu two additional treatment units having a capacity of 60 MLD and 120 MLD had been commissioned in the year 2005 and 2016 respectively.

14. Zone–IV is the smallest of the macro systems lying to the South West of the City. The areas covered are Ashok Nagar, Saidapet, Jafferkhanpet, K.K. Nagar and Nesapakkam. The wastewater generated in this Zone is conveyed to the treatment plant at Nesapakkam (Zone–IV Plant) which was commissioned in the year 1974 for a capacity of 23 MLD. At Nesapakkam two additional units having a capacity of 40 MLD and 54 MLD were commissioned in the year 2006 and 2013, respectively.

15. Zone–V is the second largest of the five macro systems and is to the South of the City which is bifurcated by the Adyar River. Areas covered are Ice House, Mylapore, Adyar, Guindy, Velacherry, Gandhi Nagar, Indra Nagar etc. The wastewater collected in this Zone is conveyed to the treatment plant at Perungudi (Zone–V Plant) which was commissioned for primary treatment only in the year 1980 for the capacity of 45 MLD. Subsequently the treatment units were upgraded to ASP. Now two treatment units are available with a treatment capacity of 79 MLD and 72 MLD. In addition for treating the sewage generated from Alandur, which is one among the 42 added area, a STP with a capacity of 12 MLD is available with in Perungudi.

16. The above STPs are having adequate capacity to treat the sewage generated from the proposed 4 added areas. Hence no separate STPs are proposed now.

C. Proposed Sewerage System

17. The sewerage system for the expanded areas has been taken up by CMWSSB in a phased manner. Out of the 42 added areas, sewerage schemes have, so far, been implemented in Valasaravakkam, Madhavaram, Alandur and Meenambakkam. The sewerage schemes are under progress in 15 added areas.

18. Another 4 areas have been added, namely: Manali, Chinnasekkadu, Karambakkam and Manapakkam. There is currently no organized underground sewerage system in the above four subproject areas. Most of the households are provided with water borne latrine facilities. These latrines have septic tanks or holding tanks and the sewage is collected periodically in tankers and disposed in nearby sewage pumping station/STP. Further, the effluent from the septic tanks are directly let in to open roadside drains which find its way to the nearest low lying areas/ nearby water bodies. This leads to stagnation of water and unsanitary conditions and mosquito breeding. This is detrimental to the health of the people and are prone to disease like malaria, filarial etc. To protect the residents of the subproject area from ill effects, it is required to provide comprehensive underground sewerage system for the entire area.

19. The sewage generated from Manali and Chinnasekkadu for the Intermediate year 2035 and ultimate year 2050 is 9.83 MLD and 13.60 MLD, respectively. This is to be discharged in to

the existing Kodungaiyur STP of total treatment capacity 270MLD which is treating about 230MLD of sewage at present.

20. The sewage generated from Karambakkam for the Intermediate year 2035 and ultimate year 2050 is 8.05 MLD and 11.48 MLD, respectively. This is to be discharged in to the existing Koyambedu STP having a total treatment capacity of 214 MLD which is treating about 108MLD of sewage at present.

21. The sewage generated from Manapakkam for the Intermediate year 2035 and ultimate year 2050 is 4.57 MLD and 6.41 MLD, respectively. This is to be discharged in to the existing Nesapakkam STP having a total treatment capacity of 117 MLD which is treating about 93 MLD of sewage at present.

22. All the above STPs are to be enhanced in a phased manner based on the recommendations of the Master Plan prepared by CMWSSB.

23. CMWSSB is the agency responsible for providing water supply and sewerage schemes in the Chennai Metropolitan Area. Also CMWSSB is the implementation agency for this subproject. Detailed project report for the proposed underground sewage scheme is prepared by CMWSSB.

D. Proposed Project

24. Following table shows the nature and size of the various components of the subproject. Sewerage 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. Sewerage system is designed for 120 liters per capital per day, based on sewage generation rate of 80% of water supply. Sewerage system is design with gravity flow as far as possible, however topography do not permit a complete gravity system from collection to inlet at the STP, and therefore wherever required sewage lifting and pumping stations introduced to optimize the system design.

Table 1: Proposed Sewerage Subproject Components

<table>
<tr><th>Infrastructure</th><th>Function</th><th>Description</th><th>Location</th></tr>
<tr><td>Sewer network</td><td>Collect sewage from houses and convey to lifting / pumping stations by gravity</td><td>Total length of Collection system: 113.20 km; Size: 200-300 mm dia: double walled corrugated (DWC) pipes (85.9 km), 200-600 mm dia: cast iron pipes (27.3 km)
<table>
<tr><th>Dia</th><th>Length</th><th>%</th><th>Material</th></tr>
<tr><td>200</td><td>81921</td><td>72.37%</td><td>DWC</td></tr>
<tr><td>250</td><td>3262</td><td>2.88%</td><td>DWC</td></tr>
<tr><td>300</td><td>691</td><td>0.61%</td><td>DWC</td></tr>
<tr><td>200</td><td>9499</td><td>8.39%</td><td>CI</td></tr>
<tr><td>250</td><td>4027</td><td>3.56%</td><td>CI</td></tr>
<tr><td>300</td><td>4249</td><td>3.75%</td><td>CI</td></tr>
<tr><td>350</td><td>2926</td><td>2.58%</td><td>CI</td></tr>
<tr><td>400</td><td>1731</td><td>1.53%</td><td>CI</td></tr>
<tr><td>450</td><td>3310</td><td>2.92%</td><td>CI</td></tr>
<tr><td>500</td><td>1047</td><td>0.92%</td><td>CI</td></tr>
<tr><td>600</td><td>530</td><td>0.47%</td><td>CI</td></tr>
</table>
Manholes
4362 nos</td><td>Sewers will be laid underground in the roads and internal streets in the project area covering Manali, Chinnasekkadu, Karambakkam and Manapakkam. These four added areas of Chennai city is moderately populated. Sewers will be laid in all roads and internal streets in the project area.</td></tr>
</table>

<table>
<tr><th>Infrastructure</th><th>Function</th><th>Description</th><th>Location</th></tr>
<tr><td>Sewage pumping mains</td><td>Convey sewage from lifting stations to higher level manholes; and pumping stations to STP, under pressure</td><td>Length: 28.80 km;
Size: 150 – 700 mm dia cast iron pipes
<table>
<tr><th>Dia</th><th>Length</th><th>%</th><th>Material</th></tr>
<tr><td>150</td><td>3150</td><td>10.95%</td><td>CI</td></tr>
<tr><td>200</td><td>2500</td><td>8.69%</td><td>CI</td></tr>
<tr><td>250</td><td>1000</td><td>3.48%</td><td>CI</td></tr>
<tr><td>300</td><td>4800</td><td>16.68%</td><td>CI</td></tr>
<tr><td>350</td><td>2120</td><td>7.37%</td><td>CI</td></tr>
<tr><td>400</td><td>2100</td><td>7.30%</td><td>CI</td></tr>
<tr><td>500</td><td>1700</td><td>5.91%</td><td>CI</td></tr>
<tr><td>600</td><td>6400</td><td>22.25%</td><td>CI</td></tr>
<tr><td>700</td><td>5000</td><td>17.38%</td><td>CI</td></tr>
<tr><td>Total</td><td>28770</td><td></td><td></td></tr>
</table></td><td>Pumping mains will be laid from 7 lifting stations to nearby higher level manhole/ pumping station, and from pumping station to pumping stations / STP. These will be laid mostly along edge of the roads.</td></tr>
<tr><td>Sewage lift stations</td><td>Collect sewage from low level sewer and pump to higher level manholes</td><td>Sewage lift stations: 7
Components of Lift stations:
• Suction well of dia3.0 m and depth 6.25– 8.3 m (closed) with a vent pipe
• Non-clog submersible pump sets
• Control panel box</td><td>Lift well will be constructed in small available extent of land or along the road side. Lift stations are of 3.0 m dia to accommodate two small capacity submersible sewage pumps and 3.0 m x 3.0 size room or Kiosk to accommodate Pump Control Panel. Lift stations are proposed at following locations:
Manali:
1 Chinnamathur Road
Manapakkam:
2. MacroMarvel 1st st
3. MGR Road
4. Sethilakshmi nagar (Road side)
5. Sathya Nagar 4th street
Karambakkam:
6. Erikarai street
7. Samayapuram</td></tr>
<tr><td>Sewage pumping stations (SPS)</td><td>Collect sewage from lift stations and pumping stations and ultimately pump to sewage treatment plant</td><td>Pumping stations: 11
Components of Sewage Pumping Station
• Screen cum Grit well
Dia ranges from 3.0m to 5.0 m and depth ranges from 5.70 m to 8.50 m
• Suction well
Dia 3.0 m to 8.0 m and
depth from 7.17 to 10.0 m
• Non-clog submersible pump sets</td><td>New sewage pumping station are proposed in the identified vacant lands belongs to CMWSSB/ GCC/ Govt.(Revenue lands), for which necessary land alienation action initiated.
Sewage pumping stations are proposed at following locations:
Manali:
1 CPCL layout
2. Bharathiyar street,
3. Srinivasaperumal koil street,
4. Kamarajar street
Chinnasekkadu:
5. Inside Kodungaiyur STP</td></tr>
</table>

Infrastructure	Function	Description	Location
			Manapakkam: 6.River view colony 7. Indira Nagar **Karambakkam:** 8. Chettiyar Agaram 9. Maharishi Nagar 10. Gandhi Nagar 11.Inside existing Maduravoyal Sewage Pumping Station
House service connections	Collect sewage from individual houses and convey into network	• 25,974 (domestic and commercial)	Provision has been given from property boundary to nearest manhole.

Figure 1: Map showing Sewer Network in Manali

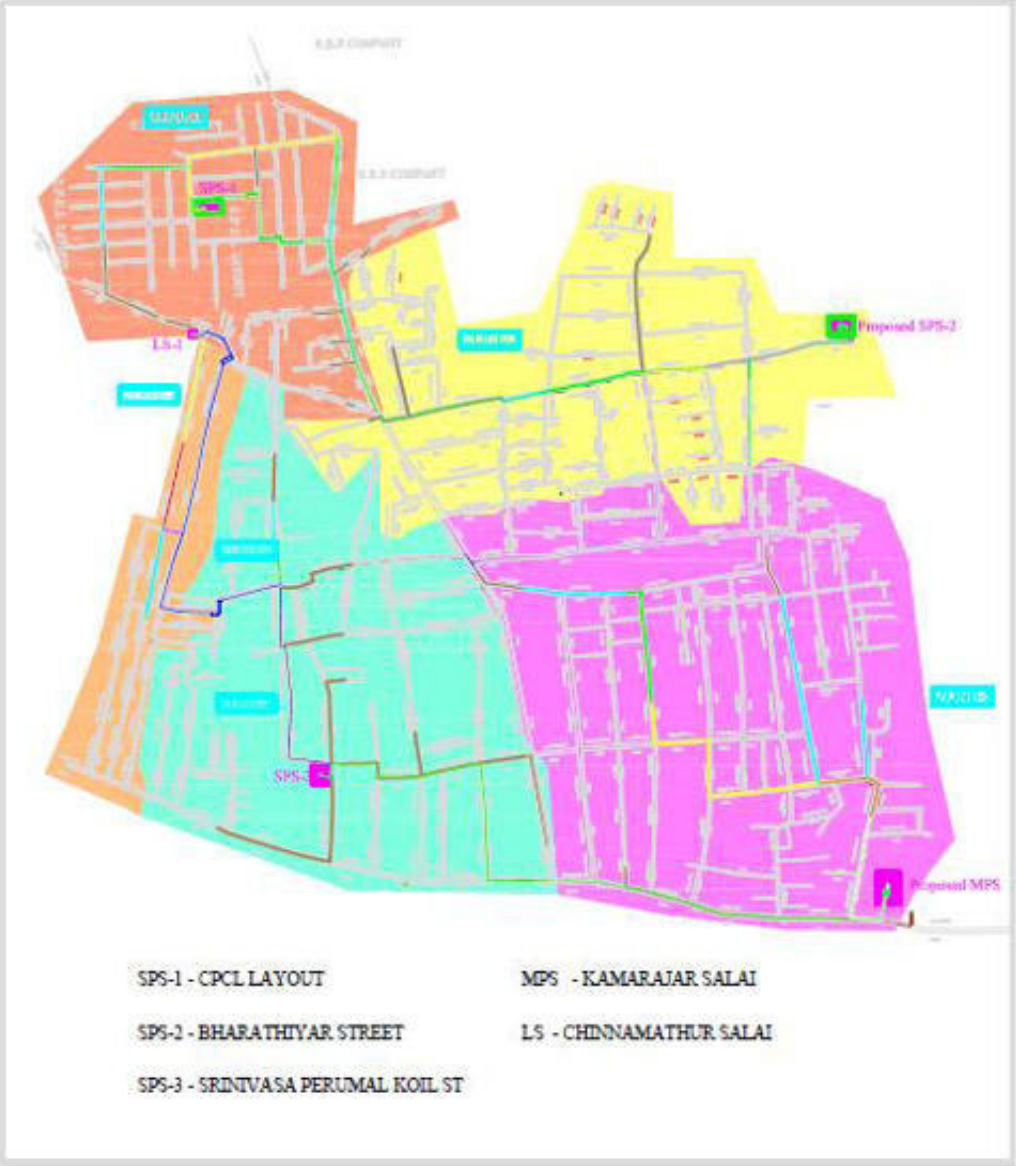


Figure 2: Map showing Sewer Network in Chinnasekkadu

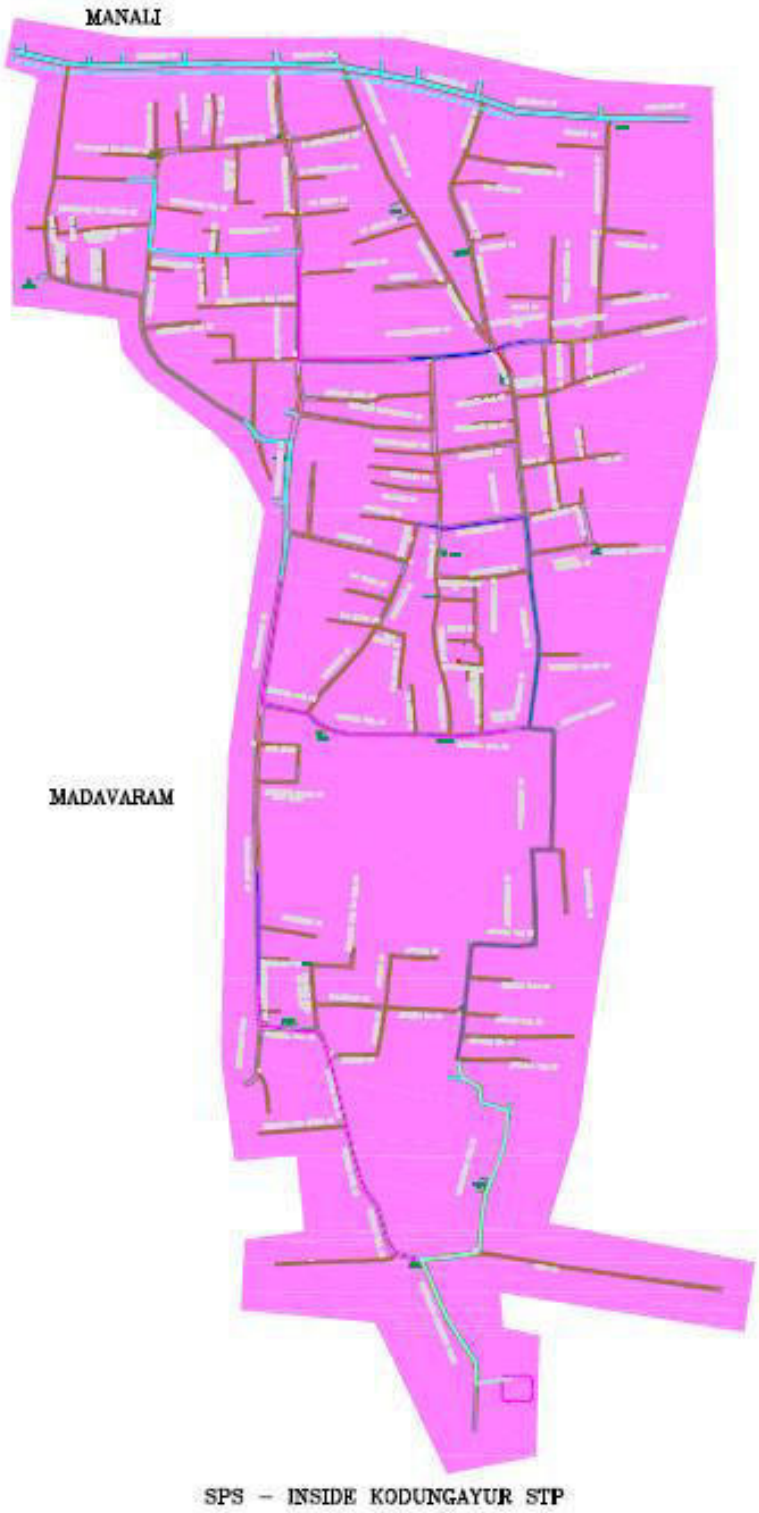


Figure 3: Map showing Sewer Network in Karambakkam

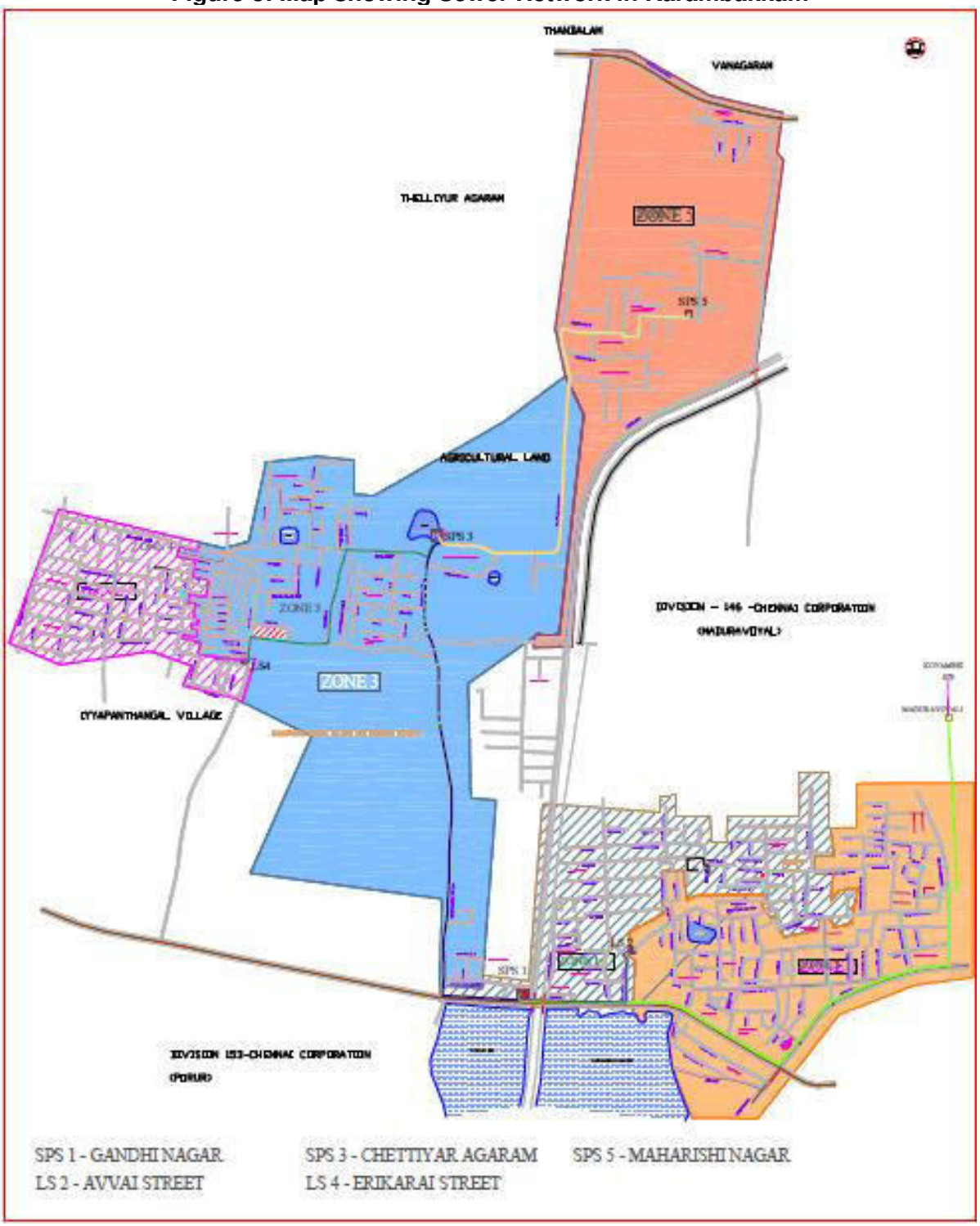


Figure 4: Map showing Sewer Network in Manapakkam

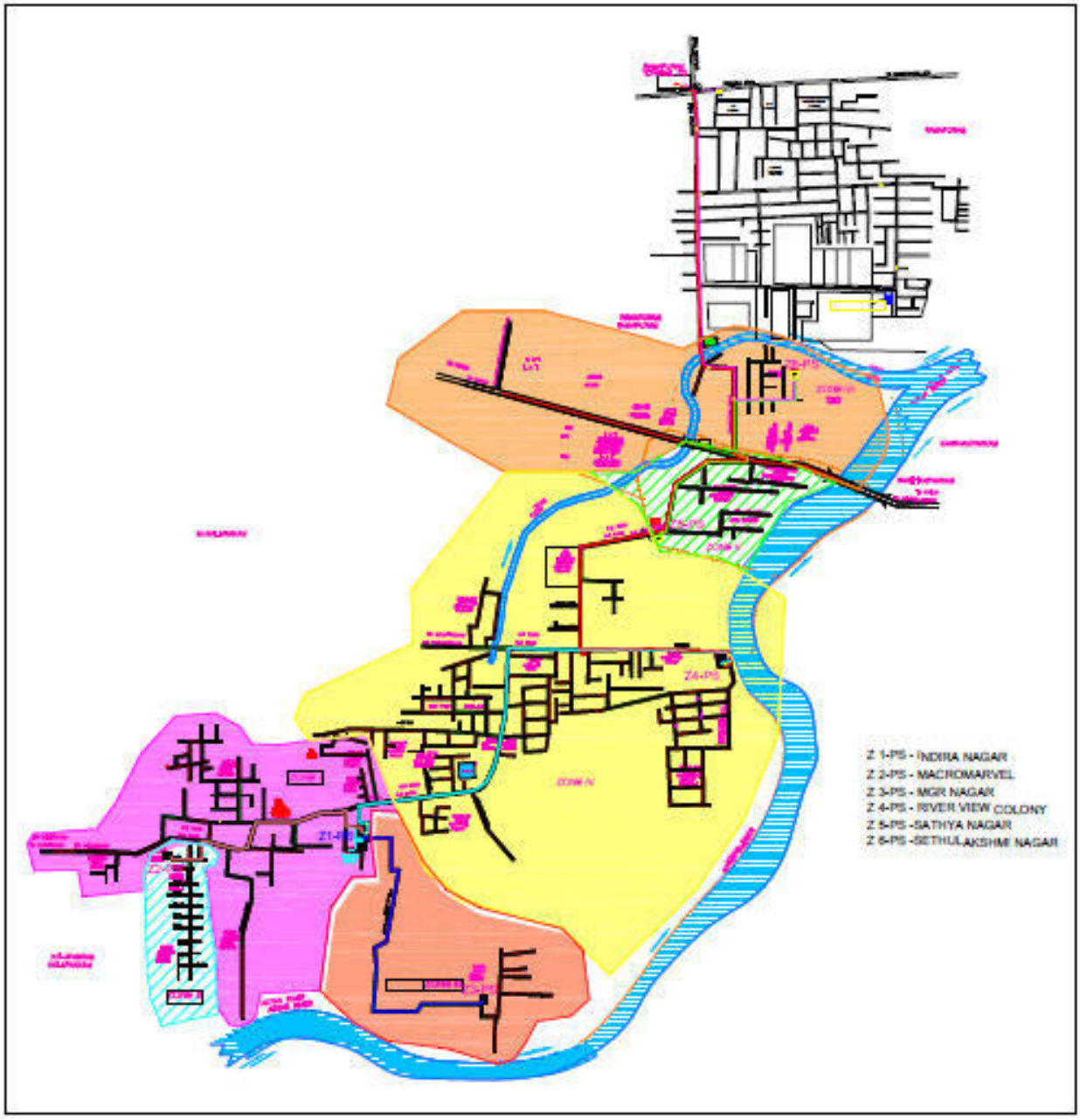


Figure 5: Typical Layout of Sewage Pumping Station at Manali- Bharathiyar Street

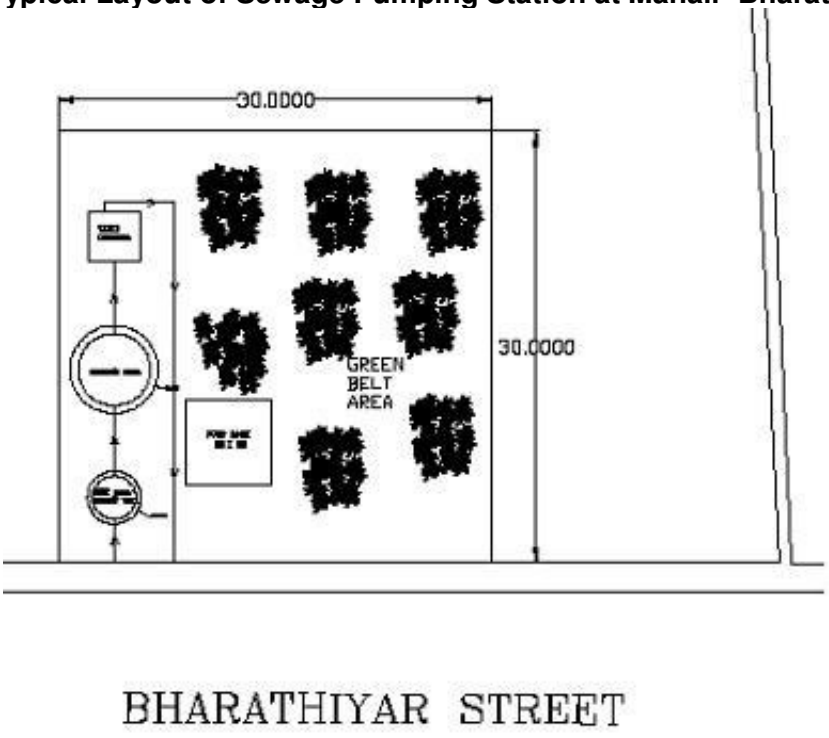
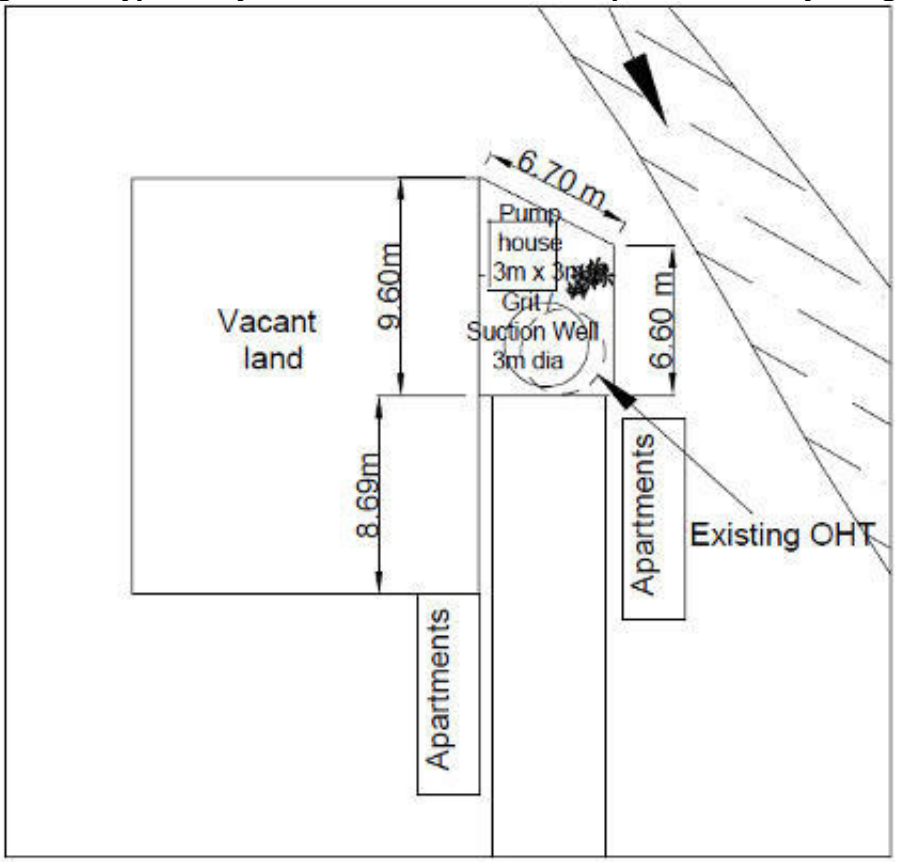


Figure 6: Typical layout of Lift Station at Manapakkam -Sathya Nagar



E. Implementation Schedule

25. Contract will be awarded by May-June 2018. Construction is likely to start in June 2018, and will take about 30 months to complete.

III. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. ADB Policy

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

27. **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).

28. **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.

29. **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

30. **Environmental Assessment.** The Government of India Environmental Impact Assessment (EIA) Notification of 2006 (replacing the EIA Notification of 1994), sets out the requirement for Environmental Assessment in India. This states that Environmental Clearance is

required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts.

31. Category A projects require Environmental Clearance from the central Ministry of Environment, Forests and Climate Change (MOEFCC). The proponent is required to provide preliminary details of the project in the prescribed manner with all requisite details, after which an Expert Appraisal Committee (EAC) of the MOEFCC prepares comprehensive terms of reference (TOR) for the EIA study. On completion of the study and review of the report by the EAC, MOEFCC considers the recommendation of the EAC and provides the Environmental Clearance if appropriate.

32. 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.

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

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

Table 2: Applicable Environmental Regulations

Law	Description	Requirement
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Act was enacted to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water. Control of water pollution is achieved through administering conditions imposed in consent issued under to this Act. All pollution potential activities will require consent to establish (CTE) from Tamil Nadu Pollution Control Board (TNPCB) before starting implementation and consent to operate (CTO) before commissioning.	No new STP proposed in the subproject. The CTO obtained from TNPCB for existing STPs.
Environment (Protection) Act, 1986 and Central Pollution Control Board (CPCB) Environmental Standards.	Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the notified standards	To comply with applicable notified standards
Noise Pollution (Regulation and Control) Rules,	Rule 3 of the Act specifies ambient air quality standards in respect of noise for different areas/zones.	To comply with the noise standards.

Law	Description	Requirement
2000 amended up to 2010.		
Air (Prevention and Control of Pollution) Act, 1981, amended 1987 and its Rules, 1982.	- Applicable for equipment and machinery's potential to emit air pollution (including but not limited to diesel generators and vehicles); - CTE and CTO from TNPCB; - Compliance to conditions and emissions standards stipulated in the CTE and CTO.	Generators will require CTE and CTO from TNPCB Generators to comply with applicable emission standards
Solid Wastes Management Rules, 2016	Rules to manage municipal solid waste generated; provides rules for segregation, storage, collection, processing and disposal.	Solid waste generated at proposed facilities shall be managed and disposed in accordance with the SWM Rules
Construction and Demolition Waste Management Rules, 2016	Rules to manage construction and to waste resulting from construction, remodeling, repair and demolition of any civil structure. Rules define C and D waste as waste comprising of building materials, debris resulting from construction, re-modeling, repair and demolition of any civil structure.	Construction and demolition waste generated from the project construction shall be managed and disposed as per the rules
Labor Laws	The contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The contractor shall base the employment relationship upon equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline. The contractor shall provide equal wages and benefits to men and women for work of equal value or type.	Appendix 2 provides applicable labor laws including amendments issued from time to time applicable to establishments engaged in construction of civil works , which will need to be followed by the project.

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	<50

S. No.	Parameter	Standard	
		Location	Concentration not to exceed
		Islands, Dadar and Nagar Haveli Daman and Diu and Lakshadweep	
		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".

Table 4: 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 II A, Standards for Composting) have been adopted here. According to the standards "In order to ensure safe application of compost, the following specifications for compost quality shall be met, namely:-

Parameters	Units	Organic Compost (FCO 2009)	Phosphate Rich Organic Manure (FCO 2013)
Arsenic	mg/kg	10	10
Cadmium	mg/kg	5	5
Chromium		50	50
Copper		300	300
Lead		100	100
Mercury		0.15	0.15
Nickel		50	50
Zinc		1000	1000
C/N ratio		<20	<20:1
PH		6.5 – 7.5	(1:5 solution) maximum 6.7
Moisture, percent by weight, maximum		15.0 – 25.0	25.0
Bulk density (g/cm3)		<1	Less than 1.6
Total Organic Carbon, per cent by weight, minimum		12	7.9
Total Nitrogen (as N), per cent by weight, minimum	percent by weight	0.8	0.4

Standards for Composting. As there are no specific standards notified for sludge reuse, the compost quality standards notified under the Solid Waste Management Rules, 2016 (Schedule II A, Standards for Composting) have been adopted here. According to the standards "In order to ensure safe application of compost, the following specifications for compost quality shall be met, namely:-

Parameters	Units	Organic Compost (FCO 2009)	Phosphate Rich Organic Manure (FCO 2013)
Total Phosphate (as P205) percent by weight, minimum	percent by weight	0.4	10.4
Total Potassium (as K20), percent by weight, minimum	percent by weight	0.4	-
Color			
Odor		Absence of foul Odor	
Particle size		minimum 90% material should pass through 4.0 mm is sieve	minimum 90% material should pass through 4.0 mm is sieve
Conductivity, not more Than	dsm-1	4	8.2

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

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

Table 5: Clearances and Permissions Required for Construction

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

No	Construction Activity	Statutory Authority	Statute under which Clearance is Required	Implementation	Supervision
			particular source. PIU to review and approve only existing licensed mines		
6	New quarries and borrow areas	MOEFCC	Not applicable No new quarries/borrow areas will be created for the subproject.	Contractor	PIU
7	Groundwater extraction	Public Works Department	(Groundwater) Tamilnadu Groundwater Development and Management Act 2000	Contractor	PIU
8	Disposal of bituminous wastes	Tamilnadu State Pollution Control Board	Hazardous Wastes (Management and Handling) Rules. 1989	Contractor	PIU
9	Temporary traffic diversion measures	-	MORTH 112 SP 55 of IRC codes	Contractor	PIU

IRC = Indian Road Congress, MOEFCC = Ministry of Environment, Forest, and Climate Change, MORTH = Ministry of Roads Transport and Highway, PIU = program implementation unit, PMU = program management unit, TNPCB = Tamil Nadu Pollution Control Board.

36. **ADB Safeguard Policy Statement Requirements.** During the design, construction, and operation of the project the PMU and PIUs will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines.[6] 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.

[6] Both general guidelines and sector specific guidelines of water and sanitation projects to be referred to IFC World Bank Group, Environmental, Health, and Safety Guidelines.

Table 6: WHO Ambient Air Quality Guidelines

WHO Ambient Air Quality Guidelines[7,8]		
	Averaging Period	Guideline value in µg/m³
Sulfur dioxide (SO_2)	24-hour 10 minute	125 (Interim target-1) 50 (Interim target-2) 20 (guideline) 500 (guideline)
Nitrogen dioxide (NO_2)	1-year 1-hour	40 (guideline) 200 (guideline)
Particulate Matter PM_{10}	1-year 24-hour	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline) 150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $PM_{2.5}$	1-year 24-hour	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline) 75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

Table 7: WHO Ambient Air Quality Guidelines

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

IV. DESCRIPTION OF THE ENVIRONMENT

A. Methodology Used for Baseline Study

37. **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.

38. The literature survey broadly covered the following:
    (i) Project details, reports, maps, and other documents prepared by CMWSSB;
    (ii) Discussions with Technical experts, public and other relevant government agencies;
    (iii) Secondary data from previous project reports and published articles; and
    (iv) Literature on land use, soil, geology, hydrology, climate, socioeconomic profiles, and other planning documents collected from Government agencies and websites.

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

B. Physical Resources

1. Location, Area and Connectivity

40. Tamil Nadu is one among the most urbanized states in India and Chennai is the fourth largest and populous Metropolitan City in India. The Chennai City (formerly known as the Madras City) is about 400 years old having been found out during the beginning of 17th Century A.D. Gradually, the city blossomed into one of the four major cities in the Indian sub-continent next to Delhi, Mumbai and Kolkata. Chennai City is situated in the North East of Tamilnadu on the coast of Bay of Bengal. Chennai city is bounded by the Northern Latitude of 12°59'10" and 13°08' 50" and Eastern longitudes of 80°12'10" and 80°18'20". Chennai city has a long coastal line of 43.0 km from Kathivakkam in North to Uthandi in South along Bay of Bengal.

41. The jurisdiction of Chennai has been expanded from 174 km^2 to 426.0 km^2 in the year 2011, covering three Revenue Districts namely Chennai, part of Thiruvallur and Kancheepuram District. At present, Chennai Metropolitan Water Supply and Sewerage Board is providing services through 15 Area Offices and 200 Depot Offices. The population of Chennai city as per 2011 census population is 66.72 Lakh. The subproject area of Manali, Chinnasekkadu, Karambakkam and Manapakkam is having a population of 33,250, 12,396, 21,376 and 13,344 (as per 2011 census), respectively.

42. Chennai is a major transportation hub for road, rail, air and sea transport connecting major cities inland and abroad. Chennai is one of the major educational center in India with a number of colleges and research institutions.

2. Geology

43. The Geology of Chennai comprises mostly of Clay, Sediment rocks and Sand stone. Based on geology, the city has been classified in to sandy area, clayey area and hard-rock area. Sandy areas are found along the coastal area and river banks like Thiruvanmiyur, Adayar, Santhome, Kottivakkam, George Town, Kathivakkam, Thiruvottiyur and the rest of coastal regions. Most interior part of the city like T.Nagar, West Mambalam, Anna Nagar, Perambur and Virugambakkam are covered with clayey soil. Guindy, Velachery, Adambakkam and part of Saidapet are hard-rock areas.

44. The subproject areas covering Manali, Chinnasekkadu, Manapakkam and Karambakkam are mostly clayey areas. The ground water table in most part of Chennai city is at about 4.0 to 5.0 m below ground level.

3. Topography

45. Chennai city is a plain terrain and the land surface is almost flat with contour ranges from 2.0 m to 10 m above mean sea level (msl). It rises slightly as the distance from sea shore increases but the average latitude of the city is not more than 7 m above msl and the average slope varies from 0.70 m/km whereas some parts are just at sea level. City terrain slopes from 1:5,000 to 1:10,000.

4. Seismology

46. Bureau of Indian Standards, based on the past seismic history, grouped the country into four seismic zones, viz. Zone-II, -III, -IV and –V. Of these, Zone V is the most seismically active region, while zone II is the least. The subproject area is in Moderate Damage Risk Zone III and as per the Modified Mercalli (MM) intensity scale, which measures the impact of the earthquakes on the surface of the earth, the project region is in MSK VII or less which indicates moderate intensity.

5. Weather and Climate

47. The geographical location determines the weather and climate. Being close proximity to sea shore and thermal equator, weather in Chennai is relatively consistent with less variation in seasonal temperature. The weather in Chennai is mostly hot and humid. Chennai has three major seasons namely summer, monsoon and winter. April to June is the hottest months in Chennai with a temperature of 38°C to 42°C. However the cool breeze at night comes as a relief to the residents of Chennai. Chennai experiences two monsoons namely South-West monsoon from June to September and North-East monsoon from October to December. The average rain fall during South-west monsoon is 440 mm and during North-East monsoon is about 760 mm. The average rainfall throughout the year is about 1200 mm. Winter season in Chennai is from November to February.

Table 8: Rainfall in the Catchment Areas of the City Reservoirs

Year	Rainfall (mm)		Difference in Percentage (%)
	Normal (30 years average)	Actual	
2012	1293.42	981.8	-24.09
2013	1297.5	1064.87	-17.93
2014	1286.21	1025.8	-20.25
2015	1273.17	2155.23	69.28
2016	1308.05	837	-36.03

Source: India Meteorological Department (IMD).

6. Air Quality

48. Tamil Nadu Pollution Control Board (TNPCB) regularly monitors the ambient air quality of Chennai through a network of eight ambient air quality monitoring stations established under the National Air Quality Monitoring Programme (NAMP). Samples are collected for 24 hours basis twice a week, and are for the Respirable Suspended Particulate Matter (RSPM) (RSPM is particulate matter less than 10 microns) and gaseous pollutants such as Sulphur dioxide (SO_2)

and Nitrogen dioxide (NO_2). According to TNPCB annual report 2015-2016, the parameters such as SO_2, NO_2 recorded well within the standards including industrial areas. The average values of RSPM exceeded the standard in some monitoring stations, located mostly in the core Chennai, which is mainly attributed to construction related dust, road dust and vehicle emissions. Following table shows the air quality monitoring data of Manali monitoring station, located within the subproject area. All the monitored parameters (SO_2, NO_2 and RSPM are well within the standards.

Table 9: Air Quality 2015-2016
(Annual Average Concentrations of Air Pollutants)

Monitoring Location	Category	SO_2 ($\mu g/m^3$)			NO_2 ($\mu g/m^3$)			RSPM ($\mu g/m^3$)		
		Max	Min	Average	Max	Min	Average	Max	Min	Average
Manali	Industrial	19	10	14	23	13	17	79	17	43
NAAQ standard	Industrial, residential, rural and other areas			50			40			60

$\mu g/m^3$ = micrograms per cubic meter, NO_2 = Nitrogen Dioxide, RSPM = Respirable Suspended Particulate Matter, SO_2 = Sulfur Dioxide.
Source: Annual Report & Annual Accounts, 2015-2016, TNPCB.

C. Ecological Resources

49. **Guindy National Park.** In 1978, 270.57 ha area was declared as a National Park and has come to play a significant role in the ecological environment of Chennai. Guindy National Park lies towards the southwestern corner of Chennai. The terrain is rather flat, gently sloping towards the south to two tanks - Appalankulam and Kathankulam, which, together, occupy 30 hectares of land. There is a small duck pond towards the north of the park and Bogi pond just outside the national park limits. Soil type varies from red to red gravelly and Alluvium dominates is most of the area. So far over 350 species of plants have been found including trees, shrubs, climbers, herbs and grasses.The national park is located outside the project area and about 4 km from nearest project location in Manapakkam.

50. **Pallikaranai Marsh Land.** The is one among the few remaining wetlands located inside Chennai City, which falls under Perungudi and Pallikaranai villages in the Kancheepuram district of Tamil Nadu, within Chennai city. The wetland is rich with 61 species of flowering plants. The Pallikaranai Marsh Land is located outside the project area and is more than 5 km from nearest project location in Manapakkam.

51. **Nanmangalam Reserve Forest**. Nanmangalam Reserve Forest is a protected area located in the southern part of Chennai, about 24 km from the city centre. It is located in Medavakkam on Velachery High Road between Velachery and Tambaram, with a total reserve forest area of 320 ha. The forest is popular among bird watchers and is home to about 85 species of birds, such as the Red-Wattled Lapwing, Crested Honey Buzzard, Grey Partridge, Coucal, Indian Eagle-owl, White-breasted Kingfisher, Pied Kingfisher, Southern Bush Lark and Red-whiskered Bulbul, which are common to the area. The Nanmangalam Reserve Forest is located outside the project area and more than 8 km from nearest project location in Manapakkam.

52. **Mangroves in the Adyar Estuary.** The Adyar River rises in the Chembarabakkam Tank and runs 20 km before entering city limits. After which, it runs about 5 km in the city before its estuary opens out to the sea. In what is essentially a salty lagoon, there are several islands, the

largest of them called Quibble Island. These backwaters are called Adyar Creek, distinct from the Adyar River and its broad estuary with a silted narrow mouth due to the sand bank created by the currents ever since the Harbour's groynes were built. The Adyar Estuary, with its remaining islands and mangrove stands on the southern bank, is an area that offers river, marsh, woods, backwaters, islets, sea and open ground which have, at times, hosted over 150 species of birds as well as small wildlife, including jackals, foxes, wild cats, snakes and other reptiles. The Mangroves in the Adyar estuary is located outside the project area and more than 5 km from nearest project location in Manapakkam.

53. **Ennore Creek.** Ennore Creek is a backwater located in Egmore, Chennai along the Coromandel Cost of the Bay of Bengal. It is located in the zone comprising lagoons with salt marshes and backwashers, submerged under water during high tide and forming an arm of the sea with opening to Bay of Bengal at the creek. The zone is spread over an area of 4 km^2 and the creek covers an area of 2.25 km^2. It is located 20 km north of the city centre and 2.6 km south of the Ennore Port, and the creek area stretched 3 km in to the sea and 5 km along the coast. The creek is nearly 400m wide, elongated in northeast-southwest direction and merging with the backwater bodies. Once a flourishing mangrove swamp, the creek has been degraded to patches in the fringes mainly due to human activities in the region. The Ennore creek is located outside the project area and more than 8 km from nearest project location in Manali.

D. Surface Water

54. Two major rivers meandering through the Chennai City are Adyar and Cooum. A third river, Kosasthalayar, flows through the northern fringes of Chennai City before draining into the Bay of Bengal at Ennore. The Buckingham canal flows parallel to the coast linking Cooum and Adyar river. Adyam river forms the south and eastern boundary of Manapakkam scheme area. Poorur Lake is located on the south of Karambakkam scheme area.

E. Economic Development and Urban Prosperity

1. Infrastructure - Water Supply and Sewerage System

55. The Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB), constituted in 1978, is responsible in promoting and securing the planned development of water supply and sewerage services, creation, operation and maintenance of the needed infrastructure and implementation of perspective plans to meet both current and future requirements in the areas falling under Chennai Metropolitan Area.

Sources of Drinking Water for Chennai City

56. Since its inception in 1978, the growth in Board’s water supply operations have seen significant increase in its coverage. After the expansion of Chennai City in 2011, 9 areas were added into the water supply scheme, namely: Thiruvottiyur, Kathivakkam, Ambattur, Maduravoyal, Valasaravakkam, Porur, Alandur, Meenambakkam, and Injambakkam. The total length of distribution network in Chennai City is about 6,697 km with water being distributed through 74 distribution stations. For the balance areas of Chennai City the water supply schemes are under progress/ will be taken up shortly

57. For providing potable water to the city, CMWSSB operating water treatment plants at Kilpauk, Redhills, Chembarambakkam, Surapattu and Vadakuthu and desalination plants at Minjur and Nemmeli.

Table 9: Treatment Capacity of Water Treatment Plants

Water Treatment Plants	Treatment Capacity (MLD)
Kilpauk	270
Redhills	300
Chembarambakkam	530
Vadakuthu	180
Surapattu	14
Desalination plants at Kattupalli-Minjur and Nemmeli	200
Total	**1494**

58. Chennai City draws water from surface sources, ground water and desalination plants to meet its water requirement.

Surface Water

59. The reservoirs at Poondi, Cholavaram, Redhills (Puzhal) and Chembarambakkam near Chennai city, Veeranam lake in Cuddalore district and the Telugu Ganga Project are the main surface water sources for Chennai city.

Table 10: Storage Capacity of Reservoirs Supplying Water to Chennai

No	Reservoir	Storage Capacity (Mcft)
1	Poondi	3,231
2	Redhills (Puzhal)	3,300
3	Chembarambakkam	3,645
4	Cholavaram	881
5	Veeranam	1,465
	Total	**12,522**

Table 11: Quality Standards of Raw Water

No.	Parameters	Range
1	Ph	7.5 -9.0
2	TDS	240-350
3	Turbidity	9.0-12.5

Desalination Plants

60. Chennai City is mainly dependent on the rain fall during monsoon for surface water availability. Scarcity in the amount of rainfall leads to acute shortages in reservoir levels and affects water supply to Chennai City. The non-availability of perennial rivers near Chennai adds to the challenge. Hence, to meet the growing water demand, the Government has established two desalination plants with a capacity of 100 MLD each which are currently operational at Minjur and Nemmeli. These plants contribute substantially for city water supply. In addition, CMWSSB is in the process of establishing another 150 MLD capacity desalination plant at Nemmeli and 400 MLD desalination plant at Perur, South of Chennai city.

Groundwater

61. CMWSSB uses ground water to supplement other sources. The amount of extraction varies with need. The drawing out of ground water from the aquifers at Tamaraipakkam, Poondi and Neyveli can go up to 150 MLD.

Table 12: Quality Standards of Groundwater

No	Parameters	Range
1	Potential of hydrogen (pH)	6.5 - 8.5
2	Total dissolved solid (TDS)	500-1500
3	Turbidity	<5

Sewerage Services

62. CMWSSB provides sewerage services to Chennai City including waste water treatment, reuse of treated water and power generation from Sewage Treatment Plants. Sewage Treatment Plants at Chennai have an installed capacity of 764 MLD.

63. Chennai City's sewerage system is 4250 km long and sewage generated from houses and other buildings is collected through 250 sewage pumping stations. The sewage system of the city is divided into 5 zones with independent zonal collection, conveyance, treatment and disposal facilities. The collected sewage from pumping stations is treated at 12 Sewage Treatment Plants.

Table 13: Capacity of Sewage Treatment Plants

No.	Treatment Plant	Capacity (MLD)
1	Nesapakkam (3 units : 23+40+54 mld)	117
2	Kodungaiyur (3 units : 110+80+80 mld)	270
3	Koyambedu (3 units : 34+60 +120 mld)	214
4	Perungudi (2 units : 79+72 mld)	151
5	Alandur (1 unit : 12 mld)	12
	Total - 12 units	764

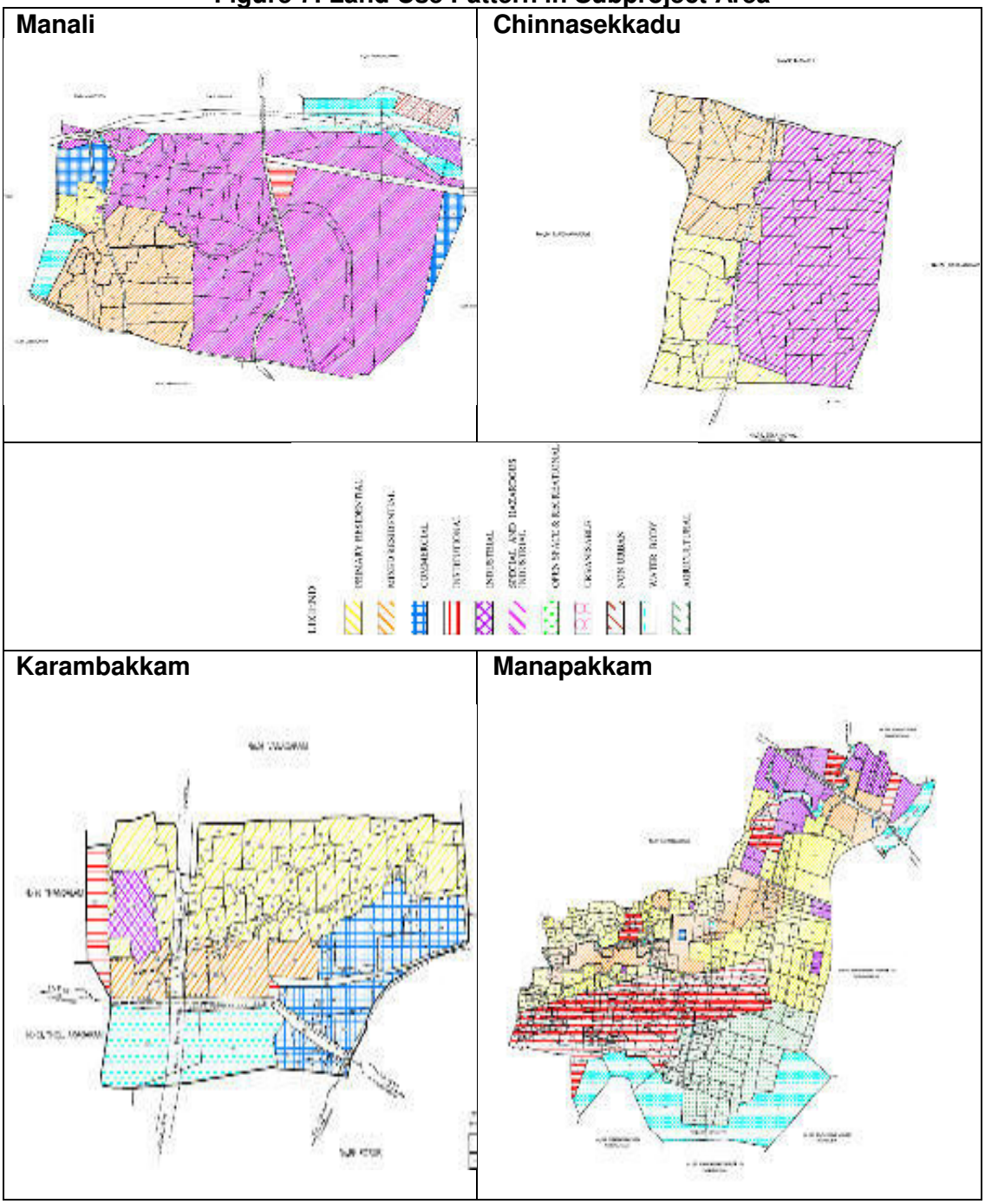
Table 14: Sewage Treatment Plants under Construction

No.	Location	Capacity (MLD)
1	Thiruvottiyur	31
2	Sholinganallur-I	18
3	Sholinganallur-II	54
	Total	103

Land Use

64. Chennai City's total geographical area is 426 km^2. As indicated in the Master Plan prepared by CMDA, the land use pattern of Manali, Chinnasekkadu, Karambakkam and Manapakkam is furnished below. There are no Archeological Survey of India (ASI) monuments in the project areas.

Figure 7: Land Use Pattern in Subproject Area



2. Transport and Traffic

65. Road development, public transport services and suburban rail transport are recognized as essential for the efficient functioning of the urban system. In Chennai the urban rail network development is carried out by the Southern Railway. The suburban and city railway transportation system is maintained by MRTS and CMRL. The major arterial and sub-arterial road corridors and other roads are developed and maintained by National Highways Authority of India, Highways and the local bodies concerned respectively. As regards traffic management and enforcement,

the same is looked after by the Chennai Traffic Police in respect of Greater Chennai Area and District Police for the remaining Chennai Metropolitan Area. The public bus transport is with Metropolitan Transport Corporation

3. Agriculture

66. Agriculture is the prime profession that helps in the overall development of the State economy. Tamil Nadu occupies 7% of the Nation's population, 4% of the land area and 3% of the water resources at all India level. The total geographical area of CMA is 1189 km^2 of which the net sown area is 26% of the geographical area of CMA. CMA covers the area of Chennai district, Ambathur, Puzhal, Poonamallee and Sholavaram blocks of Tiruvallur district and parts of Chitlapakkam block of Kancheepurm district. No crop is cultivated in Chennai district and in the Metropolitan area of Kancheepuram District. The CMA that comes under Tiruvallur district has cultivable area of paddy, pulses and oil seeds.

4. Industry

67. Chennai Metropolitan Region (including adjoining districts) is endowed with a diversified and balanced economic base. The region has attracted sizeable investments including Foreign Direct Investment (FDI) in manufacturing, and has a thriving services base with well-developed information technology, financial services, education and healthcare sectors. Implementation of proposed trunk infrastructure initiatives including the Chennai- Bengaluru Industrial Corridor, Ring Roads and Projects identified under Government of Tamil Nadu's agenda for infrastructure development could stimulate investment and engender growth. These strengths reflect in the region's high historical economic growth: cumulative district GDP (at constant prices) of Chennai and adjoining districts grew at a Compound Annual Growth Rate (CAGR) of 11% during FY 2005-2012.

68. **Manufacturing**. Chennai has a thriving manufacturing base with globally competitive Automotive and Electronic hardware clusters operating in its vicinity.

5. Automotive Sector

69. Chennai is often referred to as the Detroit of Asia, given the strong presence of automotive, and auto components manufacturers around the city. Chennai has a market share of around 30% of India's automobile industry and 35% of its auto components industry. A 60-km long automotive corridor, stretches from Gummidipoondi, in north of Chennai to Malaraimalai Nagar, in the south and passes through Tiruvallur, Sriperumbudur and Oragadam and is home to several global scale automotive manufacturing facilities of large auto majors. With a cumulative capacity of close to 1.4 million cars annually, Chennai region is one of the largest automotive hubs globally.

Electronics Manufacturing

70. Chennai has also emerged as an electronic manufacturing service (EMS) hub of India with multinational corporations setting up their manufacturing planning particularly along the EMS corridor which stretches from Sriperumbudur to Orgadam. Chennai is among the largest electronics hardware exporter in India, accounting for 45% of the total electronic hardware exports in 2010-2011.

Services

(i) **Information Technology**. Since the 1990s, software development and business process outsourcing have emerged as a major drive of Chennai's economic growth. Several major software services companies have global software development centers in the city. Chennai is the second largest exporter of IT and IT enabled Services in the country behind Bangalore. The IT corridor, on Old Mahablipuram Road houses several technology parks and stretches from TIDEL park in Taramani to SIPCOT IT park in Siruseri. Several Special Economic Zones (SEZs) have also been developed along the GST road including the MEPZSEZ, Mahindra World city, Shriram's Gateway SEZ, Estancia SEZ. ETL Infrastructure and India land SEZ.

(ii) **Banking and Financial Services.** With a growing financial sector skill base, Chennai is home to offshore and business continuity operations of several banks and financial institutions. The City is home to operations of several financial institutions.

(iii) **Healthcare.** Chennai is referred to as the Health Capital of India and in increasingly becoming a favored destination of medical tourists and over 6 lakh tourists visit the State annually. In addition, health care institutions in Chennai are estimated to attract over 200 international visitors every day.

(iv) **Higher Education and Research.** Chennai is home to many educational and research institutions owned by different agencies ranging from Central Government to state Government to State Government to private institutions. Institutions for different major studies such as engineering, arts and science, law, medical, management, polytechnic, Vocations and research are present in the city.

71. With a diversified and balance economic base and intrinsic ecosystem for fueling the growth of both manufacturing and service sectors, Chennai has been an important engine of economic growth for Tamil Nadu since independence. Chennai and its adjoining districts have been able to attract sizeable investments including Foreign Direct Investment (FDI) in Manufacturing. Retaining and building on the advantages of a balanced economy and relatively good physical and social infrastructure would require addressing three imperatives:

F. Protected Monuments

72. Chennai, formerly known as Madras, is a 400 year old historical city. Location on Coromondal coast of Bay of Bengal, it is the India's fourth largest city and is the capital of Tamil Nadu state. Chennai has a rich culture and long history. The present day city of Chennai started as an English settlement known as Fort St. George. The region was then a part of Vijayanagara Empire. Chennai boasts of a long history from the English East India Company, through the British rule to its evolution in the late 20th century as a services and manufacturing hub for India. There are several protected historical monuments in Chennai, however, none of these protected monuments are located in the subproject area.

Table 15: Subproject Site Environmental Features

Infrastructure	Location and Environmental Features	Site Photograph
Sewage pumping stations for Manali UGSS	**Sewage Pumping Station (SPS) at Kamarajar salai** The terminal pumping station for Manali is located at Kamarajar salai. This site was handed over to CMWSSB by GCC. The site is surrounded by solid waste management site, burial ground and Kamarajar salai and away from residential area. Sufficient buffer space is available to provide tree plantation all-round the site. The nearest house property is located about 200 m from the SPS site	
Sewage pumping stations for Manali UGSS	**SPS at CPCL layout**: This site located in CPCL layout in residential area. Sufficient open space is available to provide green space. inside and outside the SPS. Roads are available all around the site. .The nearest house property is located about 8 m from the SPS site on the other side of the road.	
Sewage pumping stations for Manali UGSS	**Lift station site at Chinnamathur salai:** This location is adjacent to Manali eri. This is a road side lift station. As large vacant space is available all around there will not be any environmental issues. The nearest house property is located about 10 m from the lift station site on the other side of the road.	
Sewage pumping stations for Manali UGSS	**SPS at Bharathiyar street Burial ground:** This SPS site is away from residential area near burial ground. As open space is available around the site, there will not be any environmental issue. This site is located in an industrial area and away from houses. Sufficient space is available to provide green cover.	

Infrastructure	Location and Environmental Features	Site Photograph
Sewage pumping stations for Manali UGSS	**SPS at Srinivasaperumal koil street (Periyathopu).** An existing OHT belonging to CMWSSB is available in this site. As the Manali Water supply supply scheme is under implementation, this OHT will become defunct. Hence it is proposed to utilize the available space of this site. Since the site is located near residential area, suitable mitigation measures will be taken to control odor problem and green cover will be provided inside the pumping station site. The nearest house property is located about 6 m from the SPS site on the other side of the road.	
Sewage pumping stations for Chinnasekkadu	**Chinnasekkadu SPS site**: Inside Kodungaiyur STP. Surrounded by vast open area. There will not be any environmental issues The nearest house property is located about 300 m from the SPS site on the other side of the road. Sufficient space is available to provide green cover	
Sewage pumping stations for Karambakkam UGSS	**SPS at GANDHINAGAR** This site is terminal pumping station for Karambakkam. This site belongs to GCC for which ward council resolution has been obtained. This site is near to burial ground and located on the PH road. Sufficient space is available for the green belt area. . The nearest house property is located about 10 m from the SPS site.	
Sewage pumping stations for Karambakkam UGSS	**Lift Station at Avvai Street, Samyapuram** , This site belongs to CMWSSB and proposed for LS. The site is surrounded by trees , vacant lands and CMWSSB well. The nearest house property is located about 6 m from the lift station site.	

Infrastructure	Location and Environmental Features	Site Photograph
Sewage pumping stations for Karambakkam UGSS	**SPS at Chettiyar Agaram,** This site is a sub pumping station site and surrounded by trees and roads. Though, Temple and school is located near to the site , sufficient space available for development of green belt area. . The nearest house property/ Temple is located about 50 m from the SPS.	
Sewage pumping stations for Karambakkam UGSS	**Lift Station at Erikarai Street,** This site proposed for construction of lift station is located near to burialground and belongs to CMWSSB Existing OHT is available at this site. The WSS for Karambakkam area is under progress and once the WSS is commissioned, the exiting OHT at the this site will become defunct and demolished for lift station construction. . The nearest house property is located about 6 m from the lift station site on the other side of the road. Green cover will be provided alarounf the pumping station.	
Sewage pumping stations for Karambakkam UGSS	**SPS at Maharishi Nagar, Karambakkam** This site is proposed for construction of sub pumping station . Ration shop and OHT is located near to this site. This OHT will become defunct once the WSS for Karambakkam is commissioned. Sufficient space is available for green belt area. The nearest house property is located about 6 m from the SPS site on the other side of the road. Since the site is located near residential area, suitable mitigation measures will be taken to control odor problem.	

Sewage pumping stations for Karambakkam UGSS	**SPS Inside existing Maduravoyal SPS site** This SPS is proposed inside the existing pumping station site. Suction well and pump house will be constructed in the vacant portion in the site and will be linked to the existing pumping system.	
Sewage pumping stations for Manapakkam UGSS	**SPS at Indira Nagar, Manapakkam** This site belongs to CMWSSB and proposed for sub pumping station. The site has sufficient space to develop green belt area. . The nearest house property is located adjacent to the SPS site. Since the site is located near residential area, suitable mitigation measures will be taken to control odor problem.	
Sewage pumping stations for Manapakkam UGSS	**LS at Macromarvel, Manapakkam** This site is proposed for Lift station .A park is situated near to the site . The existing OHT available at the site will be demolished after commissioning of WSS for Manapakkam The nearest house property is located about 8 m from the SPS site on the other side of the road. Sufficient green cover will be provided.	
Sewage pumping stations for Manapakkam UGSS	**LS at MGR Nagar, Manapakkam** This site is proposed for Lift station and surrounded by roads and many trees and plantations. E-Toilet and factory is situated near to site. The nearest house property is located about 6 m from the lift station site on the other side of the road. Necessary green cover will be provided..	

Sewage pumping stations for Manapakkam UGSS	**SPS at River View Colony, Manapakkam.** This site is proposed for sub pumping station .A park is available adjacent to the site and has sufficient space available for development of green belt. Opposite to site is Adyar canal. The nearest house property is located about 50 m from the SPS site. Since the site is located in a residential area, suitable mitigation measures will be taken to control odor problem.	
Sewage pumping stations for Manapakkam UGSS	**LS at Sathya Nagar , Manapakkam** This site is proposed for lift station. Existing OHT is available at the site. The OHT will become defunct on commissioning of WSS and demolished. A canal is running adjacent to the site area. Residential housed are situated near to the site. Buffer for development of green belt is available. The nearest house property is located adjacent to the lift station site.	
Sewage pumping stations for Manapakkam UGSS	**LS at Sethulakhmi Nagar, Manapakkam** This lift station is proposed to be located roadside. Lift station is proposed as enlarged manhole (either road-side on available land or on road center by enlarging a collection system manhole) fitted with sewage pumps and kiosk.	

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

73. 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.

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

(i) **Location impacts** include impacts associated with site selection and include loss of on-site biophysical array and encroachment either directly or indirectly on adjacent environments. It also includes impacts on people who will lose their livelihood or any other structures by the development of that site.

(ii) **Design impacts** include impacts arising from Investment Program design, including technology used, scale of operation/throughput, waste production, discharge specifications, pollution sources and ancillary services.

(iii) **Construction impacts** include impacts caused by site clearing, earthworks, machinery, vehicles and workers. Construction site impacts include erosion, dust, noise, traffic congestion and waste production.

(iv) **O&M impacts** include impacts arising from the operation and maintenance activities of the infrastructure facility. These include routine management of operational waste streams, and occupational health and safety issues.

75. 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).

76. 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.

77. The ADB rapid environmental assessment checklist in http://www.adb.org/documents/guidelines/environmental_assessment/eaguidelines002.asphas been used to screen the project for environmental impacts and to determine the scope of the IEE.

78. In the case of this project (i) most of the individual elements involve simple construction and operation, so impacts will be mainly localized and not greatly significant; (ii) negative impacts associated with sewage facilities, such as odor are already considered in the design and siting, (iii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation and earth movements; and (iv) being mostly located in an urban area, will not cause direct impact on biodiversity values. The project will be in properties held by the local government and access to the project location is through public rights-of-way and existing roads hence, land acquisition and encroachment on private property will not occur.

A. Pre-Construction Impacts – Design and Location

79. **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.

80. **Sewage Treatment**. No new STP is proposed in the subproject as it is proposed to utilize the available capacity of existing STPs at Kodungaiyur, Nesapakkam and Koyambedu. Adequate unutilized capacity is available in these STPs to meet the requirement of subproject areas. Details are provided below:

(i) The sewage generated from Manali and Chinnasekkadu for the Intermediate year 2035 and ultimate year 2050 is 9.83 MLD and 13.60 MLD respectively. This is to be discharged in to the existing Kodungaiyur STP of total treatment capacity 270 MLD which is treating about 230 MLD of sewage at present.

(ii) The sewage generated from Karambakkam for the Intermediate year 2035 and ultimate year 2050 is 8.05 MLD and 11.48 MLD respectively. This is to be discharged in to the existing Koyambedu STP having a total treatment capacity of 214 MLD which is treating about 108 MLD of sewage at present.

(iii) The sewage generated from Manapakkam for the Intermediate year 2035 and ultimate year 2050 is 4.57 MLD and 6.41 MLD respectively. This is to be

discharged in to the existing Nesapakkam STP having a total treatment capacity of 117 MLD which is treating about 93 MLD of sewage at present.

81. The above three STPs have sufficient treatment capacity to take care of the sewage generated from the project area till the intermediate design period year 2035. Already Master Plan for the water supply and sewerage sector for the period 2020 to 2050 has been prepared. In the Master Plan, detailed proposal for enhancing the capacity of various STPs over a period of time in a phased manner have been given. Accordingly, when the sewage generation from the STP command area reaches treatment capacity of respective STPs, the capacity will be enhanced by providing additional units in the land extent available within the STP area .

82. Sustainability of new sewer infrastructure and realization of intended purpose (removing the sewage from those areas served by the network rapidly and treated to an acceptable standard) and benefits (improved environmental conditions, public health etc.,) would accrue only with a proper functioning of the existing STPs. Therefore the existing STPs are considered as existing related facilities as per the ADB Safeguard Policy Statement 2009. The existing related facilities need to be in compliance with the ADB SPS, and it requires conduct of environmental audit of such facilities. In these existing STPs of CMWSSB, TNPCB is checking the various environmental aspects periodically and the environmental parameters are found to be within the threshold limits as required by TNPCB/Central Pollution Control Board (CPCB). The STPs are functionally properly and the treated effluent is discharged as per TNPCB norms. Environmental audit of existing STPs conducted, and attached at Appendix 3. Important points are summarized below.

(i) All the STPs are established and being operated with the consent from TNPCB. The STPs at Nesapakkam and Koyambedu have Consent to Operate (CTO) from the TNPCB, which is valid up to March 2018, while for STP at Kodungaiyur, CTO is expired, and application submitted for renewal up to March 2018. CTO will be renewed as required in future.

(ii) All the treatment plants are equipped with built-in lab facilities, the quality parameters are analyzed daily at these laboratories. Monitoring results are presented in Appendix 3. Further, the quality parameters are monitored by TNPCB on monthly basis. The BOD (in mg/l) of raw sewage and treated effluent from the STPs are furnished in below table in comparison with the discharge standard of TNPCB:

(iii) The sludge generated from the above STPs is used to generate biogas (methane CH_4) by way of sludge digestion, which then used has fuel to generate electricity. The generated electricity is used to operate the STPs. The above process reduces the carbon emissions to the atmosphere by way of methane capture from the raw sludge. The digested sludge is then fed into mechanical centrifuge for dewatering the sludge. The dewatered sludge cakes is then collected and used for landfills inside the STP premises. In order to further utilize the digested sludge, CMWSSB has appointed a consultant to study the sludge and to suggest various methods for disposal and reuse of sludge. After obtaining the detailed project report (DPR) from the consultant, sludge management will be further improved.

Table 16: Treatment Performance of Existing Sewage Treatment Plants in terms of Biochemical Oxygen Demand

Name of the Sewage Treatment Plant	**Raw Sewage BOD** (mg/l)	**Treated Effluent BOD** (mg/l)	**TNPCB Discharge Standard** (mg/l)
Kodungaiyur	326	15	< 20

Name of the Sewage Treatment Plant	Raw Sewage BOD (mg/l)	Treated Effluent BOD (mg/l)	TNPCB Discharge Standard (mg/l)
Koyambedu	245	11	< 20
Nesapakkam	298	16	< 20

BOD = biochemical oxygen demand, mg/l = milligram per liter, TNPCB = Tamil Nadu Pollution Control Board.

83. As presented above, the existing STPs are functioning as per the conditions specified by the TNPCB in terms of meeting the discharge standards. Proper sludge collection and digestion systems are in place, and further CMWSSB has already initiated a project preparation to further enhance the sludge management for reusing or disposal as appropriate. However, Kodungaiyur STP at present do not have a valid CTO from the TNPCB. Although renewal fee paid, CTO needs to be obtained. Following corrective action will be implemented.

Table 17: Corrective Action Plan for Environmental Compliance of Existing Sewage Treatment Plant

Item	Compliance	Action Required/ Proposed for Compliance	Timeline	Responsible Agency and Funding Source
Compliance with Applicable National and State Laws, Rules, and Regulations				
Kodungaiyur STP	Consent to operate (CTO) to be renewed. Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	Application put up to TNPCB and under process. Annual renewal fee paid up to March-2018	Will be obtained before March 2018	CMWSSB Own funds

84. **Sewer system – collection and conveyance.** The sewerage system is designed as a separate system of sewage collection (i.e., caters only to wastewater). Existing storm water 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, CMWSSB 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.

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

(i) Limit the sewer depth where ever possible to 4.50 m depth due to prohibition of manual entry in to sewer line and to facilitate removal of silt through desilting machineries;

(ii) Sewers shall be laid away from water supply lines and drains (at least 1 m) if not possible, sewer lines shall be laid below the water lines;

(iii) In all cases, the sewer line should be laid deeper than the water pipeline (the difference between top of the sewer and bottom of water pipeline should be at least 300 mm);

(iv) In unavoidable cases, where sewers are to be laid close to storm water drains, appropriate pipe material (that has no or least infiltration risk) shall be selected. Only double walled corrugated (DWC) and cast iron pipes have been proposed;

(v) For shallower sewers and especially in narrow roads, use small inspection chambers in lieu of manholes;
(vi) Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize silt/garbage entry; and
(vii) Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulfide generation.

86. **Sewage Pumping Stations and Lift Stations**. The construction of seven sewage lift stations and 11 new sewage pumping stations has been proposed. These will receive sewage from the sewer command area via the sewer network and pump to higher level manholes or pumping stations or to STP as per the design. Lift stations become necessary when the design depth of the sewer exceeds 4.50 m depth or the downstream interlinking manhole invert levels. Attempts to eliminate lift stations by examining the feasibility of providing rider mains were assessed and proven to be uneconomical. A low capacity lift station with submersible pumps to lift and convey the collected sewage from peripheral areas to the downstream system through a discharge chamber was seen to be the more feasible and practical solution instead. However, due to the proximity of sewage pumping stations, lift stations in some locations have been avoided by laying deeper manholes for a shorter distance between stations.

87. Lift stations will cater to a small area, and will be located at the lowest point where the sewage from catchment area will be collected, and then pumped to a higher level manhole for further gravity flow or to a pumping station, from where it is ultimately pumped to the STP. Lift station will consists of a suction well of dia 2.50 m/3.0 m and 6.25 m to 8.30 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.

88. **Sewage Pump Stations.** The sewage pump stations will also perform the same function as sewage lift stations but will cater to a much larger area or sewage flow, and will also have several components, which will occupy a comparatively larger area. Components of the proposed sewage pumping station in Manali, Chinnasekkadu, Karambakkam and Manapakkam are as follows:

(i) Screen well cum grit well;
(ii) Suction well; and
(iii) Pump house to house the control panels.

89. 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.

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

91. **Site for Sewage Pumping Stations:** For the proposed sewerage schemes, the following sites were identified.

(i) **Manali UGSS.** The SPS sites at Srinivasaperumal koil street and CPCL layout are located in residential locality. Bharathiyar street site is located inside burial ground and Kamarajar salai site is situated in a SWM site surrounded by burial ground and factories and away from residential localities.

(ii) **Chinnasekkadu UGSS.** Site for Chinnasekkadu is located inside Kodungaiyur STP of CMWSSB and away from residential areas.

(iii) **Karambakkam UGSS.** Avvai street at Samayapuram is away from residential area, Chettiyaragaram is near pond away from residential area, Maharishi nagar site at Sivaboodham is near residential area, Gandhi nagar and Erikarai street sites are near burial ground.

(iv) **Manapakkam UGSS.** Macrow Marvel nagar lift station is located near park, River View Colony site is located near Adayar river and a Park, Sathya nagar lift station is located near residential area, MGR nagar lift station located near e-toilet away from residential area, Sethulakshmi nagar lift station is located along roadside and Indira Nagar SPS located near residential area.

92. Following design related measures are included in the pumping station designs to avoid any odor nuisance:

93. **Measures for Sewage Pumping Station**:

(i) Maintain maximum buffer distance from residential area side to the pumping station wells;

(ii) Locate pumping station as far as away from the residence.

(iii) Develop green buffer zone around the facility with a combination of tall and densely growing trees in multi rows as per the land availability to control odor and also act as visual shield, and improve aesthetical appearance

(iv) Proposed wells in Road side pumping stations 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.

(v) RCC slab to be designed and fixed in a modular manner such that access to pumps/appurtenances and other equipment can be provided for maintenance/ replacement/renewal purposes.

(vi) Since human intervention is involved and safety shall be primary and critical consideration, additional protection by way of a metaled grating/grill work shall be provided over the sections (or full cross section if required) where workers will stand / work for inspection and repair/O&M purposes.

(vii) Provision of passive gas ventilation arrangement by providing a take-off vent from top of well by positioning vent in such a way that cover slab fitment / movement / drawl if required for maintenance purposes is not compromised.

(viii) Height of vent to be provided appropriately and a minimum 2 m above the lintel level (top level) of window(s)/passageways/doors in the nearby adjoining buildings.

(ix) Provision of odor control / mitigation system as per site conditions / requirements. Suitable granular activated carbon filter with bird-screen fitted at the vent outlet to control odor. Size of GAC (including material size) should be selected based on the vent diameter and expelled air flow rate expected.

(x) Submersible sewage pumps of suitable rating, minimum submergence requirements, open impeller with cutting-tearing arrangement and high strength-corrosion resistant heavy duty construction shall be proposed.

(xi) In locations / cases where sewage flow in the present to intermediate design stage is envisaged to be low, position of the submersible pumps and design of the collection well floor by providing necessary side benching / sloped flooring to allow for higher submergence during low flow shall be made to ensure regular pump operation and avoid sewage stagnation beyond the permissible limit.

(xii) Diesel Generators shall be provided for all pump stations and in cases of lift stations with space for control room. In cases of lift manholes (road-side or road-center type structures with only provision of kerb-side kiosk), an electrical cut-out provision shall be made for connecting an Emergency Mobile / Skid Mounted Diesel Generator for pumping out during long period of electricity supply interruption.

(xiii) Develop standard operating procedures / operational manual for operation and maintenance of lifting and pump stations; this shall include measures for emerge situations.

(xiv) Provide training to the staff in SOPs and emergency procedures

(xv) Periodic monitoring of H_2S levels at sewage pumping and lifting stations using handheld H_2S meters.

94. **Lifting stations** are also to be located at technically feasible locations (lowest point to where sewage can be conveyed from households by gravity) within or close to the residential areas which are being served by respective lifting station. Given very limited land availability in urban areas like the project area, that too of government owned lands, locating the lifting stations away from the houses is not practical. in Manali, Karambakkam and Manapakkam, sites for lifting stations were identified based on the technical suitability and availability of government owned/ GCC owned/ CMWSSB vacant land parcels to avoid land acquisition. The sites are located along the road side, Park side or near the lowest point, and most of the area are thinly populated. Odor nuisance from lifting stations is very limited compared to pumping stations. Lift stations are essentially proposed as enlarged manholes (either road-side on available land by enlarging a collection system manhole) fitted with two sewage pumps (small capacity) and a curb or road-side Kiosk mounted Pump Control Panel. Following odor control and mitigation measures have been adopted in the DPR:

(i) Provide closed wells fitted with necessary ventilation wherever required;

(ii) Provide greenbelt (tree cover) around the lift stations, wherever possible; and

(iii) For lifting stations which are located adjacent to houses from the sewage wells to nearest house/property boundary, a suitable arrangement such to capture the gaseous emissions from the wells and treat via scrubber/activated carbon filter before letting out into the ambient air; such system should be designed appropriately to meet the likely emissions/flow rate of respective lifting stations.

95. Depending on the type of facility (pumping / lifting station), location, land availability and distance from the residential areas, odor control measures included in the subproject are presented in the following table.

Table 18: Odor Control Measures Proposed in Sewage Pumping Station/Lift Station

No.	Scheme/Location	Odor Control Measures Proposed
I	**Manali UGSS**	
1	Srinivasa Perumal Koil Street (SPS)	green buffer zone and Odor control unit
2	CPCL Layout (SPS)	green buffer zone and odor control unit
3	Bharathiyar street (SPS)	green buffer zone
4	Kamarajar Street (SPS)	green buffer zone
5	Chinna Mathur Road (Road side lifting station)	Road side lift station / lift manhole. Will be covered and ventilating column will be provided.
II	**Chinnasekkadu UGSS**	
6	Inside Kodungaiyur STP (SPS)	green buffer zone
III	**Karambakkam UGSS**	
7	Avvai street, Samayapuram (LS)	Road side lift station with green buffer zone.
8	Chettiyar agaram (SPS)	green buffer zone
9	Maharishi Nagar (SPS)	green buffer zone and Odor control unit
10	Gandhi Nagar (SPS)	green buffer zone and odor control unit
11	Erikarai street (LS)	green buffer zone
12	Inside existing Maduravoyal SPS	green buffer zone
IV	**Manapakkam UGSS**	
13	Macrow Marvel Nagar (LS)	Road side lift station/ lift manhole. Will be covered and ventilating column will be provided
14	River View Colony (SPS)	green buffer zone / Odor control unit.
15	Sathya Nagar (LS)	green buffer zone
16	MGR Nagar (LS)	green buffer zone
17	Sethulakshmi Nagar (LS, Roadside)	Road side lift station/ lift manhole. Will be covered and ventilating column will be provided.
18	Indira Nagar (SPS)	green buffer zone and Odor control

LS = lift station, SPS = sewage pumping system, UGSS = underground sewerage system.

96. **Noise from Pumping Operations**. The operation of pumps, motors and diesel generators is a major source of noise. As the pumping and lifting stations are located in the residential areas, with few located very close to the houses, noise generated from lifting/pump stations can have adverse impacts on the surrounding population. High pitched sounds can adversely affect the health of operators and staff at the facility, therefore, noise levels need to be maintained within the threshold in and out of the plant. To eliminate the likelihood of generating toxic noise, only submersible pumps in the SPS and lift station will be provided.

(i) Since submersible pumps are used in the SPS and lift station there will not be much noise pollution during running of pump sets;
(ii) 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;[7]
(iii) Use appropriate building materials and construction techniques for pump houses which can absorb sound rather than reflect noise;
(iv) Use acoustic enclosures – manufacturer specified, for all DG sets, pumps, motors
(v) Procure only CPCB approved generators to meet air emission and noise level requirements; and
(vi) Provide sound mufflers for ventilators in the plant rooms; and sound proof doors
(vii) Provide ear plugs designated for noise reduction to workers.

[7] 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.

97. **Energy Efficiency**. Project area is mostly plain and gently sloping ground. It is, therefore, not technically feasible or economical to design a completely gravity dependent system to collect sewage from individual houses and transfer to STP located in the outskirts of the city. The provision of lifting and pumping stations became necessary to minimize overall pumping. In the current design, sewage will be collected from the houses via sewer network and conveyed by gravity to the lifting station. Lifting stations are designed to lift the sewage to a higher level and deliver it to a nearby sewer manhole on higher elevation. Gravity will then push it to flow freely, instead of pumping directly to a pumping station. , rather than pumping directly to a pumping station. This demonstrates a more efficient manner of energy consumption.

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

(i) Using low-noise and energy efficient pumping systems; and
(ii) Efficient Pumping system operation.

99. **Tree Cutting at Selected Project Sites**. As presented in the baseline profile of subproject sites, there are no notable tree cover in the project sites. There are only few small trees in the proposed sites at Srinivasa Perumal Koil site, Bharathiyar street in Manali, inside Kodungaiyur STP in the proposed site for Chinnasekkadu SPS which may require to be removed for construction of new units. Sewers are proposed at the center of the roads, and therefore no tree cutting envisaged. Following measures need to be implemented to minimize and/or compensate for the loss of tree cover.

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

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

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

101. **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.

102. **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.

103. **Social and Cultural Resources** – **Chance Finds**. Any work involving ground disturbance can uncover and damage archaeological and historical remains. For this project, excavation will occur in project sites for foundations, laying pipelines, and for construction of underground structures at pumping/lifting stations. Although Chennai city is an historical city, there are no archeologically or historically recognized sites or places close to project sites or within the project area. There are no known sites or areas potential for containing archaeological or historical remains, and risk of uncovering them is low. During implementation of sewerage scheme CMWSSB will follow chance find protocol to ensure that any chance finds are recognised and measures are taken to ensure they are protected and conserved:

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

B. Construction Impacts

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

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

106. Subproject also include linear works (laying of about 113 km of sewer mains, and 28 km of pumping mains along the roads). This covers entire Manali, Chinnasekkadu, Karambakkam and Manapakkam area of extended areas of Chennai city. Trunk sewers and branch will be laid

covering all the roads. House sewer connections will collect sewage from households will be laid in all streets and roads, the larger sewers that collect sewage from HSC and convey to pumping stations. Sewers will be laid by open cut method.

107. Open cut trenching method of sewer laying involves trench excavation in the road, placing sewers in the trench, jointing and testing, and refilling with the excavated soil. Proposed pipes for sewers are double wall corrugated (DWC) pipes up to 3.0 m deep and cast iron pipes above 3.0 m deep and conveying mains (pumping mains) are of cast iron. The diameter of sewer ranges from 200 mm to 600 mm, of which nearly 90% of the sewers are of size between 200 mm and 250 mm. According to the design the sewers will be laid at a depth of 1 to 6.5 m. The width of the trench excavation along the roads will vary from 0.65 m to 1.4 m, and the depth varies from a minimum of 1 m to 6.5 m. Nearly 83% length of sewers will be laid in trench of depth 3 m of less, and only about 3.7% of sewers will be laid deeper between 5 and 6.5 m. The design is optimized to minimize the sewer depth to the extent possible with an optimal combination of sewer depth and pumping requirements. Details of sewer construction are provided in the following table.

Table 19: Sewer Construction

Proposed Depth of Sewer (m)	Total Length of Sewers to be Laid (m)	Percentage of Length (%)
1.00	15,153	13.45
1.50	42,036	37.30
2.00	17,838	15.83
2.50	11,227	9.96
3.00	7,559	6.71
3.50	6,573	5.83
4.00	5,148	4.57
4.50	3,028	2.69
5.00	1,962	1.74
5.50	1,316	1.17
6.00	849	0.75
Total	**112,689**	**100.00**

108. 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 (up to 6.5 m), there is risk of collapse of trenches and/ or damage to surrounding buildings, safety risk to pedestrians and traffic. Necessary precautions such as bracing / shoring and strutting in the trench will be provided for trenches of more than 2.50 m deep. The normal working hours will be 8 hours daily, the total duration of each stage depends on the soil condition and other local features. Excavated soil will be used for refilling the trench after placing the sewer and therefore residual soil after pipe laying and refilling is not significant. About 97-98% of the excavated earth will be reused for refilling the trenches and the remaining excess soil will be disposed safely in the low lying areas of nearby CMWSSB land.

109. Although sewer laying work involves quite simple techniques of civil work, the invasive nature of excavation in the urban area where there are a variety of human activities, will result in impacts to the environment and sensitive receptors such as residents, businesses, and the community in general. These anticipated impacts are temporary and for short duration, however, needs to be mitigated. For laying sewer main in arterial roads trenchless technology will be adopted without causing any hindrance to the movement of traffic.

110. Manali is an erstwhile Municipality and Chinnasekkadu, Karambakkam and Manapakkam areas are erstwhile Village Panchayats. The above areas are characterized by moderately populated residential areas with narrow streets and roads. The above areas are now added with Chennai city. Sewers will extend to all residential and developed areas and trunk sewers will be laid mostly along the main roads.

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

112. **Sources of Materials**. Significant amount of sand and coarse aggregate will be required for this project, which will be sourced from quarries. Quarries inevitably cause extensive physical changes; as construction materials are excavated from the ground, leaving large cavities, or leveling hillsides, etc. The physical damage caused by quarries is controlled by allowing them to operate within specific limited areas only, so the damage is restricted in extent and not allowed to spread indiscriminately. New quarries are subject to a rigorous process of environmental assessment to ensure appropriate sitting and adequate environmental controls on the operation. It will therefore be important to ensure that construction materials for this project are obtained from existing government approved licensed quarries only, to ensure these controls are in place. In Chennai city the construction sand is normally obtained from PWD approved quarry at Palar (about 57 km from the city), and gravel and aggregate is available locally from Pallavaram and nearby areas in Kancheepuram District (about 20 km from the city). Contractor should not crease/use any new borrow pits / quarries. The contractor should also make a concerted effort to re-use as much excavated material from this project as possible. The construction contractor will be required to:

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

113. **Air Quality**. Construction work, especially from earthwork activities, coupled with dry and windy working conditions, material and debris transport, and works along the public roads carrying significant traffic, have high potential to generate dust. Significant quantities of earthwork will be conducted in the subproject, spread all over the project area. Nearly 3,00,000 m^3 of earthwork is anticipated from the subproject, and 87-90% of which will be reused for filling the trenches. Also emissions from construction vehicles, equipment, and machinery used for excavation and construction will induce impacts on the air quality. Anticipated impacts include dust and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons. Dust generation from construction work in individual and confined work sites lifting and pumping stations etc., will be mainly during the initial construction phase of earth work, as the site is confined, dust can be effectively controlled with common measures. Dust generation will be significant during sewer laying along the roads. Increase in dust/ particulate matter in ambient air is detrimental, and may have adverse impacts on people and environment. To mitigate the impacts, construction contractors will be required to:

114. **For all construction Works.**

(i) Provide a dust screen (6 m high) around the construction sites of pumping and lifting stations; provide 2 m high barricades for the sewer;

(ii) Damp down the soil and any stockpiled material on site by water sprinkling; (3-4 times a day - before the start of work, 1-2 times in between, and at the end of the day); when working in the roads there should permanently be one person responsible for directing when water sprinkling needs to take place to stop the dust moving;

(iii) Reduce the need to sprinkle water by stabilizing surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition;

(iv) Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process;

(v) Cover the soil stocked at the sites with tarpaulins and surround by dust screens

(vi) Control access to work area, prevent unnecessary movement of vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation

(vii) Use tarpaulins to cover the loose material (soil, sand, aggregate etc.,) when transported by open trucks;

(i) 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;

(viii) Clean wheels and undercarriage of haul trucks prior to leaving construction site

(ix) Ensure that all the construction equipment, machinery are fitted with pollution control devises, which are operating correctly, and have a valid pollution under control (PUC) certificate; and

(x) no vehicles or plant to be left idling at site generators to be at placed maximum distance from properties.

115. **For Sewer Works.**

(i) Barricade the construction area using hard barricades (of 2 m height) on both sides

(ii) Initiate site clearance and excavation work only after barricading of the site is done

(iii) Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes etc.,), to the barricaded area;

(iv) Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area;

(v) Undertake the work section wise: a 500 m section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones;

(vi) Conduct work sequentially - excavation, sewer laying, backfilling; testing section-wise (for a minimum length as possible) so that backfilling, stabilization of soil can be done;

(vii) Remove the excavated soil of first section to the disposal site; as the work progresses sequentially, by the time second section is excavated, the first section will be ready for back filling, use the freshly excavated soil for back filling, this will avoid stocking of material, and minimize the dust; and

(viii) Backfilled trench at any completed section after removal of barricading will be the main source of dust pollution. The traffic, pedestrian movement and wind will generate dust from backfilled section. Road restoration shall be undertaken immediately.

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

117. **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 during southwest and northeast monsoon seasons, between June/July to November/December. Manali and Chinnasekkadu will drains into Kosasthalayar river passing near to the project area. Adayar river is passing near the Manapakkam boundary and it carries flood water during monsoon. Karambakkam area drains in to the Cooum river. Besides, there are small canals and other small water bodies in and around the project area. It is important that runoff from the construction areas, which may contain silt and chemical traces do not enter these river.. Impact will be temporary, and but needs to be mitigated. Construction contractor will be required to:

(i) All earthworks be conducted during the dry season to prevent the problem of soil/silt run-off during rains;
(ii) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; do not stock earth/material close to water bodies (at least100 m);
(iii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, only designated disposal areas shall be used;
(iv) Install temporary silt traps, oil traps or sedimentation basins along the drainage leading to the water bodies;
(v) Place storage areas (with impermeable surface) for fuels and lubricants away from any drainage leading to water bodies; these should be at least 100 m away from water bodies and groundwater wells;
(vi) Store fuel, construction chemicals etc., on an impervious floor, also avoid spillage by careful handling; provide spill collection sets for effective spill management;
(vii) Dispose any wastes generated by construction activities in designated sites; and
(viii) Conduct surface quality inspection according to the EMP.

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

(i) Conduct works in the water body (especially foundation work) only during no-flow season;
(ii) Select a construction method which is less disruptive (e.g., precast type);
(iii) Do no spill construction chemicals, fuels, lubricants in the water body;

(iv) Clean up the site immediately after construction is complete; construction debris, materials, etc., shall be cleared and pre project condition restored or improved.

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

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

120. **Generation of Construction Wastes.** Solid wastes generated from the construction activities are excess excavated earth (spoils), discarded construction materials, cement bags, wood, steel, oils, fuels and other similar items. Domestic solid wastes may also be generated from the workers' camp. Improper waste management could cause odor and vermin problems, pollution and flow obstruction of nearby watercourses and could negatively impact the landscape. Total earthwork excavation will be nearly 3,00,000 m^3, of which nearly 87% -90% will be reused, and the remaining 30,000-40,000 m^3 of excess soil needs to be disposed safely. The following mitigation measures to minimize impacts from waste generation shall be implemented by the contractor:

(i) Prepare and implement a Construction Waste (Spoils) Management Plan (format is given in Appendix 5);
(ii) As far as possible utilize the debris and excess soil in construction purpose, for example for raising the ground level or construction of access roads etc.;
(iii) Avoid stockpiling any excess spoils at the site for long time. Excess excavated soils should be disposed off to approved designated areas immediately;
(iv) If disposal is required, the site shall be selected preferably from barren, infertile lands; sites should located away from residential areas, forests, water bodies and any other sensitive land uses;
(v) Domestic solid wastes should be properly segregated in biodegradable and non-biodegradable for collection and disposal to designated solid waste disposal site; create a compost pit (with impermeable bottom and sides)at workers camp sites for disposal of biodegradable waste; non-biodegradable / recyclable material shall be collected separately and sold in the local recycling material market;
(vi) Residual and hazardous wastes such as oils, fuels, and lubricants shall be disposed off via licensed (by TNPCB) third parties;
(vii) Prohibit burning of construction and/or domestic waste;
(viii) Ensure that wastes are not haphazardly thrown in and around the project site; provide proper collection bins, and create awareness to use the dust bins; recycle waste material where possible; and
(ix) Conduct site clearance and restoration to original condition after the completion of construction work; PIU to ensure that site is properly restored prior to issuing of construction completion certificate.

121. **Noise and Vibration Levels**. As submersible pump sets are proposed for all the sewage pumping stations and lift stations and these pumps are placed at the bottom of suction well there will not be much noise and vibration will be felt.

122. However most of the pumping station and lift station sites are located within habitations, where there are houses, schools and hospitals, religious places and businesses. The sensitive receptors are the general population in these areas. During construction stage increase in noise level may be caused by excavation, particularly breaking of cement concrete or bitumen roads for laying of sewers, operation of construction equipment, and the transportation of equipment, materials, and people. Vibration generated from construction activity, for instance from the use of pneumatic drills, will have impact on nearby buildings. The construction contractor will be required to:

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

123. **Accessibility and Traffic Disruptions**. Excavation along the roads for laying of sewers, hauling of construction materials and operation of equipment on-site will cause traffic problems. Sewers are proposed along all the main roads and streets:

(i) Kamarajar salai, Manali;
(ii) Nedunchezhiyan salai, Manali;
(iii) Thiruvalluvar street, Chinnasekkadu;
(iv) Parthasarathi street, Chinnasekkadu;
(v) Manapakkam Main Road, Manapakkam;
(vi) Mount Poonamallee road, Manapakkam;
(vii) Alapakkam Main road, Karambakkam; and
(viii) Arcot road, Karambakkam.

124. Almost all of the above roads carry considerable traffic. These roads also centers of commercial activities. Internal roads in the project area are narrow, except in the newly developing residential layout which comparatively have wide roads. . Hence, provision for trenchless technology method has been included in the estimates for Manali UGSS, Karambakkam UGSS and Manapakkam UGSS to avoid open cut excavation across the busy Highway roads like Kamarajar salai, Mount Poonamallee Road and Arcot Road. In the above major roads trenchless technology will be adopted for laying the pipe line across the roads. In other GCC maintained

busy roads, work will be taken up during non-traffic hours/ night hours without much hindrance to the free flow of traffic.

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

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

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

128. **Sewer Works.**

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

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

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

(iv) Undertake the work section wise: a 30 m section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones;

(v) Confine work areas in the road carriageway to the minimum possible extent; all the activities, including material and waste/surplus soil stocking should be confined to this area. Proper barricading should be provided; avoid material/surplus soil stocking in congested areas – immediately removed from site/ or brought to the as and when required;

(vi) Limit the width of trench excavation as much as possible by adopting best construction practices; adopt vertical cutting approach with proper shoring and bracing; this is especially to be practiced in narrow roads and deeper sewers; if they deep trenches are excavated with slopes, the roads may render completely unusable during the construction period;

(vii) Leave spaces for access between mounds of soil to maintain access to the houses / properties; access to any house or property shall not be blocked completely; alternative arrangements, at least to maintain pedestrian access at all times to be provided;

(viii) Provide pedestrian access in all the locations; provide wooden/metal planks with safety rails over the open trenches at each house to maintain the access;

(ix) Inform the affected local population in advance about the work schedule, a week before, and a day before start of work;

(x) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum;

(xi) Keep the site free from all unnecessary obstructions;

(xii) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints. Provide information to the public through media – newspapers and local cable television (TV) services; and

(xiii) At work site, public information/caution boards shall be provided including contact for public complaints.

129. **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 7a.m. to 10 a.m. and 4 p.m. 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; and

(v) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.

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

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

(ii) Do not block any access; leave spaces for access between barricades/mounds of excavated soil and other stored materials and machinery, and providing footbridges so that people can crossover open trenches;

(iii) Barricade the construction area and regulate movement of people and vehicles in the vicinity, and maintain the surroundings safely with proper direction boards, lighting and security personnel – people should feel safe to move around;

(iv) Control dust generation;

(v) Immediately consolidate the backfilled soil and restore the road surface; this will also avoid any business loss due to dust and access inconvenience of construction work.

(vi) Employee best construction practices, speed up construction work with better equipment, increase workforce, etc., in the areas with predominantly commercial, and with sensitive features like hospitals, and schools;

(vii) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and

(viii) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.

131. **Socio-Economic – Employment**. Manpower will be required during the 30-months construction stage. This can result in generation of temporary employment and increase in local revenue. Thus potential impact is positive and long-term. The construction contractor will be required to employ local labour force as far as possible.

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

(i) Follow all national, state and local labour laws (indicative list is in Appendix 2);
(ii) Develop and implement site-specific occupational health and safety (OHS) Plan informed by OHS risk assessment seeking to avoid, minimize and mitigate risk, which shall include measures such as: (a) safe and documented construction procedures to be followed for all site activities; (b) ensuring all workers are provided with and use personal protective equipment; (c) OHS Training for all site personnel, (d) excluding public from the work sites; and (e) documentation of work-related accidents.[8] Follow International Standards such as the World Bank Group's Environmental, Health and Safety Guidelines;[9]
(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 OHS 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;
(x) Disallow worker exposure to noise level greater than 85 dBA for duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively;
(xi) Provide supplies of potable drinking water; and
(xii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances.

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

[9] IFC World Bank Group. Environmental, Health and Safety Guidelines 101.

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

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

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

(i) Consult PIU before locating project offices, sheds, and construction plants;
(ii) Select a camp site away from residential areas (at least 100 m buffer shall be maintained) or locate the camp site within the existing facilities of City Corporation
(iii) Avoid tree cutting for setting up camp facilities;
(iv) Provide a proper fencing/compound wall for camp sites;
(v) Camp site shall not be located near (100 m) water bodies, flood plains flood prone/low lying areas, or any ecologically, socially, archeologically sensitive areas
(vi) Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit;
(vii) Ensure conditions of liveability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be

provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be used as accommodation for workers;

(viii) Camp shall be provided with proper drainage, there shall not be any water accumulation;

(ix) Provide drinking water, water for other uses, and sanitation facilities for employees; drinking water should be regularly tested to confirm that drinking water standards are met;

(x) Prohibit employees from cutting of trees for firewood; contractor should provide cooking fuel (cooking gas); fire wood not allowed;

(xi) Train employees in the storage and handling of materials which can potentially cause soil contamination;

(xii) Wastewater from the camps shall be disposed properly either into sewer system; if sewer system is not available, provide on-site sanitation with septic tank and soak pit arrangements (100 m away from surface water body or groundwater well)

(xiii) Recover used oil and lubricants and reuse or remove from the site;

(xiv) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; provide a compost pit for bio degradable waste, and non-biodegradable / recyclable waste shall be collected and sold in local market;

(xv) Remove all wreckage, rubbish, or temporary structures which are no longer required; and

(xvi) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to PIU. PIU to review and approve camp clearance and closure of work site.

C. Operation and Maintenance Impacts

135. Operation and Maintenance of the sewerage system will be carried out by CMWSSB. Operation will involve collection and conveyance of sewage from houses to nearest lifting / pumping stations; operation of lifting/pumping stations to pump the collected sewage to main pumping stations; operation of main pumping stations to pump the collected sewage to STP. STP is already under operation. The sewage is treated to meet the standards and are disposed into natural water course. To reuse the treated effluent for industrial use from the existing Kodungaiyur STP and Koyambedu STP, 45 MLD capacity (each) TTRO plant are under construction. It is proposed to reuse the treated effluent for industrial purposes in the Industrial belt along Ennore in north Chennai and for the Industries along Chennai- Bangalore corridor in the West.

136. **Sewage Sludge**. Sewage sludge contains harmful substances such as bacteria and pathogens, and nutrients like nitrogen, phosphates. Improper handling and disposal of the sludge will have adverse impacts on health and environment. The STPs at Kodungaiyur and Koyambedu are having sludge digesters and power is generated from the sludge collected in the primary and secondary treatment process. The residual sludge is thickened in the sludge thickener and used for refilling within the STP campus. Since the sewage sludge contains nutrients like nitrogen, phosphates it can used as manure. The reuse of sludge should be preceded by rigorous bacteriological tests to confirm that the treatment methods render all dried sludge and effluent free from enteric bacteria and pathogens, so that it is safe to humans, animals and crops. Sludge shall also need to be periodically tested for presence of heavy metals, to check if it meets the compost standards specified the Solid Waste Management and Handling Rules, 2016.

137. As discussed in the environmental audit, following measures are to be followed and complied with:

(i) No untreated wastewater from the STP will be disposed on to land or water bodies or storm water drains. Part of the sewage from the STP at Kodungaiyur and Koyambedu will be conveyed to proposed TTRO plant. Remaining treated effluent which will be within the prescribed norms of TNPCB will be discharged in to the nearby natural water course.
(ii) As the existing STPs are under operation, sewage system developed under this subproject will be operated immediately on completion of the project.
(iii) 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.

138. **Quality of Raw Sewage**. As discussed previously, one of the critical aspects in STP operation is, change in raw sewage characteristics at inlet of STP may affect the process and output quality. The system is designed for 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. The project area except Manali will not contain any major or minor industries. In Manali the major industries and refineries are having their own treatment units. Hence in the entire project area it is expected that only domestic sewage will enter in to the sewer system. Although proposed sewer network will not cater to industrial wastewater, It is important to ensure that no wastewater from industries enters the sewer network with strict monitoring and enforcement. Following measures are to be implemented:

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

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

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

140. **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.

141. 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:

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

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

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

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

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

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

(vii) Provide all necessary personnel protection equipment; and

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

VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Overview

142. The active participation of stakeholders including local community, NGOs/ CBOs, etc., in all stages of project preparation and implementation is essential for successful implementation of the project. It will ensure that the subprojects are designed, constructed, and operated with utmost

consideration to local needs, ensures community acceptance, and will bring maximum benefits to the people. Public consultation and information disclosure is a must as per the ADB policy.

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

B. Public Consultation

144. 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

145. The subproject proposal is formulated by CMWSSB in consultation with the public representatives in the project area to suit their requirements and as per Central Public Health and Environmental Engineering Organization (CPHEEO) norms.

146. Focused group discussions with the local public and other stakeholders were conducted to learn their views and concerns. General public and the people residing along the project activity areas were also consulted. A project area level consultation workshop was conducted with the public representatives and prominent citizens, NGOs etc., on 13 November 2017 (details are enclosed at the end of this report).

147. 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 construction of sewage pumping stations in residential localities as they are suspecting that odor problem will arise. Also they are anticipating nuisance and disturbance (dust, road closure and traffic management activities) during the construction stage which can have impact on their day to day activities. During the focus group discussion, in some location there are concerns expressed by the people regarding the location of pumping stations which are located close to residential locations. The concerns expressed by people on location of pumping stations and the clarifications given by CMWSSB during the focus group discussions conducted at Manali - Chinnasekkadu, Karambakkam and Manapakkam are consolidated and annexed at the end of this report. In this regard it is to be stated that the entire sub project area is almost flat terrain. Considering the prohibition of manual entry into manhole for cleaning the sewer system and O&M issues in maintaining the sewer system, in the design stage itself it was decided to restrict the maximum depth of manhole to 4.50 m, which necessitates more numbers of pumping stations and lift stations which cannot be avoided. Moreover, the identified sites are selected at the lowest point as per the design criteria. Since the entire project area is well developed and there is no alternate vacant government/GCC/CMWSSB lands are available except the already identified vacant lands. It will be nearly impossible to implement the sewerage scheme if the identified sites are not available. Hence, suitable mitigation measures like providing green cover, odor control measures and providing close wells and providing ventilating shaft with height above the window opening of the nearby residential houses will be taken during construction stage to address the concerns

expressed by the public. Construction on narrow roads is seen as biggest hindrance. Public demanded for advance notice before construction and proper warning signs along the construction area to avoid accidents and inconvenience and the project completed within the stipulated contract period. Public opined that an appropriate operation and maintenance system should be in place for sewerage system for its best functioning and to have the maximum health and aesthetic benefits. Issue of bad odor from lifting and pumping stations located close to the houses was also raised. Project team explained proposed EMP to manage the negative impacts, including odor prevention and control measures included in the design and operation. Details of public consultation are appended at Appendix 10.

2. Consultation during Construction

148. Prior to start of construction, PIU will conduct information dissemination sessions at various places and solicit the help of the local community, leaders/prominent for the project work. Focus group meetings ,as required, will be conducted to discuss and plan construction work (mainly pipeline work) with local communities to reduce disturbance and other impacts and also regarding the project grievance redress mechanism. Project information and construction schedule will be provided to the public A constant communication will be established with the affected communities to redress the environmental issues likely to surface during construction phase. Contractor will provide prior public information (in Tamil and English) about the construction work in the area, once seven 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 9). At the work sites, public information boards will also be provided to disseminate project related information.

C. Information Disclosure

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

150. 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.

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

VII. GRIEVANCE REDRESS MECHANISM

152. 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 CMWSSB will ensure that their grievances are addressed.

153. 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 CMWSSB 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.

154. 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; Deputy Construction Manager, along with support Engineer – Construction supervision (Non key expert) and Environmental safeguard Assistant (Non key expert) of Construction Management and Supervision Consultant (CMSC) will be responsible for creating awareness among affected communities and help them through the process of grievance redress, recording and registering grievances of non-literate affected persons.

155. 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).

156. 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 PIU/CMWSSB level. In the event that certain grievances cannot be resolved even at PIU/CMWSSB level., particularly in matters related to land purchase/ acquisition, payment of compensation, environmental pollution etc., they will be referred to the GRC headed by the Managing Director, CMWSSB. Any issue which requires higher than district level inter-departmental coordination or grievance redress, will be referred to the State level Steering Committee.

157. 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.

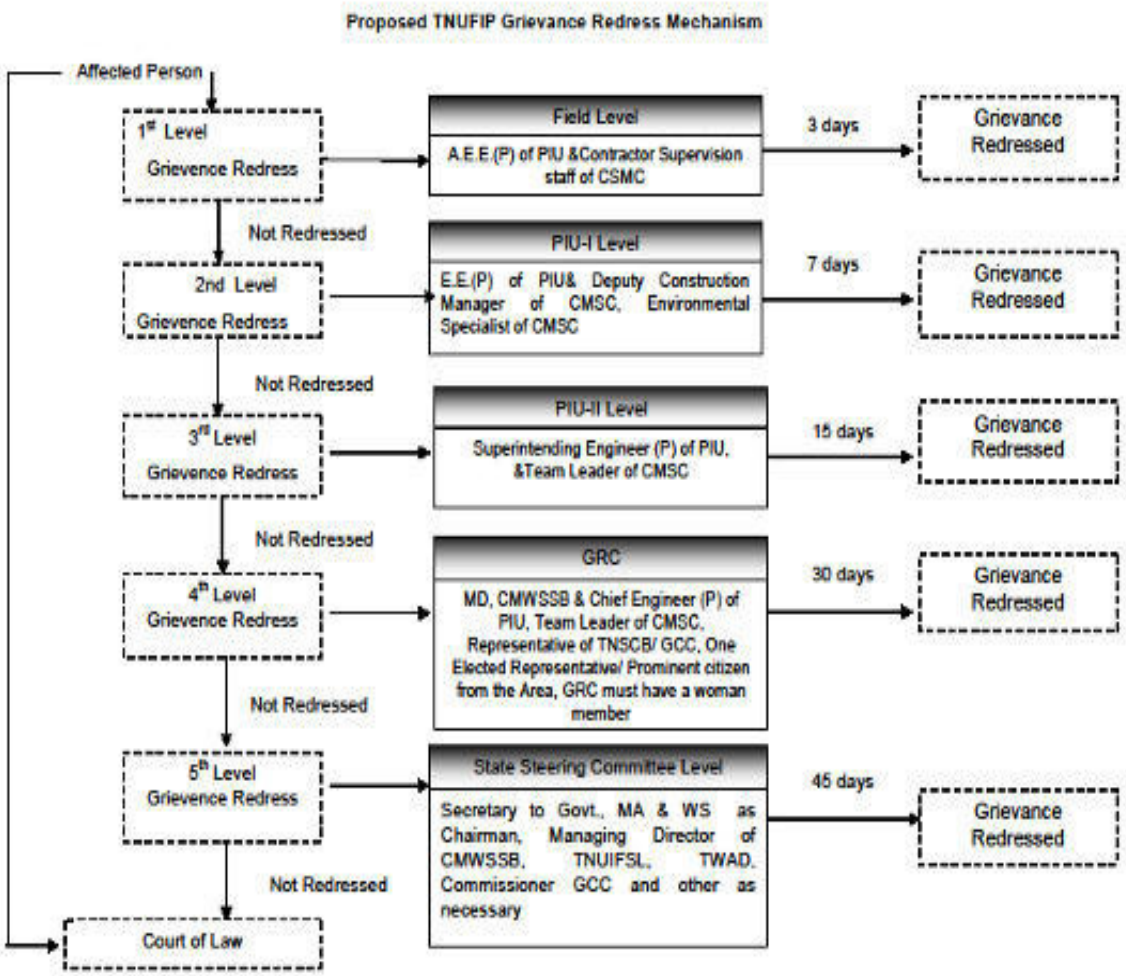
158. **Composition of Grievance Redress Committee**. GRC will be headed by the Managing Director, CMWSSB, and members include: Chief Engineer (P), Team leader of CMSC, representative of TNPCB, one elected representative/prominent citizen from the area, and a representative of affected community. GRC must have a women member.

159. **State Level Steering Committee** will include Secretary to Government, MA&WS Department as chairman, member include Managing Directors of TNUIFSL, CMWSSB, TWADB Board, Commissioner GCC and others as necessary.

160. **Areas of Jurisdiction.** The areas of jurisdiction of the GRC/SSC, will be all locations of sites within the Chennai city where subproject facilities are proposed.

161. The multi-tier GRM for the project is outlined below (Figure 8), 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 8: Proposed TNUFIP Grievance Redress Mechanism



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.

162. **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.

163. **Information Dissemination Methods 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, 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.

164. **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.

165. **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.

166. **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.

167. **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

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

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

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

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

172. 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.

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

Table 20: Design Stage Environmental Impacts and Mitigation Measures
(included in detailed project report)

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
Operation of existing sewage treatment plant (STP)	Non-compliance with government regulations: no valid consent to operate (CTO) from Tamil Nadu Pollution Control Board (TNPCB)	(i) Obtain CTO for Kodingaiyur STP	Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB)	CMWSSB's own fund
Sewer network	Nuisance due to leaks, overflows, contamination of water supplies, occupation health and safety of workers, etc.	(i) Limit the sewer depth up to 4.50 m where possible (ii) Sewers shall be laid away from water supply lines and drains (at least 1 m if not possible, sewer lines shall be laid below the water lines; (iii) In all cases, the sewer line should be laid deeper than the water pipeline (the difference between top of the sewer and bottom of water pipeline should be at least 300 mm) (iv) In unavoidable cases, where sewers are to be laid close to storm water drains, appropriate pipe material (that has no or least infiltration risk) shall be selected (v) For shallower sewers and especially in narrow roads, use small inspection chambers in lieu of manholes; (vi) Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize silt/garbage entry (vii) Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulfide generation	CMWSSB	Project Costs
Sewage pumping stations	Odor nuisance	**Proposed Sewage Pumping Station for Manali, Chinnasekkadu, Karambakkam and Manapakkam** i) Based on the site condition maintain maximum available buffer distance from suction well to residential areas (ii) Locate pumping station as far as away from the road/ residential house (iii) Develop green buffer zone around the facility with a combination of tall and densely growing trees in multi rows as per the land availability to control	CMWSSB	Project Costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		odor and also act as visual shield, and improve aesthetical appearance **Design measures for all pumping stations (11 SPS+ 7 LS)** (i) Proposed wells to be closed using reinforced cement concrete (RCC) slabs. Design of RCC slab to consider both superimposed loads (human and equipment loads) and severe corrosion risk from sewer gas from within wells. (ii) RCC Slab to be designed and fixed in a modular manner such that access to pumps / appurtenances and other equipment can be provided for maintenance / replacement / renewal purposes. (iii) Since human intervention is involved and safety shall be primary and critical consideration, additional protection by way of a metaled grating / grill work shall be provided over the sections (or full cross section if required) where workers will stand / work for inspection and repair/O and M purposes. (iv) In pumping stations where odor control measures are contemplated, provision of passive gas ventilation arrangement by providing a take-off vent from top of well by positioning vent in such a way that cover slab fitment/movement / drawl if required for maintenance purposes is not compromised. (v) Height of vent to be provided appropriately and a minimum 2 m above the lintel level (top level) of window(s)/passageways/doors in the nearby adjoining buildings. (vi) Provision of odor control / mitigation system as per site conditions / requirements; Suitable granular activated carbon filter with bird-screen fitted at the vent outlet to control odor. Size of GAC (including material size) should be selected based on the vent diameter and expelled air flow rate expected; odor control units are proposed at following		

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		sewage pumping station sites along with green buffer zones: Srinivasa Perumal Koil Street, CPCL Layout, Maharishi Nagar, Gandhi Nagar, River View Colony and Indira Nagar (vii) Submersible sewage pumps of suitable rating, minimum submergence requirements, open impeller with cutting-tearing arrangement and high strength-corrosion resistant heavy duty construction shall be proposed. (viii) In locations/cases where sewage flow in the present to intermediate design stage is envisaged to be low, position of the submersible pumps and design of the collection well floor by providing necessary side benching / sloped flooring to allow for higher submergence during low flow shall be made to ensure regular pump operation and avoid sewage stagnation beyond the permissible limit. (ix) Diesel Generators shall be provided for pumping stations only In cases of lift manholes (road-side or road-center type structures with only provision of kerb-side kiosk), an electrical cut-out provision shall be made for connecting an Emergency Mobile/Skid Mounted Diesel Generator for pumping out during long period of electricity supply interruption. (x) Develop standard operating procedures / operational manual for operation and maintenance of lifting and pump stations; this shall include measures for emerge situations (xi) Provide training to the staff in SOPs and emergency procedures (xii) Conduct periodic H2S monitoring using handheld meter		
Sewage lifting stations	Odor nuisance	(i) For lift stations close to residential areas provide closed wells fitted with necessary ventilation and odor abatement systems such as GAC air filters fitted to the ventilation shaft outlet(s). (ii) Provide greenbelt (tree cover) around the lift stations, wherever possible	CMWSSB	Project costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
Sewage pumping and lifting stations	Noise	(i) Procure good quality latest technology high pressure pumps that guarantee controlled noise at a level of around 80 dB(A) at a distance of 1 m (ii) Use appropriate building materials and construction techniques for pump houses which can absorb sound rather than reflect noise (iii) Use DG sets with acoustic enclosures. (iv) Procure only Central Pollution Control Board (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	CMWSSB	Project costs
Sewage pumping and lifting stations	Energy consumption	(i) Using low-noise and energy efficient pumping systems (ii) Efficient Pumping system operation	CMWSSB	Project 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	CMWSSB	Project Costs

Table 21: Preconstruction Stage Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Cost and Source of Funds
Submission of updated environmental management plan (EMP)/site environmental plan (SEP); EMP implementation and reporting	Unsatisfactory compliance to EMP	(i) Appoint environmental, health and safety (EHS) Supervisor by CMSC to ensure EMP implementation (ii) Submission of updated EMP/SEP (ii) Timely submission monthly of monitoring reports including documentary evidence on EMP implementation such as photographs	Contractor	Contractor cost
Utilities	Telephone lines, electric poles and wires, water lines	(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	Contractor in coordination with program	Project cost-

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Cost and Source of Funds
	within proposed project area	(ii) Require construction contractors to prepare a contingency plan to include actions to be taken in case of unintentional interruption of services.	implementation unit (PIU)	
Construction work camps, stockpile areas, storage areas, and disposal areas.	Conflicts with local community; disruption to traffic flow and sensitive receptors	(i) Prioritize areas within or nearest possible vacant space in the project location; (ii) If it is deemed necessary to locate elsewhere, consider sites that will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems; (iii) Do not consider residential areas; (iv) Take extreme care in selecting sites to avoid direct disposal to water body which will inconvenience the community. (v) For excess spoil disposal, ensure (a) site shall be selected preferably from barren, infertile lands. In case agricultural land needs to be selected, written consent from landowners (not lessees) will be obtained; (b) debris disposal site shall be at least 200 m away from surface water bodies; (c) no residential areas shall be located within 50 m downwind side of the site; and (d) site is minimum 50 m away from sensitive locations like settlements, ponds/lakes or other water bodies.	Contractor to finalize locations in consultation and approval of PIU	Project cost-
Sources of Materials	Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution.	(i) Obtain construction materials only from the existing government approved quarries with prior approval of PIU (ii) PIU to review, and ensure that proposed quarry sources have all necessary clearances/ permissions in place prior to approval (iii) Contractor to submit to PIU on a monthly basis documentation on material obtained from each sources (quarry/ borrow pit) (iv) No new borrow areas, quarries etc., shall be developed for the project	Contractor to prepare list of approved quarry sites and sources of materials with the approval of PIU	Contractor cost
Consents, permits, clearances, No Objection Certificates (NOCs), etc.	Failure to obtain necessary consents, permits, NOCs, etc. can result to design revisions	(i) Obtain all necessary consents, permits, clearance, NOCs, etc. prior to award of civil works. (ii) Ensure that all necessary approvals for construction to be obtained by contractor are in place before start of construction (iii) Acknowledge in writing and provide report on compliance all obtained consents, permits, clearance, NOCs, etc.	Contractor and PIU	Cost of obtaining all consents, permits, clearance, NOCs, etc.

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Cost and Source of Funds
	and/or stoppage of works			prior to start of civil works responsibility of PIU.
Chance finds	Damage / disturbance to artifacts	(i) Construction contractors to follow these measures in conducting any excavation work (ii) Create awareness among the workers, supervisors and engineers about the chance finds during excavation work (iii) Stop work immediately to allow further investigation if any finds are suspected; (iv) Inform State Archaeological Department if a find is suspected, and taking any action they require to ensure its removal or protection in situ.	Contractor and PIU	Contractor cost

Table 22: Construction Stage Environmental Impacts and Mitigation Measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
Environmental management plan (EMP) Implementation Training	Irreversible impact to the environment, workers, and community	(i) Project manager and all key workers will be required to undergo training on EMP implementation including spoils/waste management, Standard operating procedures (SOP) for construction works; occupational health and safety (OHS), core labor laws, applicable environmental laws, etc.	Contractor	Contractor cost
Air Quality	Dust, emissions from construction vehicles, equipment, and machinery used for installation of pipelines resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter,	**For all construction works** (i) Provide a dust screen (6m high) around the construction sites of pumping and lifting stations, ; provide 2 m high barricades for the sewer works (ii) Damp down the soil and any stockpiled material on site by water sprinkling (3-4 times a day - before the start of work, 1-2 times in between, and at the end of the day); when working in the roads there should permanently be one person responsible for directing when water sprinkling needs to take place to stop the dust moving; (iii) Reduce the need to sprinkle water by stabilizing surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
	nitrous oxides, and hydrocarbons.	(iv)Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process (v) Cover the soil stocked at the sites with tarpaulins, and surround by dust screens. (vi)Control access to work area, prevent unnecessary movement of vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation (vii)Use tarpaulins to cover the loose material (soil, sand, aggregate etc.,) when transported by open trucks; ; minimize the drop height when moving the excavated soil. (viii)Control dust generation while unloading the loose material (particularly aggregate, sand, soil) at the site by sprinkling water and unloading inside the barricaded area (ix)Clean wheels and undercarriage of haul trucks prior to leaving construction site (x) Ensure that all the construction equipment, machinery are fitted with pollution control devises, which are operating correctly, and have a valid pollution under control (PUC) certificate (xi) No vehicles or plant to be left idling at site generators to be at placed maximum distance from properties **For sewer works** (i) Barricade the construction area using hard barricades (of 2 m height) on both sides (ii) Initiate site clearance and excavation work only after barricading of the site is done (iii) Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes etc.,), to the barricaded area (iv) Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area (v) Undertake the work section wise: a 500 m section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones (vi)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.		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(vii) Remove the excavated soil of first section to the disposal site; as the work progresses sequentially, by the time second section is excavated, the first section will be ready for back filling, use the freshly excavated soil for back filling, this will avoid stocking of material, and minimize the dust. (viii) Backfilled trench at any completed section after removal of barricading will be the main source of dust pollution. The traffic, pedestrian movement and wind will generate dust from backfilled section. Road restoration shall be undertaken immediately. (ix) Immediately consolidate the backfilled soil and restore the road surface; if immediate road restoration is not possible, provide a layer of plain cement concrete (PCC) of suitable mix on the backfilled trench so that dust generation, erosion is arrested and it will also provide a smooth riding surface for the traffic until the road is properly restored. Backfilled trench without any road restoration is a major source of dust.		
Surface water quality	Mobilization of settled silt materials, and chemical contamination from fuels and lubricants during construction can contaminate nearby surface water quality. Ponding of water in the pits /foundation excavations	(i) All earthworks be conducted during the dry season to prevent the problem of soil/silt run-off during rains (ii) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; do not stock earth/material close to water bodies (at least100 m) (iii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, only designated disposal areas shall be used; (iv) Install temporary silt traps, oil traps or sedimentation basins along the drainage leading to the water bodies; (v) Place storage areas (with impermeable surface) for fuels and lubricants away from any drainage leading to water bodies; these should be at least 100 m away from water bodies and groundwater wells) (vi) Store fuel, construction chemicals etc., on an impervious floor, also avoid spillage by careful handling; provide spill collection sets for effective spill management (vii) Dispose any wastes generated by construction activities in designated sites; (viii) Conduct surface quality inspection according to the EMP.	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
Pipe bridge construction across streams and canals	Degradation of water quality / silting of water body	(i) Conduct works in the water body (especially foundation work) only during no-flow season (ii) Select a construction method which is less disruptive (e.g., precast type) (iii) Do no accidental spill construction chemicals, fuels, lubricants in the water body (iv) Clean up the site immediately after construction is complete; construction debris, materials, etc., shall be cleared and pre project condition restored or improved	Contractor	Contractor cost
	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 Consider safety aspects related to pit collapse due to accumulation of water	Contractor	Contractor cost
Noise Levels and vibration	Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people	(i) Plan activities in consultation with program implementation unit (PIU) so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance, especially near schools and other sensitive receptors (ii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and use portable street barriers to minimize sound impact to surrounding sensitive receptor; and (iii) Maintain maximum sound levels not exceeding 70 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s. (iv) Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity; if any building at risk, structural survey be completed prior to work, to provide baseline in case any issues from vibration, and if building is structurally unsound that measures taken to avoid any further damage (v) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach;	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(vi) Consult local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as night times, religious and cultural festivals.		
Landscape and aesthetics – waste generation	Impacts due to excess excavated earth, excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items.	(i) Prepare and implement a Construction Waste Management Plan (refer Appendix 5) (ii) As far as possible utilize the debris and excess soil in construction purpose, for example for raising the ground level or construction of access roads etc., (iii) Avoid stockpiling any excess spoils at the site for long time. Excess excavated soils should be disposed off to approved designated areas immediately (iv) If disposal is required, the site shall be selected preferably from barren, infertile lands; sites should located away from residential areas, forests, water bodies and any other sensitive land uses (v) Domestic solid wastes should be properly segregated in biodegradable and non-biodegradable for collection and disposal to designated solid waste disposal site; create a compost pit (with impermeable bottom and sides) at workers camp sites for disposal of biodegradable waste; non-biodegradable / recyclable material shall be collected separately and sold in the local recycling material market (vi) Residual and hazardous wastes such as oils, fuels, and lubricants shall be disposed off via licensed (by TNPCB) third parties (vii) Prohibit burning of construction and/or domestic waste; (viii) Ensure that wastes are not haphazardly thrown in and around the project site; provide proper collection bins, and create awareness to use the dust bins; , recycle waste material where possible. (ix) Conduct site clearance and restoration to original condition after the completion of construction work; PIU to ensure that site is properly restored prior to issuing of construction completion certificate	Contractor	Contractor cost
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	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		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 barricading should be provided; avoid material/surplus soil stocking in congested areas – immediately removed from site/ or brought to the as and when required (vi) Limit the width of trench excavation as much as possible by adopting best construction practices; adopt vertical cutting approach with proper shoring and bracing; this is especially to be practiced in narrow roads and deeper sewers; if they deep trenches are excavated with slopes, the roads may render completely unusable during the construction period (vii) Leave spaces for access between mounds of soil to maintain access to the houses / properties; access to any house or property shall not be blocked completely; alternative arrangements, at least to maintain pedestrian access at all times to be provided (viii) Provide pedestrian access in all the locations; provide wooden/metal planks with safety rails over the open trenches at each house to maintain the access. (ix) Inform the affected local population in advance about the work schedule, a week before, and a day before to start of work (x) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum.		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(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. (xiii) At work site, public information/caution boards shall be provided including contact for public complaints **Hauling (material, waste/debris and equipment) activities** (i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites (ii) Schedule transport and hauling activities during non-peak hours; (peak hours 7 to 10 AM and 4 to 7 PM);(iii) Locate entry and exit points in areas where there is low potential for traffic congestion; (iv) Drive vehicles in a considerate manner (v) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.		
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 open trenches (iii) Barricade the construction area and regulate movement of people and vehicles in the vicinity, and maintain the surroundings safely with proper direction boards, lighting and security personnel – people should feel safe to move around (iv) Control dust generation (v) Immediately consolidate the backfilled soil and restore the road surface; this will also avoid any business loss due to dust and access inconvenience of construction work. (vi) Employee best construction practices, speed up construction work with better equipment, increase workforce, etc., in the areas with predominantly commercial, and with sensitive features like hospitals, and schools;	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(vii)Consult businesses and institutions regarding operating hours and factoring this in work schedules; and (viii)Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.		
Socio-Economic – Employment	Generation of temporary employment and increase in local revenue	(i) Employ local labor force as far as possible (iii) Comply with labor laws	Contractor	Contractor cost
Occupational Health and Safety	Occupational hazards which can arise during work	(i) Follow all national, state and local labor laws (indicative list is in Appendix 2); (ii) Develop and implement site-specific occupational health and safety (OHS) Plan, informed by OHS risk assessment seeking to avoid, minimize and mitigate risk which shall include measures such as: (a) safe and documented construction procedures to be followed for all site activities; (b) ensuring all workers are provided with and use personal protective equipment; (c) OHS Training for all site personnel, (d) excluding public from the work sites; and (e) documentation of work-related accidents.[a] Follow International Standards such as the World Bank Group's Environment, Health and Safety Guidelines.[b] (iii) Ensure that qualified first-aid is provided at all times. Equipped first-aid stations shall be easily accessible throughout the sites; (iv) Secure all installations from unauthorized intrusion and accident risks (v) Provide health and safety orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; (vi) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(vii) Ensure the visibility of workers through their use of high visibility vests and other PPE when working in or walking through heavy equipment operating areas; (viii) Ensure moving equipment is outfitted with audible back-up alarms; (ix) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and (x) Disallow worker exposure to noise level greater than 85 dBA for duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively. (xi) Provide supplies of potable drinking water; (xii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances		
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians during material and waste transportation	(i) Consult PIU before locating project offices, sheds, and construction plants; (ii) Select a camp site away from residential areas (at least 100 m buffer shall be maintained) or locate the camp site within the existing facilities of City Corporation (iii) Avoid tree cutting for setting up camp facilities (iv) Provide a proper fencing/compound wall for camp sites (v) Camp site shall not be located near (100 m) water bodies, flood plains flood prone/low lying areas, or any ecologically, socially, archeologically sensitive areas (vi) Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit (vii) Ensure conditions of livability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be used as accommodation for workers	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		(viii) Camp shall be provided with proper drainage, there shall not be any water accumulation (ix) Provide drinking water, water for other uses, and sanitation facilities for employees, ; drinking water should be regularly tested to confirm that drinking water standards are met (x) Prohibit employees from cutting of trees for firewood; contractor should provide cooking fuel (cooking gas); fire wood not allowed (xi) Train employees in the storage and handling of materials which can potentially cause soil contamination (xii) Wastewater from the camps shall be disposed properly either into sewer system; if sewer system is not available, provide on-site sanitation with septic tank and soak pit arrangements (100 m away from surface water body or groundwater well) (xiii) Recover used oil and lubricants and reuse or remove from the site; (xiv) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; provide a compost pit for bio degradable waste, and non-biodegradable / recyclable waste shall be collected and sold in local market (xv) Remove all wreckage, rubbish, or temporary structures which are no longer required; and (xvi) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to PIU; PIU to review and approve camp clearance and closure of work site		
Work Camps and worksites	Temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants	(i) As far as possible located the camp site within the work sites (at STP or large pumping station sites); if any camp to be established outside these, then select a camp site away from residential areas (at least 100 m buffer shall be maintained) (ii) Avoid tree cutting for setting up camp facilities (iii) Ensure that a proper compound wall is provided, and erect a wind/dust screen around (iv) Camp site shall not be located near (100 m) water bodies, flood plains flood prone/low lying areas, or any ecologically, socially, archeologically sensitive areas	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
	Unsanitary and poor living conditions for workers	(v) Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit (vi) Provide proper temporary accommodation with proper materials, adequate lighting and ventilation, appropriate facilities for winters and summers; ensure conditions of liveability at work camps are maintained at the highest standards possible at all times; (vii) Consult PIU before locating project offices, sheds, and construction plants; (viii) Minimize removal of vegetation and disallow cutting of trees (ix) Ensure conditions of liveability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be allowed as accommodation for workers (x) Camp shall be provided with proper drainage, there shall not be any water accumulation (xi) Provide drinking water, water for other uses, and sanitation facilities for employees (xii) Prohibit employees from cutting of trees for firewood; contractor should be provide proper facilities including cooking fuel (oil or gas; fire wood not allowed) (xiii) Train employees in the storage and handling of materials which can potentially cause soil contamination (xiv) Recover used oil and lubricants and reuse or remove from the site (xv) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; provide a compost pit for biodegradable waste, and non-biodegradable / recyclable waste shall be collected and sold in local market (xvi) Remove all wreckage, rubbish, or temporary structures which are no longer required (xvii) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		PIU; PIU to review and approve camp clearance and closure of work site		
Post-construction clean-up	Damage due to debris, spoils, excess construction materials	(i) Remove all spoils wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (ii) All excavated roads shall be reinstated to original condition. (iii) All disrupted utilities restored (iv) All affected structures rehabilitated/compensated (v) The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up. (vi) All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be top soiled and regrassed using the guidelines set out in the revegetation specification that forms part of this document. (vii) The contractor must arrange the cancellation of all temporary services. (viii) Request PIU to report in writing that worksites and camps have been vacated and restored to pre-project conditions before acceptance of work.	Contractor	Contractor cost
Temporary economic impacts	Disruption to vendors, hawkers on right-of-way (ROW) during sewer laying works	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. No works can be commenced unless 100% shifted in sections ready for implementation.	CC and PIU	Contractor / PIU

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

[b] IFC World Bank Group. Environmental, Health and Safety Guidelines 101.

Table 23: Operation Stage Environmental Impacts

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
Existing sewage	Non-compliance with government	Obtain CTO from Tamil Nadu Pollution Control Board (TNPCB) immediately.	Chennai Metropolitan	Operating costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
treatment plant (STP) operation	regulations – no valid consent to operate (CTO) for Kodinguir STP operation		Water Supply & Sewerage Board (CMWSSB)	
Operation of sewage lifting and pumping stations	Odor nuisance	(i) Strictly follow standard operating procedures/operational manual for operation and maintenance of lifting and pump stations (ii) Ensure that operating staff is properly trained, and have clear understanding of odor issues vis a vis its relation with operational practices (iii) Ensure that pumping cycles are properly followed; and there is no buildup of sewage beyond design volume in the wells (iv) Conduct H_2S monitoring periodically at pumping stations and at lifting stations using handheld meters	CMWSSB	Operating costs
Operation and maintenance of sewerage system	Blocks, overflows, system malfunction, occupational health and safety	(i) Establish regular maintenance program, including: • Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas • Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration; and • Monitoring of sewer flow to identify potential inflows and outflows • Conduct repairs on priority based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages); (ii) Maintain records; review previous sewer maintenance records to help identify “hot spots” or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of	CMWSSB	Operating costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost and Source of Funds
		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

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 Construction Management and Supervision Consultant (CMSC)	Staff and consultant costs are part of incremental administration costs
Ambient air quality	5 locations (locations 50 m downwind direction near sewer and	• PM_{10}, $PM_{2.5}$ NO_2, SO_2, CO	Once before start of construction Quarterly (yearly 4-times) during	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor

Monitoring Field	Monitoring Location	Monitoring Parameters	Frequency	Responsibility	Cost and Source of Funds
	pumping / lifting station work sites in the city);		construction (2.5 year period)		(50 samples x Rs.5000/- per sample = ₹250,000)
Ambient noise	5 locations (locations near sewer and pumping / lifting station work sites in the city);	• Day time and night time noise levels	Once before start of construction Quarterly (yearly 4-times) during construction (2.5 year period)	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (50 samples x 1500 per sample = 75,000)
Surface water quality	2 locations (2 points in River Adyar u/s and d/s, and two points in Cooum u/s and d/s).	• pH, Oil and grease, Cl, F, NO_3, TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalnity	Once before start of construction Half yearly during construction (2.5 year construction period considered)	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (28 samples x 4000 per sample = 112,000)

Table 25: Operation Stage Environmental Monitoring Plan

Monitoring Field	Monitoring location	Monitoring Parameters	Frequency	Responsibility	Cost and Source of Funds
Monitoring of treated wastewater quality from sewage treatment plant (STP)	Inlet and outlet of STP	Parameters as specified by Tamil Nadu Pollution Control Board (TNPCB) in the consent.	Monthly Once	TNPCB	Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) Operating Cost
Disposal of treated wastewater	At the outlet of STP: flow measurement	BOD = < 20mg/l SS = < 30 mg/l F. Coliform = < 10000 MPN/100 ML	Daily	CMWSSB	CMWSSB Operating Cost
Odor monitoring at pumping stations	3 points (downwind direction) at all pumping stations: near inlet/suction well; outside the pumping station and at nearest house, at the boundary wall of the pumping stations	Hydrogen sulphide (H_2S)	Periodical	CMWSSB	Handheld H_2S meters to be procured as part of the project and operated by operating staff O&M Costs
Odor monitoring at lifting stations	3 points (down wind direction) at all lift stations: near inlet/suction well; outside the pumping station and at nearest house, at the boundary wall of the pumping stations	Hydrogen sulphide (H_2S) in ambient air	Periodical	CMWSSB	Handheld H2S meters to be procured as part of the project and operated by operating staff O&M Costs

Monitoring Field	Monitoring location	Monitoring Parameters	Frequency	Responsibility	Cost and Source of Funds
Sludge quality and suitability as manure	STP	Analysis for concentration of heavy metals and confirm that value are within the following limits	Start of operation and Yearly once	CMWSSB	O&M costs (testing to be done at an accredited external laboratory)

B. Implementation Arrangements

174. The Municipal Administration and Water Supply Department (MAWS) of Government of Tamil Nadu acting through the Tamil Nadu Urban Infrastructure Financial Services Ltd. (TNUIFSL) is the state-level executing agency. A program management unit (PMU) will be established in TNUIFSL headed by a Project Director and Deputy Project Director (senior official from CMWSSB), and comprising dedicated full-time staff from TNUIFSL for overall project and financial management. A Project Steering Committee headed by Principal Secretary, MAWS, and members include managing directors of TNUIFSL, CMA, and CMWSSB will be established.

175. The implementing agency for this subproject is Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB). A program implementation unit (PIU) will be established in CMWSSB headed by Chief Engineer (CMWSSB) and comprising dedicated full-time staff from engineering and other departments of CMWSSB. PIU under the CMWSSB will be responsible for planning, implementation, monitoring and supervision, and coordination of all activities of subproject. A construction, management and supervision consultant (CMSC) will be appointed to assist PIU in day-to-day implementation of the subproject.

176. **Safeguards Compliance Responsibilities**. Environmental and Social Safeguards (ESS) managers in the PMU, TNUIFSL will have overall responsibility of safeguard compliance with ADB SPS 2009. ESS Managers (TNUIFSL) will report to Vice President in the Projects Wing. At CMWSSB, the Assistant Executive Engineer in-charge of the project/Safeguards Officer will coordinate safeguard tasks at PIU. As expert support is available to CMWSSB via CMSC, and the role of Assistant Executive Engineer will be mainly to coordination, overseeing the implementation of safeguard tasks, grievance redress and reporting.

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

178. **DPR finalization and Bidding Stage:**

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

179. **Construction stage:**

- (i) Prior to start of construction:
  - (a) Ensure that all necessary clearances/permissions/licences, including that of contractor's are in place prior to start of construction.
  - (b) provide oversight on environmental management aspects of subprojects and ensure EMPs are implemented by PIUs and contractors.
- (ii) Oversee and provide guidance to the PIU to properly carry out the environmental monitoring as per the EMP;

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

180. **Operation stage.** Ensure that operation of sewerage system developed under the subproject is in compliance with all government regulations, standards and conditions.

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

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

183. **Construction Stage:**
(i) Identify regulatory clearance requirements and obtain all necessary clearances prior to start of construction; ensure construction work by contractor is conducted in compliance with all government rules and regulations including pollution control, labour welfare and safety etc.;
(ii) Prior to start of construction organize an induction course for the training of contractors, preparing them on EMP implementation, environmental monitoring, and on taking immediate action to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation;
(iii) Ensure contractor compliance with staff resources as per the IEE/EMP/Bid
(iv) Guide contractor on updating EMP/preparing Site Environmental Plan at the start of the project;
(v) Update IEE and EMP; ensure that IEE reflects the final design being implemented by contractor;
(vi) Conduct public consultation and information disclosure as necessary;

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

184. **Operation stage.**
(i) Conduct environmental management and monitoring activities as per the EMP; and
(ii) Ensure that conveyance system constructed and operated with all necessary clearances and approvals, and compliance with standards and conditions.

185. **Contractor's Responsibilities.**

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

Construction stage:
(i) Mobilize EHS Supervisor prior to start of work
(ii) Prepare SEMP and submit to PIU
(iii) Ensure that all regulatory clearances (both project related and contractor related) are in place prior start of the construction work.
(iv) Confirm with PIU availability of rights of way at all project sites prior to start of work.
(v) Prepare and submit:
  (a) Construction waste management (CWM) plan (sample is in Appendix)
  (b) Traffic management (TM) plan (sample is Appendix 6);

(c) OHS Plan, pollution control plan, dust emergency response plan.

(vi) Implement the mitigation measures as per the EMP including CWM and traffic management plans;

(vii) Follow the EMP measures/guidelines for establishment of temporary construction camps, construction waste disposal sites, and material borrow areas, etc.;

(viii) Implement EMP and ensure compliance with all the mitigation and enhancement measures;

(ix) Conduct environmental monitoring (air, noise, water etc.) as per the EMP;

(x) Undertake immediate action as suggested by PIU to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation;

(xi) Submit monthly progress reports on EMP implementation to PIU;

(xii) Act promptly on public complaints and grievances related to construction work and redress in a timely manner in coordination with PIU and CMSC; and

(xiii) Comply with applicable government rules and regulations.

C. Training Needs

186. The following Table 26 presents the outline of capacity building program to ensure EMP implementation. These capacity building and trainings will be conducted at the offices of PMU and PIU by the environmental safeguards specialist of PMU/PIU and their consultants, which are part of project implementation set-up, and therefore no separate or additional costs are envisaged. Adequate costs are already considered in project's capacity building program. The detailed program and specific modules will be customized for the available skill set after assessing the capabilities of the target participants and the requirements of the project by the PMU.

Table 26: 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, 2009 - Government of India and Tamil Nadu applicable safeguard laws, regulations and policies including but not limited to core labor standards, occupational health and safety (OHS), etc. - Incorporation of environmental management plan (EMP) into the project design and contracts - Monitoring, reporting and corrective action planning	All staff and consultants involved in the project At program management unit (PMU) (combined program for all program implementation unit, PIU)	-	Included in the overall program cost
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 - Asbestos cement pipe protocol	All PIU staff, contractor staff and consultants involved in the subproject At PIU	-	To be conducted by construction management and supervision consultant (CMSC) at the PIU office; part of project implementation cost

Description	Target Participants and Venue	Estimate (₹)	Cost and Source of Funds
- Traffic management plan - Waste management plan - Site clean-up and restoration			
3. Contractors Orientation to Workers (1/2 day) - Environment, health and safety (EHS) in project construction	Once before start of work, and thereafter regular briefing every month once. Daily briefing on safety prior to start of work All workers (including unskilled laborers)	-	Contractors' EHS officer to conduct program, with guidance of CMSC

D. Monitoring and Reporting

187. 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.

188. 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 annual report.

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

190. 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.

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

E. Environmental Management Plan Implementation Cost

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

Table 27: Cost Estimates to Implement the Environmental Management Plan

	Particulars	Stages	Unit	Total Number	Rate (₹)	Cost (₹)	Costs Covered By
A.	**Implementation staff**						
1	EHS Supervisor	Construction	per month	30	35,000	1,050,000	Civil Works Contract
	Subtotal (A)					**1,050,000**	
B.	**Mitigation Measures**						
1	Procurement of H_2S meters	Construction	Per unit	4 (hand held)	30,000	120,000	Provisional sums of contract (PIU)
2	Providing gas capture and treatment system at pumping and lifting stations	Construction	Lump sum provision	-	-	3,000,000	Provisional sums of contract (PIU)
3	Measures related to make the STP compliant with TNPCB consent	Design/ construction	-	-	-	-	CMWSSB own funds
4	Provision for tree cutting and compensatory plantation measures (1: 10 ratio replantation)	Construction	Per tree	10	1,000	10,000	Project costs (PIU)
5	Preparation of plans traffic management plan, waste (spoils) management plan etc.,), traffic management at work sites (Pavement Markings, Channelizing Devices, Arrow Panels and Warning Lights)	Construction	Lump sum	-	-	300,000	Civil works contract
	Subtotal (B)					**3,430,000**	
C.	**Monitoring Measures**						
1	Air quality monitoring	Construction	per sample	50	5,000	250,000	Civil works contract
2	Noise levels monitoring	Construction	Per sample	50	1,500	75,000	Civil work contract
3	Surface water monitoring	Construction	Per sample	28	4,000	112,000	Civil work contract
	Subtotal (C)					**437,000**	
D.	**Capacity Building**						
1.	Training on EMP implementation	Pre-construction				**-**	Part of PIU and PMU , consultant tasks
2.	Contractors Orientation to Workers on EMP implementation	Prior to dispatch to worksite				-	Civil works contractor cost
	Subtotal (D)						
	Total (A+B+C+D)				**₹**	**4,917,000**	

Contractor Cost - 1,787,000
PIU Cost - 3,130,000
Total - 4,917,000

IX. CONCLUSION AND RECOMMENDATIONS

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

194. No sewage treatment facility is included in the subproject as it is proposed to utilize the available excess capacity of existing sewage treatment plants (STPs). According to technical studies, existing capacity is adequate to meet the sewage generated from the subproject area. Three existing STPs will be utilized for treating the sewage generated from the subproject areas: Manali and Chinnasekkadu areas to Kodungaiyur STP) of 110 million liter per day (MLD) capacity; Karambakkam area to Koyambedu STPs (120 MLD) and Manapakkam area sewage will be conveyed to the Nesapakkam STP (54 MLD). All the three STPs are functioning normally, and treating the sewage to discharge standards specified by Tamil Nadu Pollution Control Board (TNPCB). As per the monitoring data, the biochemical oxygen demand (BOD) of treated effluent ranges from 11 t0 17 mg/l, which is meeting the TNPCB discharge standard of less than 20 mg/l. The STPs at Koyambedu and Nesapakkam have valid consent to operate (CTO) from TNPCB, while for Kodungaiyur STP CTO renewal application submitted along with the applicable fee, and CTO renewal is awaited. Sludge generated from STPs is used to generate bio gas (methane CH4) by way of sludge digestion, which then used has fuel to generate electricity. The generated electricity is used to operate the STPs. The above process reduces the carbon emissions to the atmosphere by way of methane capture from the raw sludge. The digested sludge is then fed into mechanical centrifuge for dewatering the sludge. The dewatered sludge cakes is then collected and disposed inside the STP premises by landfilling.

195. In order to further improve and enhance the operation of STP, CMWSSB has taken various initiatives: (i) construction of 45 MLD capacity tertiary treatment plants - one each at Kodungaiyur STP and Koyambedu STP, to further treat the secondary treated sewage and to reuse it for industrial purpose, and (ii) appointed consultants to study the existing sludge management system at the STPs, and suggest reuse options. This will further improve the efficiency of the existing sewage treatment systems.

196. All new lifting and pumping station sites (18 in all -11SPS and 7 lift station) are situated on GCC/CMWSSB/government owned vacant land parcels, and sewers will be laid on the public roads. Therefore subproject do not involve any private land acquisition.

197. New sewage pumping station, which collect sewage from the sewer network and pump to higher level to convey the sewage to STP for safe treatment and disposal, is located within the

city. All 11 nos. new sewage pumping stations and 7 nos. lifting stations are located within or close to residential areas. These facilities may generate odor and may cause nuisance to nearby households. Site selection is done with utmost care to located as far as away from the houses, however, given design considerations and land constraints, many 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. All the pumping stations are to be constructed taking into consideration the maximum flood level.

198. Except sewer laying 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.

199. Once the new system is operating, the facilities will operate with routine maintenance, which should not affect the environment. Improved system operation will comply with the O and M manual and standard operating procedures to be developed for all the activities. Pre audit will be carried out prior to operation of the scheme

200. 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.

201. Stakeholders were involved in developing the IEE through face-to-face discussions. 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 CMWSSB and ADB websites. The consultation process will be continued during project implementation, as required, to ensure that stakeholders are engaged in the project and have the opportunity to participate in its development and implementation.

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

203. 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, to ensure compliance to the conditions set out in this document

204. The citizens of the sub projects area of Manali, Chinnasekkadu, Karambakkam and Manapakkam are the major beneficiaries of this subproject. The new sewerage system will remove the sewage generated from the households of the above areas served by the network rapidly and treated to an acceptable standard, and treated wastewater is utilized beneficial purposes. In addition to improved environmental conditions, the subproject will improve the over-all public health in the project area. Diseases of poor sanitation, such as Dengue, diarrhoea 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.

205. Therefore, per ADB SPS, the project is classified as environmental category B and does not require further environmental impact assessment. As identified in the environmental audit, CTO from TNPCB will be obtained for Kodungaiyur to implement a CMWSSB-initiated study on the benefits of safely reusing digested sludge. This IEE shall be updated by CMWSSB during the implementation phase to reflect any changes, amendments.

RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

Sewerage

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

Country/Project Title: **India / Tamil Nadu Urban Flagship Investment Program – Providing Comprehensive Sewerage Scheme to Manali, Chinnasekkadu, Karambakkam and Manapakkam In Chennai City**

Sector Division: **Urban Development and Water Division**

<table>
<tr><th>Screening Questions</th><th>Yes/No</th><th>Remarks</th></tr>
<tr><td>A. Project Siting
Is the project area…</td><td></td><td></td></tr>
<tr><td>Densely populated?</td><td>☒Yes
☐No</td><td>Core Chennai city areas are very densely populated. Added areas are comparatively less dense.Sub project areas are part of the added areas of Chennai city. As core Chennai city is already saturated, developments are taking place in the added areas including present sub project area. The entire core Chennai city has already been provided with water supply and sewerage facilities. It is proposed to provide sewerage facilities in the entire 42 added areas of Chennai city on par with core city. Accordingly providing water supply and sewerage infrastructures in some parts of added areas are in various stages of implementation. As part of the sewerage proposal, now it is proposed to extend the sewerage facilities in the Sub project area covering Manali, Chinnasekkadu, Karambakkam and Manapakkam.
The Extent, Population and Density of the sub project area is furnished below:.
<table>
<tr><th>Area</th><th>Extent in Hect</th><th>Population (2020) in thousand</th><th>Population density per Hect</th></tr>
<tr><td>Manali</td><td>748</td><td>42,550</td><td>57</td></tr>
<tr><td>Chinnasekkadu</td><td>167</td><td>15,955</td><td>96</td></tr>
<tr><td>Karambakkam</td><td>107</td><td>38,510</td><td>361</td></tr>
<tr><td>Manapakkam</td><td>412</td><td>22,490</td><td>55</td></tr>
</table>
As about 80% of the area in Manali area is industrial area, the population density is only 57 person/Hect. However, if only the residential/ mixed residential areas are considered, the population denisity is in the</td></tr>
</table>

Screening Questions	Yes/No	Remarks
		order of 324 persons/ hectare. Similarly in Manapakkam as per land use map, only 52.8% of the area is residential area and rest of the areas are Institutional, water body and non-urbanisable classification.
Heavy with development activities?	☒Yes ☐No	It is a developing area; urban expansion is considerable
Adjacent to or within any environmentally sensitive areas?	☐Yes ☒No	-
Cultural heritage site	☐Yes ☒No	-
Protected Area	☐Yes ☒No	-
Wetland	☐Yes ☒No	-
Mangrove	☐Yes ☒No	-
Estuarine	☐Yes ☒No	-
Buffer zone of protected area	☐Yes ☒No	-
Special area for protecting biodiversity	☐Yes ☒No	-
Bay	☐Yes ☒No	officially
B. Potential Environmental Impacts Will the Project cause…		
Sewerage		
impairment of historical/cultural monuments/areas and loss/damage to these sites?	☐ Yes ☒ No	No historical or cultural sites in the subproject area
interference with other utilities and blocking of access to buildings; nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.?	☒ Yes ☐ No	No interference with other utilities and blocking of access to buildings. However, few sewage lifting and pump stations are located close to the houses, and odor may create nuisance. Necessary measures are included to prevent and control odor; no net negative impacts envisaged
dislocation or involuntary resettlement of people?	☐ Yes ☒ No	Do not involve land acquisition or resettlement
disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?	☐ Yes ☒ No	No such possibilities; .sewerage system will cover entire population including urban poor; In fact, it will have positive health impact due to improved sanitation condition.
impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?	☐Yes ☒No	It is proposed to utilize the available capacity in existing STP, which is functioning well. The treated effluent is discharged as per TNPCB norms.
overflows and flooding of neighboring properties with raw sewage?	☒Yes ☐No	Sewerage system has been designed considering the population growth. It has been designed to accommodate sewage until design year. Design considers standard peak factors and therefore no such impact envisaged.
environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?	☐ Yes ☒ No	-

Screening Questions	Yes/No	Remarks
noise and vibration due to blasting and other civil works?	☒Yes ☐No	No blasting activities envisaged. Temporary nuisance/disturbance due to construction activities will be minimized with appropriate mitigation measures.
risks and vulnerabilities related to occupational health and safety due to physical, chemical and biological hazards during project construction and operation?	☒Yes ☐No	In appropriate handling of sludge may have occupational health hazard. All necessary safety precautions will be taken to avoid any risk.
discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?	☐ Yes ☒ No	There are no sources of hazardous material that will find its way into the sewers. Wastewater other than domestic will not be discharged into the sewers.
inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?	☒ Yes ☐ No	Due to technical constraints and land availability, some lifting and pumping stations are located close to houses, however, necessary measures are included in site planning, design and operation. No net negative impacts envisaged
road blocking and temporary flooding due to land excavation during the rainy season?	☒Yes ☐No	Complete road block are not envisaged; in narrow roads, traffic may be diverted but access will be ensure for pedestrians. All necessary precautions will be taken to prevent flooding during construction; flooding is unlikely as work will be mostly be conducted during dry season.
noise and dust from construction activities?	☒ Yes ☐ No	No major noise generating activities like rock blasting is envisaged. As the sewers will be lain on the road surface, cutting open of road surface using pneumatic drills will produce noise. Appropriate measures are suggested to minimize impact. Dust will be temporary and will be controlled with proper measures.
traffic disturbances due to construction material transport and wastes?	☒Yes ☐No	Proper planning, such as selection of routes and scheduling to avoid peak traffic hours, will be carried out in consultation with concerned authorities
temporary silt runoff due to construction?	☒Yes ☐No	Earthworks will not be conducted during rains; plain topography and moderate to low rains, so no such impact envisaged
hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?	☒Yes ☐No	A chance of failure of sewerage system is very remote; proper design and standard operating procedures will be followed in O and M; necessary equipment and training to workers will be provided
deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?	☐ Yes ☒ No	sludge management plan will be implemented
contamination of surface and ground waters due to sludge disposal on land?	☐ Yes ☒ No	Sludge drying bed and Centrifuge mechanism are available in all the STPs for sludge treatment
Health and safety hazards to workers from toxic gases and hazardous materials which maybe contained in confined areas, sewage flow and exposure to pathogens in untreated sewage and unstabilized sludge?	☒ Yes ☐ No	Manual cleaning of sewers and facilities will be avoided. All necessary health and safety training and necessary personal protection equipment will be given to workers and staff during operation of sewerage system
Large population increase during project construction and operation that causes increased burden on social infrastructure (such as sanitation system)?	☐ Yes ☒ No	No such impact anticipated; local communities in the vicinity of the project would be employed as much as possible.
Social conflicts between construction workers from other areas and community workers?	☐ Yes ☒ No	No such impact anticipated; local communities in the vicinity of the project would be employed as much as possible.

Screening Questions	Yes/No	Remarks
risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?	☐ Yes ☒ No	Not applicable. Construction/operation will not involve use of explosives and chemicals.
community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?	☒Yes ☐No	Operational area will be clearly demarcated and access will be controlled. Only worker and project concerned members will be allowed to visit the construction sites. .

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ENVIRONMENTAL AUDIT OF EXISTING SEWAGE TREATMENT PLANT AT KODUNGAIYUR OF CHENNAI METROPOLITAN WATER SUPPLY AND SEWERAGE BOARD

A. Introduction

1. Under the ADB funded Tamil Nadu Urban Flagship Investment Program (TNUFIP), it is proposed to develop sewer system (sewer collection and conveyance infrastructure) in Manali, Chinnasekkadu, Karambakkam and Manapakkam. Since adequate capacity treatment facility is already available for the City, no new STPs are proposed for the subproject area. Sustainability of new sewer infrastructure and realisation of intended purpose (removing the human waste from those areas served by the network rapidly and treated to an acceptable standard) and benefits (improved environmental conditions, public health etc.) would accrue only with a properly functioning treatment facility. Therefore the existing STP is an associated facility as per the ADB Safeguard Policy Statement 2009. Compliance with the environmental safeguards will ensure the subproject sustainability.

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

3. The sewage generated from the sub project area Manali & Chinnasekkadu will be conveyed and treated in the Kodungaiyur STPs 110 MLD capacity sewage treatment unit. For this unit, required annual renewal fee paid already and the renewal application is under process with TNPCB. As per the TNPCB effluent standards, the treated effluent meets the Pollution Control Board norms. The average BOD of the treated effluent during the year 2016-17 is around 15 mg/l, which is well within the TNPCB norms. The treated effluent from Kodungaiyur STP is discharged in to the North Buckingham canal.

4. Sewage generated from the Karambakkam area will be conveyed to the Koyambedu STPs 120 MLD capacity sewage treatment unit. For this unit required annual renewal fee paid already and the renewal application is under process with TNPCB. The effluent standards from this unit meets the Pollution Control Board norms and the average BOD of the treated effluent during the year 2016-17 is around 11 mg/l. The treated effluent from Koyambedu STP is discharged in to the Cooum.

5. Similarly, sewage generated from the Manapakkam area will be conveyed to the Nesapakkam STPs 54 MLD capacity sewage treatment unit. The annual renewal fee paid already and the renewal application is under process with TNPCB. Regular laboratory test reports taken by TNPCB indicates that the STP effluent is meeting the stipulated disposal standards and the average BOD of the treated effluent during the year 2016-17 is around 16 mg/l. The treated effluents from Nesapakkam sewage treatment plant is discharged into Adyar river.

6. The sludge generated from the above STPs are used to generated Bio gas(Methane CH_4) by way of sludge digestion, which then used has fuel to generate electricity. The generated electricity is used to operate the STPs. The above process reduces the carbon emissions to the atmosphere by way of methane capture from the raw sludge. The digested sludge is then fed into mechanical centrifuge for dewatering the sludge. The dewatered sludge cakes with moisture is then collected and used for landfills inside the STP premises. In order to ascertain the effective

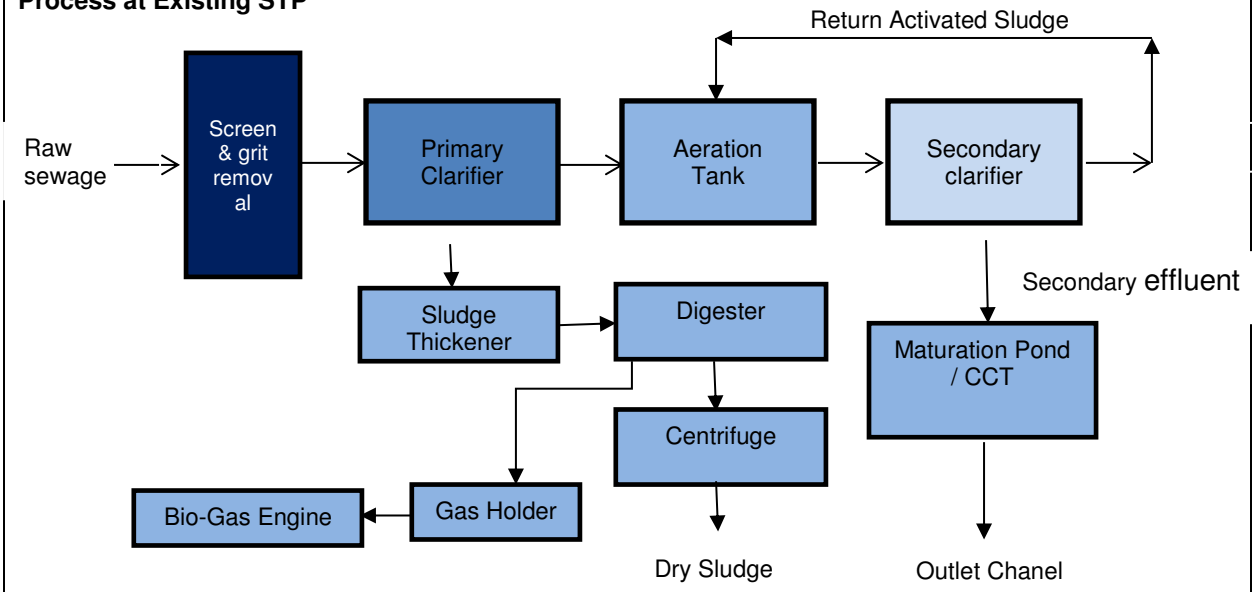
management of the sludge generated, CMWSSB has appointed a consultant to study the sludge and to suggest various methods for disposal and reuse of sludge. After obtaining the DPR from the consultant necessary action will initiated for effective sludge management.

7. The 110 MLD Kodungaiyur STP, 120 MLD Koyambedu STP and 54 MLD Nesapakkam STP are functioning at 95% to 98% treatment efficiency (in terms of BOD removal). All the above treatment plants are equipped with inbuilt lab facilities and the raw sewage and treated effluent quality parameters are analysed daily in this laboratory (Quality parameters are appended) in addition to the quality parameters monitored by TNPCB on monthly basis.

Table A3.1: Description of the Kodungaiyur Sewage Treatment Plant

(For Manali and Chinnasekkadu UGSS)

Location	Kodungaiyur STP Latitude: 13.146205 Longitude: 80.261332
Start of operation (year)	Kodungaiyur STP 80 MLD Zone –I – 1991 80 MLD Zone – II – 1989 110 MLD Zone – II – 2006
Owned by	Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB)
Contact person and designation	Chief Engineer, **O&M-II**
Capacity	Kodungaiyur – 270 (80 + 80 + 110) Million liters per day (MLD)
Sewage treatment process	1.
	Treatment Process at STP: The activated sludge process uses microorganisms to feed on organic contaminants in wastewater, producing a high-quality effluent. The basic principle behind all activated sludge processes is that as microorganisms grow, they form particles that clump together. These particles (floc) are allowed to settle to the bottom of the tank, leaving a relatively clear liquid free of organic material and suspended solids. Described simply, screened wastewater is mixed with varying amounts of recycled liquid containing a high proportion of organisms taken from a secondary clarifying tank, and it becomes a product called mixed liquor. This mixture is stirred and injected with large quantities of air, to provide oxygen and keep solids in suspension. After a period of time, mixed liquor flows to a clarifier where it is allowed to settle. A portion of the bacteria is removed as it settles, and the partially cleaned water flows on for further treatment. The resulting settled solids, the activated sludge, are returned to the first tank to begin the process again. *Preliminary & Primary Treatment* Raw sewage after passing through a manual screen materials of 25mm size will be screened. Settleable solids like grit and inorganic matter in the raw sewage are settled and removed in Detritor Tank. Primary clarifiers provided with central driven scrapper mechanism to settle the solids on the floor of the clarifier which is scrapped to the central pit and surface scum is collected in the scum box. Primary sludge can also withdrawn by motorized valve into the primary sludge sump and then pumped to thickener by primary sludge transfer pumps 60% removal of suspended solids and 40% removal of BOD are achieved in the primary clarifiers. The sludge withdrawn from the Primary clarifiers is staggered by half an hour and each withdrawal will last for 10 minutes and it will have the consistency of 3%. Sludge thickener is provided to thickening of primary sludge and excess activated sludge received from the primary clarifiers and radial flow type ensures thickening of sludge to about 5%. Secondary Treatment:

	The biological treatment is a conventional type activated sludge process in which oxidation, Cell synthesis and endogenous respiration involved. Slow speed fixed type aerators are provided in 4 rows for continuous aeration. The over flow of the primary clarifier is sent to the aeration tank. The return sludge from the secondary clarifier is also collected in the separated sump and pumped into the aeration tank. The MLSS (Mixed Liquid Suspended Solids) of 3500 mg/l and Food to microorganism (F/M) ratio of 0.33 is being maintained. Solids retention time will be 6.75days. The aerated effluent from the aeration tank is conveyed to the secondary clarifier by elevator RCC open channel. The circular type secondary clarifiers settle down all the biomass at the conical bottom and the supernatant (treated sewage) is separated and let into maturation pond where the fecal coli form is reduced discharged in to the nearby open channel leading to Buckingham canal.
Process at Existing STP 	
Treatment efficiency	Normally about 95% to 98% treatment efficiency (BOD removal) is expected in Activated Sludge process STPs. The STP design parameters are BOD – < 20mg/l SS - < 30 mg/l F.Coliform - < 10000 MPN/100 ML The treated effluent parameters are BOD– 16 mg/l SS – 24 mg/l F.Coliform – 7000 MPN/100ML The treated effluent are meeting the standards prescribed by TNPCB
Sludge management	The raw sludge is hydrolyzed and decomposed by the group of anaerobic bacteria called acid formers and methane formers in the Dome type Anaerobic Digesters. Feeding pattern for digester is 2 hours feeding, 2 settling and 4 hours will be mixing. The entire sludge is thoroughly mixed with the sludge mixing pump sets by recirculation process. During the digestion process methane, hydrogen sulphide (H_2S) and carbon di oxide (Co_2) – (Bio Gas) are produced. The solids retention time in the digester is 15 days. Before every feeding digested sludge is wasted. A pressure safety valve with flame arrestor is provided to vent if the designed pressure exceeds. The digested sludge from digesters enters to the sludge balancing tank with agitator and from there it is drawn by screw feed pumps and let into the high speed centrifuge Necessary poly-electrolyte is added through poly dosing pumping to the centrifuge The centrifuge separates the digested sludge in to sludge as a solid cake form and the centrate water. The centrate water is sent to supernatant sump and the filtered water is pumped into the inlet. The cake form sludge is removed manually and filled in the low

	lying area within the plant. Bio gas produced in the digesters enters into the bell type Gas Holder. When the gasholder reaches the high level the gas flow is diverted through butterfly to the gas burner for flaring the excess gas. A pressure relief valve with flame arrestor is also provided for safety purpose. Drip trap is provided on the biogas lines to remove the moisture from the saturated biogas. Bio gas from the gas holder enters into the scrubber The scrubbing systems consist of an aerobic reactor with an absorber and a sulphur recovery unit , It treats hydrogen sulphide containing biogas by washing the gas and converting the sulphide biologically to elemental sulphur. The reduction of concentration of hydrogen sulphide from 1 to 0.1% by scrubbing with caustic solution in the scrubber to meet the requirement of gas engine. PH, Redox , Conductivity has to be monitored within the design limit. The parameters all maintained by adding caustic, nutrients and proper aeration. The Bio gas is utilized to operate the STP with Bio Gas engine is available in Kodungaiyur 100 MLD STP.
Treated wastewater (effluent disposal)	The Kodungaiyur treated effluent from the Maturation pod is discharged in to the North Buckingham canal.

Figure A3.1: View of Kodungaiyur Sewage Treatment Plant

Table A3.2: Compliance with Applicable National and State Laws, Rules, and Regulations

Law, Rules, and Regulations	Description and Requirement	Sewage Treatment Plant at CMWSSB
		Y = compliant (if applicable, specify expiration date of permit/clearance) N = non-compliant[a] N/A = not applicable (state justification)
EIA Notification	The EIA Notification of 2006 states that environmental clearance is required for certain defined activities/projects.	N/A Environmental clearance is not required as STPs are not listed in the EIA Notification's "Schedule of Projects Requiring Prior Environmental Clearance"

Law, Rules, and Regulations	Description and Requirement	Sewage Treatment Plant at CMWSSB
		Y = compliant (if applicable, specify expiration date of permit/clearance) N = non-compliant[a] N/A = not applicable (state justification)
Manufacture, Storage, and Import of Hazardous Chemical Rules, 1989	Storage of chlorine (threshold quantity greater than 10 tons but less than 25 tons) in water treatment plants (WTPs) will require clearance from TN Pollution Control Board .and Directorate of Industrial Health and Safety	N/A No chlorine used or stored in the STP
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Consent to operate from TNPCB	**Kodungaiyur** 110 MLD STP CTO application under process. Annual renewal fees paid for the period 2017-18 and 2018-19.(Renewal pending)
Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	Consent to operate from TNPCB	**Kodungaiyur** 110 MLD STP CTO application under process. Annual renewal fees paid for the period 2017-18 and 2018-19.(Renewal pending) .
Environment (Protection) Act, 1986 and CPCB Environmental Standards	Emissions and discharges from the facilities to be created, refurbished, or augmented shall comply with the notified standards. a. Wastewater disposal standards	As per the CTO issued by TNCPB, STP effluent shall meet the following disposal standards: BOD: <20 mg/l and TSS: < 30 mg/l
Noise Pollution (Regulation and Control) Rules, 2002 amended up to 2010	Applicable ambient noise standards with respect to noise for different areas/zones	No source of noise
National Institute of Occupational Safety and Health (NIOSH) Publication No. 2002-149	Compliance with NIOSH Guidance for Controlling Potential Risks to Workers Exposed to Class B Biosolids	Training and proper PPEs are required
Forest (Conservation) Act, 1980 and Forest Conservation Rules, 2003 as amended	As per Rule 6, every user agency, who wants to use any forest land for non-forest purposes shall seek approval of the central government.	N/A
Ancient Monuments and Archaeological Sites and Remains Rules of 1959	No development activity is permitted in the “protected area,” and all development activities likely to damage the protected property are not permitted in the “controlled area” without prior permission of the Archaeological Survey of India (ASI). Protected property includes the site, remains, and monuments protected by ASI or the State Department of Archaeology.	N/A
The Child Labor (Prohibition and Regulation) Act, 1986	No child below 14 years of age will be employed or permitted to work in any of the occupations set forth in the Act’s Part A of the Schedule or in any workshop wherein any of the	STP is operated by contract staff. No children are engaged.

Law, Rules, and Regulations	Description and Requirement	Sewage Treatment Plant at CMWSSB
		Y = compliant (if applicable, specify expiration date of permit/clearance) N = non-compliant[a] N/A = not applicable (state justification)
	processes set forth in Part B of the Schedule are present.	

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

Table A3.3: Institutional Arrangement

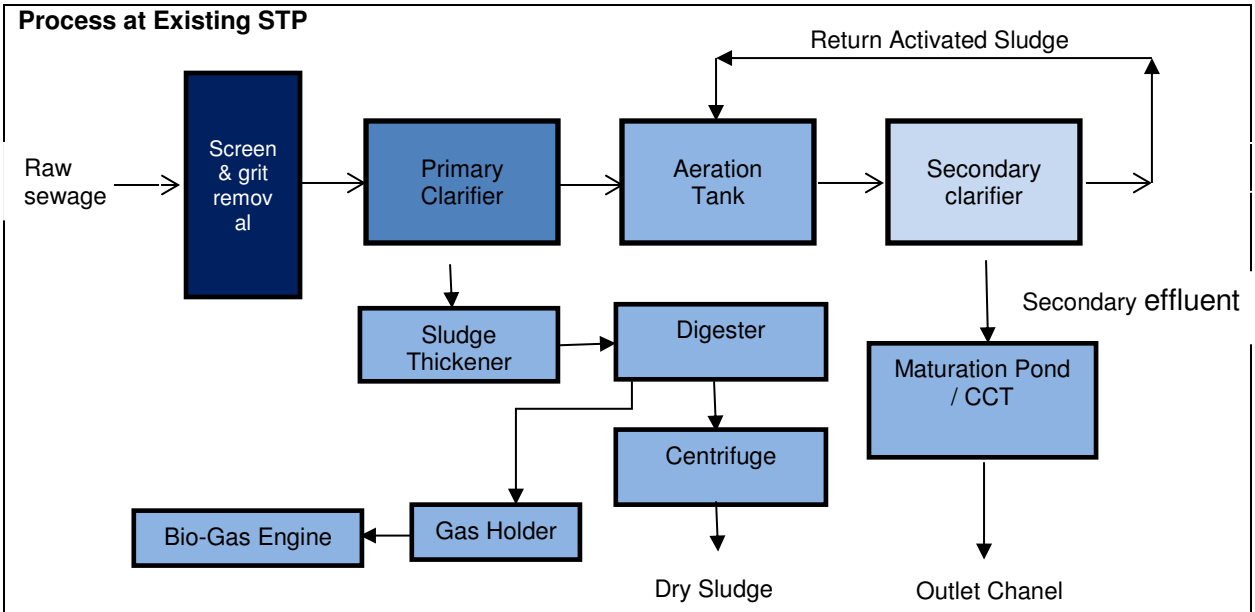
Parameter	Sewage Treatment Plant
Operations	Continuous operation; involves mechanical and electrical operation; Except manual operation for removal of debris from the screen and removal of collected grit from grit chamber, no interference is required in operation of sewage treatment plant (STP).
Manager per shift	Personnel at STP are available in one shift (day shift 9 AM to 6 PM)
Sewerage/public health engineer on-site	
Estimated number of technical employees on-site per shift	**80MLD Plant Zone-I** ChemicalEngineer-1 Diploma holder-3 Electrician-3 Labour -18 **80MLD Plant Zone-II** ChemicalEngineer-1 Diploma holder-3 Electrician-3 Labour -21 110MLD STP Plant Manager -1 Process Head-1 Electrical Engieener-1 Mechanical enginerr-1 Electrician-4- Mechanic-4 Chemist-1 Shift engineers-4 Gas engine operatos-5 Helper-4 Field Worker-16
Estimated number of laborers on-site per shift	
Estimated number of employees in charge of environmental management and monitoring	Nil
Frequency of waste water quality monitoring (raw)	Monthly
Frequency of wastewater quality monitoring (treated)	Monthly
Frequency of sludge quality monitoring	not conducted
In-house laboratory for water quality analyses (Yes/None). If none, provide name of third-party laboratory.	In-house laboratory is available at the STP; apparatus to conduct pH, BOD, COD and TSS available Laboratories of TNPCB available in Chennai

Table A3.4: Description of the Koyambedu Sewage Treatment Plant
(For Karambakkam UGSS)

Location	Koyambedu STP Latitude: 13.068740 Longitude: 80.200695
Start of operation (year)	Koyambedu –STP 34 MLD – 1978 60 MLD - 2005 120 MLD - 2015
Owned by	Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB)_
Contact person and designation	Chief Engineer, **O&M-II**
Capacity	Koyambedu – 214 Million liters per day (MLD)
Sewage treatment process	Activated Sludge Process (ASP) sewage treatment plant. Facility has the following components: (i) Manual / Mechanical screening, (ii) Mechanical grit removal, (iii) Primary Clarifier (iv) Aeration Tank (v) Secondary Clarifier (vi) Chlorine Contact Tank. Technical details of STP units are as follows: **KOYAMBEDU STP** 34 MLD STP Detritor tank - 2 Nos. of 10.70 x 10.70 x 0.9 m each Primary Clarifier - 2 Nos. of 36.60 m dia /2.70 m depth each Primary Digester - 1 No. of 26.0 m dia/5.80 m height Sludge Mixing Pump house - 2 Nos. of 75 HP each Secondary Digester - 1 No. of 26.0 m dia/5.30 m height Centrifuge for sludge handling - 2 Nos. of 30 HP each Sludge drying beds - 30 Nos. of 30.50 x 12.20 m each a) Aeration Tank - 2 Compartments of 29.20x29.0x4m each b) Details of Aerators - Fixed Aerators 8 Nos. of 50 HP each Arch median screw pump - 2 Nos. of 75 HP each Secondary clarifier - 2 Nos. of 33.50 m dia, 2.40m depth each Balancing Tanks - 4 Nos. of 4800 cu.m capacity each Details of Transformer - 2 Nos. of 1000 KVA each Details of D.G. Set - 1 No. of 1000 KVA 60 MLD i. Detritus tank - 2 Nos. of 12.2m x 12.2m x 1.0m LD each ii. Primary Clarifier - 2 Nos. of 37.7m(Dia) x 3.5m(SWD) each iii. Sludge Digester - 2 Nos. of 25.0mm(Dia) x 8.1m(SWD) each iv. Gas Holder - 2 Nos. of 18.0m (Dia) x 7.2m(SWD) each v. Sludge Thickener - 1 No. of 27.0m dia x 3.5m (SWD) vi. Sludge Mixing Pumps - 3 Nos. of 40 HP each vii. Centrifuge for sludge handling - 2 Nos. of 30 HP each viii. a) Aeration Tank - 2 Compartments of 70.0mx22.0mx4.5m(SWD) b) Details of Aerators - Fixed Aerators 6 Nos. of 60 HP 2 Nos. of 75 HP ix. Secondary clarifier - 2 Nos. of 41.2m dia x 3.5m (SWD) x. Details of Transformer - 2 Nos. of 1000 KVA each xi. Details of D.G. Set - 2 No. of 400 KVA xii. Bio-Gas Engine - 1 No. of 625 KW 120 MLD i. Detritus Tank - 4 Nos. of 12.60m x 12.60m x 1.40m (Each) ii. Balancing Tank - 1 No. of 58.30m Dia x 5.00m iii. Primary Clarifier - 4 Nos. of 33.00m Dia x 3.50 SWD (Each)

	iv. Aeration Tank - 4 Nos. of 50.00m x 25.00m x 5.50m (Each) v. Secondary Clarifiers - 4 Nos. of 41.70m Dia x 3.50m SWD (Each) vi. Chlorine Contact Tank- 2 Nos.of 30.00m x 14.00m x 3.50m (Each) vii. Treated Effluent Sump-120 MLD - 1 No. of 15.85m x 11.00m x3.50m viii. Sludge Thickener - 2 Nos. of 25.60m Dia x 4.00m (Each) ix. Thickened Sludge Sump - 1 No. of 8.00m Dia x 5.45m x. Sludge Digesters - 4 Nos. of 22.3m Dia x 8.80m (Each) xi. Gas holding Tank - 2 Nos. of 27.70m Dia x 4.30m SWD (Each) xii. Centrifuge Building - 12.73m x 6.45m x 5.00m Height (2 Floors) xiii. Details of DG - 3 Nos. of 750 KVA (Each) xiv. Details of Transformer - 1 No. of 1000 KVA
	Treatment Process at STP The activated sludge process uses microorganisms to feed on organic contaminants in wastewater, producing a high-quality effluent. The basic principle behind all activated sludge processes is that as microorganisms grow, they form particles that clump together. These particles (floc) are allowed to settle to the bottom of the tank, leaving a relatively clear liquid free of organic material and suspended solids. Described simply, screened wastewater is mixed with varying amounts of recycled liquid containing a high proportion of organisms taken from a secondary clarifying tank, and it becomes a product called mixed liquor. This mixture is stirred and injected with large quantities of air, to provide oxygen and keep solids in suspension. After a period of time, mixed liquor flows to a clarifier where it is allowed to settle. A portion of the bacteria is removed as it settles, and the partially cleaned water flows on for further treatment. The resulting settled solids, the activated sludge, are returned to the first tank to begin the process again. Preliminary & Primary Treatment: Raw sewage after passing through a manual screen materials of 25mm size will be screened . Settleable solids like grit and inorganic matter in the raw sewage are settled and removed in Detritor Tank. Primary clarifiers provided with central driven scrapper mechanism to settle the solids on the floor of the clarifier which is scrapped to the central pit and surface scum is collected in the scum box. Primary sludge can also withdrawn by motorized valve into the primary sludge sump and then pumped to thickener by primary sludge transfer pumps 60% removal of suspended solids and 40% removal of BOD are achieved in the primary clarifiers. The sludge withdrawn from the primary clarifiers is staggered by half an hour and each withdrawal will last for 10 minutes and it will have the consistency of 3%. Sludge thickener is provided to thickening of primary sludge and excess activated sludge received from the primary clarifiers and radial flow type ensures thickening of sludge to about 5%. Secondary Treatment: The biological treatment is a conventional type activated sludge process in which oxidation, Cell synthesis and endogeneous respiration involved. Slow speed fixed type aerators are provided in 4 rows for continuous aeration. The over flow of the primary clarifier is sent to the aeration tank. The return sludge from the secondary clarifier is also collected in the separated sump and pumped into the aeration tank.The MLSS (Mixed Liquid Suspended Solids) of 3500 mg/l and Food to micro organism (F/M) ratio of 0.33 is being maintained. Solids retention time will be 6.75days. The aerated effluent from the aeration tank is conveyed to the secondary clarifier by elevator RCC open channel. The circular type secondary clarifiers settle down all the biomass at the conical bottom and the supernatant (treated sewage) is separated and let into maturation pond where the fecal coli form is reduced discharged in to the nearby open channel leading to Buckingham canal.

Process at Existing STP



Treatment efficiency	Normally about 95% to 98% treatment efficiency (BOD removal) is expected in Activated Sludge process STPs. The STP design parameters are BOD – < 20mg/l SS - < 30 mg/l F.Coliform - < 10000 MPN/100 ML The treated effluent parameters are BOD – 11 mg/l SS – 18 mg/l F.Coliform – 6000 MPN/100ML The treated effluent are meeting the standards prescribed by TNPCB.
Sludge management	The Raw Sludge from the sewage is collected at the underflow of Primary clarifier and pumped to sludge thickener for increasing the sludge concentration. After the sludge thickening, the thickened sludge is fed into sludge digester for Anaerobic bacterial process. The detention time in sludge digestor is 15 days, during which Bio gas is generated for the sludge. The Bio gas from the sludge digester is used to generate Electricity, which is used for operating the STP units. The digested sludge is then send to mechanical centrifuge for sludge dewatering, the digested sludge is dewatered in centrifuge by adding polyelectrolyte. The dried sludge with moisture is then collected and used as landfills inside the STP premises. There are no specific standard for disposal sludge as per TNPCB.
Treated wastewater (effluent disposal)	The Koyambedu treated effluent from the Chlorine contact tank is discharged in to the Coovam

Figure A3.2: View of Koyambedu Sewage Treatment Plant

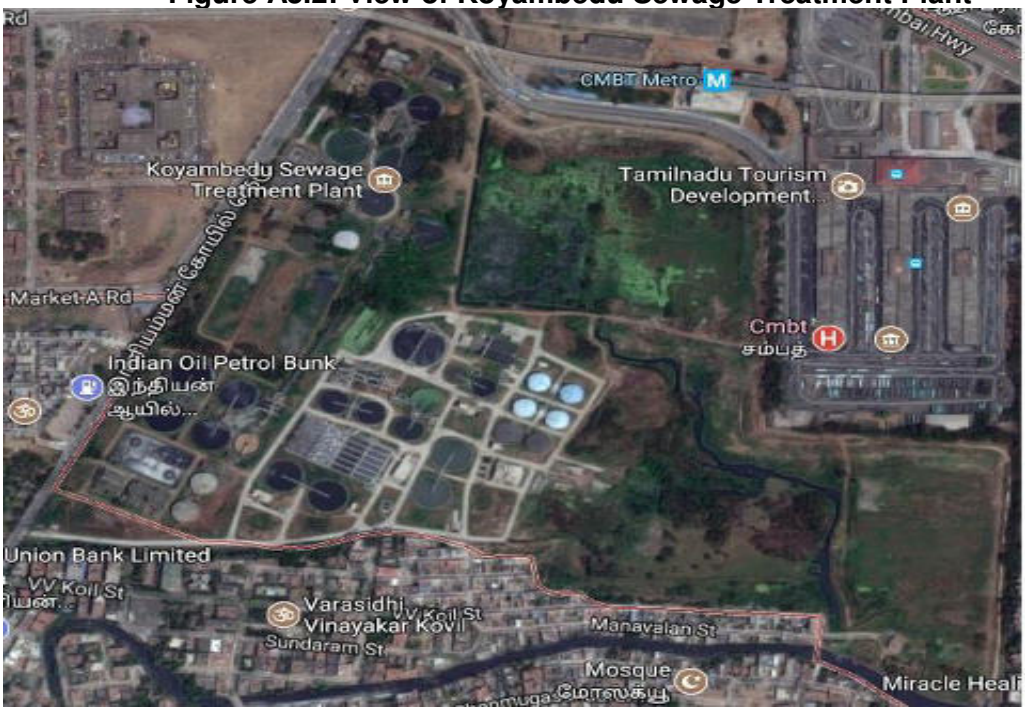


Table A3.5: Compliance with Applicable National and State Laws, Rules, and Regulations

Law, Rules, and Regulations	Description and Requirement	Sewage Treatment Plant at CMWSSB
		Y = compliant (if applicable, specify expiration date of permit/clearance) N = non-compliant[a] N/A = not applicable (state justification)
EIA Notification	The EIA Notification of 2006 states that environmental clearance is required for certain defined activities/projects.	N/A Environmental clearance is not required as STPs are not listed in the EIA Notification's "Schedule of Projects Requiring Prior Environmental Clearance"
Manufacture, Storage, and Import of Hazardous Chemical Rules, 1989	Storage of chlorine (threshold quantity greater than 10 tons but less than 25 tons) in WTPs will require clearance from PESO	.Yes. chlorine used or stored in the STP. Renewal license approved.
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Consent to operate from TNPCB	**Koyambedu** 120 MLD STP CTO obtained from TNPCB and valid up to 31.03.2018. .
Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	Consent to operate from TNPCB	**Koyambedu** 120 MLD STP CTO obtained from TNPCB and valid up to 31.03.2018.
Environment (Protection) Act, 1986 and CPCB Environmental Standards	Emissions and discharges from the facilities to be created, refurbished, or augmented shall comply with the notified standards. a. Wastewater disposal standards	As per the CTO issued by TNCPB, STP effluent shall meet the following disposal standards: BOD: <20 mg/l and TSS: < 30 mg/l

Law, Rules, and Regulations	Description and Requirement	Sewage Treatment Plant at CMWSSB
		Y = compliant (if applicable, specify expiration date of permit/clearance) N = non-compliant[a] N/A = not applicable (state justification)
Noise Pollution (Regulation and Control) Rules, 2002 amended up to 2010	Applicable ambient noise standards with respect to noise for different areas/zones	No source of noise
National Institute of Occupational Safety and Health (NIOSH) Publication No. 2002-149	Compliance with NIOSH Guidance for Controlling Potential Risks to Workers Exposed to Class B Biosolids	Training and proper PPEs are required
Forest (Conservation) Act, 1980 and Forest Conservation Rules, 2003 as amended	As per Rule 6, every user agency, who wants to use any forest land for non-forest purposes shall seek approval of the central government.	N/A
Ancient Monuments and Archaeological Sites and Remains Rules of 1959	No development activity is permitted in the "protected area," and all development activities likely to damage the protected property are not permitted in the "controlled area" without prior permission of the Archaeological Survey of India (ASI). Protected property includes the site, remains, and monuments protected by ASI or the State Department of Archaeology.	N/A
The Child Labor (Prohibition and Regulation) Act, 1986	No child below 14 years of age will be employed or permitted to work in any of the occupations set forth in the Act's Part A of the Schedule or in any workshop wherein any of the processes set forth in Part B of the Schedule are present.	STP is operated by contract staff. No children are engaged.

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

Table A3.5: Institutional Arrangement

Parameter	Sewage Treatment Plant
Operations	Continuous operation; involves no mechanical or electrical operation; Except manual operation for removal of debris from the screen, and removal of collected grit from grit chamber, no interference is required in operation of STP.
Manager per shift	Personnel at STP are available in one shift (day shift 9 a.m. to 6 p.m.)
Sewerage/public health engineer on-site	
Estimated number of technical employees on-site per shift	**34 MLD Plant** Electical Engineert-1 Chemist-1 Diploma holder-6 Labour -12 **60 MLD Plant** Electrical Engineer-1 Chemist-1
Estimated number of laborers on-site per shift	

Parameter	Sewage Treatment Plant
	Diploma holder-6 Labour 9 **120MLD STP** **Plant Manager -1** **Process Head-1** **Dilpoma -4** **Mechanical Engineer-1** **Electrician-3-** **Mechanic-4** **Chemist-1** **Gas engine operatos-4** **Helper-6**
Estimated number of employees in charge of environmental management and monitoring	Nil
Frequency of waste water quality monitoring (raw)	Monthly
Frequency of wastewater quality monitoring (treated)	Monthly
Frequency of sludge quality monitoring	not conducted
In-house laboratory for water quality analyses (Yes/None). If none, provide name of third-party laboratory.	In-house laboratory is available at the STP; apparatus to conduct pH, BOD, COD and TSS available Laboratories of TNPCB available in Chennai

Table A3.6: Description of the Nesapakkam Sewage Treatment Plant

(For Manapakkam UGSS)

Location	Nesapakkam, Chennai City Latitude: 8°45'25.00"N Longitude: 77°40'48.00"E
Start of operation (year)	2014
Owned by	Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB)
Contact person and designation	Chief Engineer(O&M) – II, CMWSS Board
Capacity	54 million liters per day (MLD)
Sewage treatment process	Activated Sludge Process (ASP) based sewage treatment plant. Facility has the following components: (i) Manual/Mechanical screening, (ii) Grit removal, (iii) Primary clarifier, (iv) Aeration Tank (v) Secondary Clarifier, (vi) Disinfection system, (vii) Sludge digester (viii) Gas holder, (ix) Bio gas engine and (x) centrifuge. (ii) Technical details of STP units are as follows: 1) Inlet chamber - 1 no. of 4.4 m x 4.0 x 2.1m depth 2) Screen chamber - 2 nos of 15.0 m x 1.85 m x1.05m depth 3) Detritus tank - 2 nos. of 10.5m x 10.5m x 1.60m depth 4) Primary clarifier - 2 nos. of 33.5mdia x 3.8m depth 5) Sludge Thickener - 1 no. of 27.5 m dia x 3.8 m depth 6) Digestor - 2 nos of 24m dia/9.2m height 7) Gas Holding Tank - 1 no of 27.2m x 6m each 8) Aeration Tank - 2 no of 64mx20mx4.5m depth 9) Secondary clarifier - 2 nos. of 42m dia x 5 m depth each 10) Chlorine Contact tank - 1 no. of 35.5m x8mx 5m depth 11) Centrifuge - 2 nos of 25Kg capacity/h 12) Gas Engine - 1 no. of 1064 KW
	Treatment Process at STP: ❖ The Treatment of Sewage May Be Divided Into Three Stages :

1. Primary Treatment
2. Secondary Treatment with disinfection.
3. Sludge Treatment.

1. **Primary Treatment**

1.1. SCREENING: Sewage arriving at a sewage treatment works is first passed through a metal screen (Bar screen) which intercepts large floating objects such as pieces of wood, rags, masses of garbage and dead animals.

The characteristics of incoming sewage are as follows:

B.O.D	350mg/l
S.S	450mg/l

Gross Solids Are Removed For Two Reasons :

If they are discharged into a water course they could cause visibly objectionable pollution.

They could result in blockage of and damage to pipe work and machinery.

The screen consists of vertical or inclined steel bars, spaced usually 20mm to 25mm apart so that any suspended or floating materials larger than this are deposited on the screen.

1.2. **Grit Removal** :

Sewage is then passed through a square chamber called the Grit chamber or detritus chamber. This chamber is approximately 10 to 20 metres in length. It is so designed as to maintain a constant velocity of about 1 foot per second with a detention period of 30 seconds to 1 minute. At this velocity grit will settle out but organic material will remain in suspension. The function of the grit chamber is to allow the settlement of heavier solids such as sand and gravel while permitting the organic matter to pass through. The deposited grit is removed from the collecting chamber by mechanical means. Grit consists of materials such as silt, sand. Gravel, ash, metal and glass.

1.3. **Primary Sedimentation**:

Sewage is now allowed into a huge tank called the primary sedimentation tank or primary clarifier. The sewage spends about 30 minutes to 2 hours in this tank. During this period 50 to 70% of the solids settle down under the influence of gravity, as sewage is a naturally flocculating substance. These are in other words settle able solids. A reduction between 30 to 40% in the number of coliform organism is obtained. The organic matter which settles down is called sludge and is removed by bottom scrapers, through a sludge well and submersible pumps, without disturbing the operation in the tank.

2. **SECONDARY TREATMENT**

All STPs activated sludge process is adopted. The 'Heart' of the activated sludge process is the aeration tank.

The effluent from the primary clarifier (primary sedimentation tank) is mixed with sludge drawn from the Secondary clarifier (final settling tank). This sludge is also known as activated sludge or return sludge. This sludge is rich culture of aerobic organisms. The proportion of activated sludge to the incoming primary effluent is about 30% to 40%.

Therefore microorganisms rapidly multiply by consuming organic matter from sewage (Primary effluent) usually.

An optimum of 2 mg/l of dissolved oxygen is required for the aerobic activities to take place effectively. In the aeration tanks the mixed liquor suspended solids is maintained between 3000 and 3500 mg/l.

2.1 **Secondary Sedimentation:**

The oxidized sewage from the aeration tank is led into the secondary clarifier (Secondary sedimentation tank) where it is detained for 3.5 to 4 hours. The sludge that collects in the secondary sedimentation tank is called Biomass sludge or activated sludge.

Part of the activated sludge is return back into the aeration tank in the activated sludge process and the wasted into the sludge digestion tanks for sludge treatment and safe disposal.

3. **Anaerobic Digester:**

One million gallons of sewage produces 15 – 20 tons of sludge. The sludge is a thick, black mass containing 95% of water and it has a revolting odor. Hence it needs conditioning to get odorless thick format sludge.

The high rate anaerobic digesters are provided for sludge treatment. The thickened sludge is feed into the digester after thickener. If sludge is incubated under favourable conditions of temperature and pH, it undergoes anaerobic auto-digestion in which complex solids are broken down into water, carbon dioxide, methane and ammonia. The volume of sludge is also considerably reduced. It takes 14days or longer for complete sludge digestion. During the digestion process, Methane, Carbon-di-oxide and traces of other gases are produced and are collected at the dome. The digested sludge settled at the bottom is transferred to the centrifuge unit for de-watering. The supernatant liquid collected at the top transferred to the inlet chamber of primary clarifier.

3.1 Bio Gas Collection and Power Generation:

The bio gas generated from the digesters is collected and holed in the floating type gas holding tank for 12H. Then the gas is purified by the biogas scrubbing unit. The unwanted hydrogen sulphide (H2S) and carbon –di-oxide (CO2) are removed from the biogas. The purified form of gas having 65 to 70% of methane (CH4) is fed in to the bio gas engine. The gas engine generates electrical power by using the methane (CH4) as fuel. It converts 1 m^3 of bio gas in to 2 units of electrical energy approximately. The electrical energy is utilized for operating the electrical equipment of STP.

3.2 **Dewatering of Sludge:**

The digested sludge withdrawn from the bottom of the digester is pumped in to the Centrifuge unit. It segregates the sludge and water by using a high speed rotating bowl. The sludge is disposed into the low-lying areas inside the STP campus.

3.3 **Disposal of Effluent** :

The treated effluent is disposed into the nearby water courses such as rivers and streams is called “disposal by dilution” with safe effluent standards. The Pollution Control Board recommended that “an effluent from a sewage treatment plant should not have more than 30mg/l of Total Suspended Solids and the 5 days B.O.D should not exceed 20 mg/l.

Process at Existing Sewage Treatment Plant

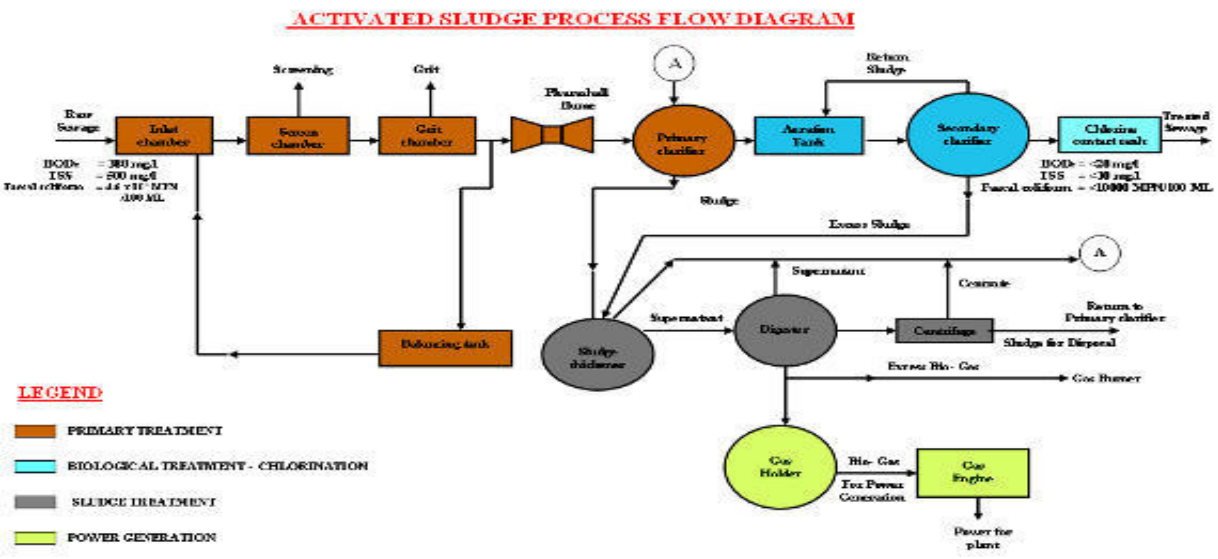


Figure A3.3: View of Existing Nesapakkam Sewage Treatment Plant

Treatment efficiency	The Nesapakkam treatment plant operates with 95% treatment efficiency and the treated effluent parameters are as follows. As per TNPCB Standard - B.O.D = 20mg/L, T. S.S.=30mg/L Fecal Coliform = 10000 MPN/100ml As Achieved at Nesapakkam STP - B.O.D< 16 mg/L T.S.S< 25 mg/L Fecal Coliform < 7000 MPN/100ml
Sludge management	The Raw Sludge from the sewage is collected at the underflow of Primary clarifier and pumped to sludge thickener for increasing the sludge concentration. After the sludge thickening, the thickened sludge is fed into sludge digestor for Anaerobic bacterial process. The dentention time in sludge digestor is 15 days, during which Bio gas is generated for the sludge. The Bio gas from the sludge digester is used to generate Electricity, which is used for operating the STP units. The digested sludge is then send to mechanical centrifuge for sludge dewatering, the digested sludge is dewatered in centrifuge by adding polyelectrolyte. The dried sludge with moisture is then collected and used as landfills inside the STP premises. There are no specific standard for disposal sludge as per TNPCB.
Treated wastewater (effluent disposal)	The final treated effluents norms from Nesapakkam sewage treatment plant adhering to the TNPCB norms from is discharged into Adyar river.

Table A3.7: Compliance with Applicable National and State Laws, Rules, and Regulations

Law, Rules, and Regulations	Description and Requirement	Sewage Treatment Plant at Nesapakkam, Chennai
		Y = compliant (if applicable, specify expiration date of permit/clearance) N = non-compliant[a] N/A = not applicable (state justification)
EIA Notification	The EIA Notification of 2006 states that environmental clearance is required for certain defined activities/projects.	N/A Environmental clearance is not required as STPs are not listed in the EIA Notification's "Schedule of Projects Requiring Prior Environmental Clearance"
Manufacture, Storage, and Import of Hazardous Chemical Rules, 1989	Storage of chlorine (threshold quantity greater than 10 tons but less than 25 tons) in STPs will require clearance from PESO	Renewal License application put up Approval awaited.
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Consent to operate from TNPCB	The Consent to operate has been obtained from TNPCB and valid up to 31.03.2018.
Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	Consent to operate from TNPCB	
Environment (Protection) Act, 1986 and CPCB Environmental Standards	Emissions and discharges from the facilities to be created, refurbished, or augmented shall comply with the notified standards. a. Wastewater disposal standards	As per the CTO issued by TNCPB, STP effluent shall meet the following disposal standards: BOD: <20 mg/l Fecal Coliform = 10000 MPN/100ml and TSS: < 30 mg/l Available laboratory reports indicate that STP effluent is meeting the stipulated disposal standards.
Noise Pollution (Regulation and Control) Rules, 2002 amended up to 2010	Applicable ambient noise standards with respect to noise for different areas/zones	No source of noise
National Institute of Occupational Safety and Health (NIOSH) Publication No. 2002-149	Compliance with NIOSH Guidance for Controlling Potential Risks to Workers Exposed to Class B Biosolids	The personnel employed in the sewage treatment plant are provided with frequent training with respect to safety and health.
Forest (Conservation) Act, 1980 and Forest Conservation Rules, 2003 as amended	As per Rule 6, every user agency, who wants to use any forest land for non-forest purposes shall seek approval of the central government.	N/A
Ancient Monuments and Archaeological Sites and Remains Rules of 1959	No development activity is permitted in the "protected area," and all development activities likely to damage the protected property are not permitted in the "controlled area" without prior permission of the Archaeological Survey of India (ASI). Protected property includes the site, remains, and monuments protected by ASI or the State Department of Archaeology.	N/A

Law, Rules, and Regulations	Description and Requirement	Sewage Treatment Plant at Nesapakkam, Chennai
		Y = compliant (if applicable, specify expiration date of permit/clearance) N = non-compliant[a] N/A = not applicable (state justification)
The Child Labor (Prohibition and Regulation) Act, 1986	No child below 14 years of age will be employed or permitted to work in any of the occupations set forth in the Act's Part A of the Schedule or in any workshop wherein any of the processes set forth in Part B of the Schedule are present.	STP is operated by **CMWSSB** staff. No children are engaged.

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

Table A3.8: Institutional Arrangement

Parameter	Sewage Treatment Plant
Operations	Daily (24 x 7)
Manager per shift	Personnel at STP are available in one shift (day shift 9 AM to 6 PM)
Sewerage/public health engineer on-site	
Estimated number of technical employees on-site per shift	12 Nos
Estimated number of laborers on-site per shift	18 Nos
Estimated number of employees in charge of environmental management and monitoring	Nil
Frequency of waste water quality monitoring (raw)	Daily
Frequency of wastewater quality monitoring (treated)	Daily
Frequency of sludge quality monitoring	Half yearly
In-house laboratory for sewage quality analyses (Yes/None). If none, provide name of third-party laboratory.	In-house laboratory is available at the STP

By Registered Post with Acknowledgement Due
(This document contains 2 Pages)

TAMILNADU POLLUTION CONTROL BOARD

RENEWAL OF CONSENT ORDER NO. : 854 **DATED : 02.02.2015**

Proceedings No. : F. CHN1033/RL/DEE/TNPCB/CHN/A/2015 dated 02.02.2015

Sub : Tamil Nadu Pollution Control Board - RENEWAL OF CONSENT – **M/s Chennai Metropolitan Water Supply & Sewerage Board, Kodungaiyur Sewage Treatment Plant 110 MLD, RS No.62, 63/1, 63/2, 169/1, Selavoyal Village, Kodungaiyur, Chennai District** - Renewal of Consent for operation of the plant and discharge of emissions under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987 (Central Act 14 of 1981) – Issued – Reg.

Ref :
1. Proc. No.DEE/CHN/TNPCB/OL 87 /2006/A DT: 02.03.2007
2. Proc. No.F.CHN1033/RL/DEE/TNPCB/CHN/A/2013 DT: 27/11/2013
3. Unit's application for Renewal of consent dated 10.04.2014
4. I.R. No. : F.CHN1033/RL/DEE /CHN /2015 dated 02.02.2015

RENEWAL OF CONSENT is hereby granted under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987 (Central Act 14 of 1981) (hereinafter referred to as "The Act") and the rules and orders made there under to

The Superintending Engineer (Construction Sewerage),
M/s Chennai Metropolitan Water Supply & Sewerage Board
Kodungaiyur Sewage Treatment Plant 110 MLD,
RS No.62, 63/1, 63/2, 169/1,
Selavoyal Village, Kodungaiyur,
Chennai District

Authorizing the occupier to operate the industrial plant in the Air Pollution Control Area as notified by the Government.

This is subject to the provisions of the Act, the rules and the orders made there under and the terms and conditions incorporated under the Special and General conditions stipulated in the Consent Order issued earlier and subject to the special conditions annexed.

This RENEWAL OF CONSENT is valid for the period ending 31.03.2015.
(Thirty first March Two Thousand Fifteen)

20/2/2015

District Environmental Engineer
Tamil Nadu Pollution Control Board
Chennai

SPECIAL CONDITIONS

TAMILNADU POLLUTION CONTROL BOARD

Sl. No.	Description	Quantity	Unit
a	***Main Products manufactured:***		
1.	Sewage Treatment plant To Treat	110	MLD
b	***By/Intermediate products manufactured:***		

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

I. Point source emission with stack:				
Sl. No.	*Source of Emission*	*APC measures to be provided*	*Point of Discharge-Stack height (in metres)*	Maximum discharge in cubic metre/hr.

1. The unit shall adhere to Ambient Air quality/Stack Emission/ Ambient Noise Level standards prescribed by the Board.
2. The unit shall take all safety precautions while carrying out maintenance work / repair work in the STP to avoid any accident.

20/2/2015

District Environmental Engineer
Tamil Nadu Pollution Control Board
Chennai

20/2/2015

To

The Superintending Engineer (Construction Sewerage),
M/s Chennai Metropolitan Water Supply & Sewerage Board
Kodungaiyur Sewage Treatment Plant 110 MLD,
Selavoyal Village, Kodungaiyur,
Chennai District

Copy to

1. The Commissioner, Chennai Corporation, Fort-Tondiarpet Taluk, Chennai District

By Registered Post with Acknowledgement Due
(This document contains 2 Pages)

TAMILNADU POLLUTION CONTROL BOARD

RENEWAL OF CONSENT ORDER NO. : 854 DATED : 02/02/2015

Proceedings No. : F. CHN1033/RL/DEE/TNPCB/CHN/W/2015 dated 02/02/2015

Sub : Tamil Nadu Pollution Control Board - RENEWAL OF CONSENT – **M/s Chennai Metropolitan Water Supply & Sewerage Board, Kodungaiyur Sewage Treatment Plant 110 MLD, RS No.62, 63/1, 63/2, 169/1, Selavoyal Village, Kodungaiyur, Chennai District** - Renewal of Consent for the operation of the plant and discharge of sewage 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. Proc. No.DEE/CHN/TNPCB/OL 87 /2006/W DT: 02.03.2007
2. Proc. No.F.CHN1033/RL/DEE/TNPCB/CHN/W/2013 DT: 27/11/2013
3. Unit's application for Renewal of consent dated 10.04.2014
4. I.R. No. : F.CHN1033/RL/DEE /CHN /2015 dated 02.02.2015

RENEWAL OF CONSENT 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 Superintending Engineer (Construction Sewerage),
M/s Chennai Metropolitan Water Supply & Sewerage Board
Kodungaiyur Sewage Treatment Plant 110 MLD,
RS No.62, 63/1, 63/2, 169/1,
Selavoyal Village, Kodungaiyur, Chennai District

Authorising the occupier to make discharge of sewage.

This is subject to the provisions of the Act, the rules and the orders made there under and the terms and conditions incorporated under the Special and General conditions stipulated in the Consent Order issued earlier and subject to the special conditions annexed.

This RENEWAL OF CONSENT is valid for the period ending 31.03.2015.
(Thirty first March Two Thousand Fifteen)

District Environmental Engineer
Tamil Nadu Pollution Control Board
Chennai

SPECIAL CONDITIONS

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

TAMILNADU POLLUTION CONTROL BOARD

2. This renewal of consent is valid for operating the facility with the below mentioned permitted 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.

EFFLUENT TYPE	OUTLET NUMBER	DESCRIPTION OF OUTLET	MAXIMUM DAILY DISCHARGE (IN KLD)	POINT OF DISPOSAL
Sewage	1	Sewage 1	110	Discharged in Buckingham canal

1. The unit shall ensure that the solid waste generated in the premises shall be disposed then and there without any accumulation.
2. The unit shall operate the STP provided continuously and efficiently so as to satisfy the standards prescribed by the Board.
3. The unit shall reuse the treated sewage to the maximum possible extent for beneficial use.
4. The unit shall remove all the bushes grown in the STP area and to maintain good housekeeping.
5. The unit shall install gas flow meter in the primary anaerobic digester and monitor the same.
6. The unit shall utilize only the centrifuge for sludge dewatering and the sludge drying beds shall be kept as a standby arrangement.
7. The unit shall disinfect the treated sewage before letting into the channel joining with Buckingham canal.
8. The unit shall furnish the consolidated daily flow of STP for every month regularly.
9. The unit shall take all safety precautions while carrying out maintenance work/repair work in the STP to avoid any accident.

District Environmental Engineer
Tamil Nadu Pollution Control Board
Chennai

20/02/2015

To

The Superintending Engineer (Construction Sewerage),
M/s Chennai Metropolitan Water Supply & Sewerage Board
Kodungaiyur Sewage Treatment Plant 110 MLD,
Selavoyal Village, Kodungaiyur,Chennai District

Copy to

TAMILNADU POLLUTION CONTROL BOARD

CONSENT ORDER NO. 170826096188 DATED: 29/08/2017.

PROCEEDINGS NO.T.I/TNPCB/F.0088CHN/RL/CHN/A/2017 DATED: 29/08/2017

SUB: Tamil Nadu Pollution Control Board - RENEWAL OF CONSENT –M/s. NEW 120 MLD STP AT KOYAMBEDU BY CMWSSB , S.F.No. 1/1, KOYEMBEDU village, Ambujikarai Taluk and Chennai District - Renewal of Consent for the operation of the plant and discharge of emissions under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987 (Central Act 14 of 1981) - Issued- Reg.

REF: 1. CTO Proc. No.F.0088CHN/RL/OE/E/TNPCB/CHN/W&A/2015 dated 21/08/2015
2. DEE's IR. No : F.0088CHN/RL/AE/CHN/2017 dated 05/08/2017

RENEWAL OF CONSENT is hereby granted under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987 (Central Act 14 of 1981) (hereinafter referred to as "The Act") and the rules and orders made there under to

Superintending Engineer V
M/s.NEW 120 MLD STP AT KOYAMBEDU BY CMWSSB,
S.F.No. 1/1,
KOYEMBEDU village,
Ambujikarai Taluk,
Chennai District.

Authorizing the occupier to operate the industrial plant in the Air Pollution Control Area as notified by the Government and to make discharge of emission from the stacks/chimneys.

This is subject to the provisions of the Act, the rules and the orders made there under and the terms and conditions incorporated under the Special and General conditions stipulated in the Consent Order issued earlier and subject to the special conditions annexed.

This RENEWAL OF CONSENT is valid for the period ending March 31, 2018

R. VIJAYABASKARAN

For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai

TAMILNADU POLLUTION CONTROL BOARD

CONSENT ORDER NO. 170816096188 DATED: 29/08/2017.

PROCEEDINGS NO.T1/TNPCB/F.0088CHN/RL/CHN/W/2017 DATED: 29/08/2017

SUB: Tamil Nadu Pollution Control Board - RENEWAL OF CONSENT – M/s. NEW 120 MLD STP AT KOYAMBEDU BY CMWSSB , S.F.No. 1/1, KOYEMBEDU village, Aminjikarai Taluk and Chennai District - Renewal of Consent for the operation of the plant and discharge of sewage and/or trade effluent 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. CTO Proc. No.F.0088CHN/RL/DEE/TNPCB/CHN/W&A/2015 dated 21/08/2015
2. DEE's IR. No : F.0088CHN/RL/AE/CHN/2017 dated 05/08/2017

RENEWAL OF CONSENT 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

Superintending Engineer V
M/s.NEW 120 MLD STP AT KOYAMBEDU BY CMWSSB,
S.F.No. 1/1,
KOYEMBEDU Village ,
Aminjikarai Taluk ,
Chennai District .

Authorising the occupier to make discharge of sewage and /or trade effluent.

This is subject to the provisions of the Act, the rules and the orders made there under and the terms and conditions incorporated under the Special and General conditions stipulated in the Consent Order issued earlier and subject to the special conditions annexed.

This RENEWAL OF CONSENT is valid for the period ending March 31, 2018

R. VIJAYABASKARAN

For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai

POLLUTION PREVENTION PAYA

TAMILNADU POLLUTION CONTROL BOARD

CONSENT ORDER NO. 170821726543 DATED: 05/12/2017.

PROCEEDINGS NO.T1/TNPCB/F.0250CHN/RL/CHN/A/2017 DATED: 05/12/2017

SUB: Tamil Nadu Pollution Control Board - RENEWAL OF CONSENT - M/s. CMWSSB (54 MLD STP) , S.F.No. 33,55,54,56,58,60,69,59, NESAPPAKKAM village, Mambalam Taluk and Chennai District - Renewal of Consent for the operation of the plant and discharge of emissions under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987 (Central Act 14 of 1981) –Issued- Reg.

REF: 1.Proc. No. F.CHN1850/RL/DEE/TNPCB/CHN/W&A/2014 dt. 10/07/2014
2. IR.No : F.0250CHN/RL/DEE/CHN/2017 dated 10/10/2017

RENEWAL OF CONSENT is hereby granted under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987 (Central Act 14 of 1981) (hereinafter referred to as "The Act") and the rules and orders made there under to

Superintending Engineer
M/s.CMWSSB (54 MLD STP),
S.F.No. 33,55,54,56,58,60,69,59,
NESAPPAKKAM village,
Mambalam Taluk,
Chennai District.

Authorizing the occupier to operate the industrial plant in the Air Pollution Control Area as notified by the Government and to make discharge of emission from the stacks/chimneys.

This is subject to the provisions of the Act, the rules and the orders made there under and the terms and conditions incorporated under the Special and General conditions stipulated in the Consent Order issued earlier and subject to the special conditions annexed.

This RENEWAL OF CONSENT is valid for the period ending March 31, 2018

R. KANNAN Digitally signed by R. KANNAN Date: 2017.12.10 07:08:26 +05'30'

For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai

TAMILNADU POLLUTION CONTROL BOARD

SPECIAL CONDITIONS

1. This renewal of consent is valid for operating the facility for the manufacture of products (Col. 2) at the rate (Col. 3) mentioned below. Any change in the products 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.	Sewage Treatment Plant	54	MLD

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

I	Point source emission with stack :			
Stack No.	**Point Emission Source**	**Air pollution Control measures**	**Stack height from Ground Level in m**	**Gaseous Discharge in Nm3/hr**
1	Gas Engine	Stack	10	
II	**Fugitive/Noise emission :**			
Sl. No.	**Fugitive or Noise Emission sources**	**Type of emission**	**Control measures**	

TAMILNADU POLLUTION CONTROL BOARD

Additional Conditions:

1. The unit shall ensure to adhere with the NAAQ standards prescribed by the Board.
2. The unit shall take utmost care to prevent odour/fly nuisance to the surroundings.

R. KANNAN Digitally signed by R. KANNAN Date: 2017.12.10 07:08:07 +05'30'

For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai

To
Superintending Engineer,
M/s.CMWSSB (54 MLD STP),
No:68, Anna main road, MGR nagar, Chennai.
Pin: 600078

Copy to:

1.The Commissioner, CHENNAI-Corporation, Mambalam Taluk, Chennai District .
2. The District Environmental Engineer, Tamil Nadu Pollution Control Board, CHENNAI.
3. The JCI(S)-Monitoring, Tamil Nadu Pollution Control Board, Chennai.
4. File

TAMILNADU POLLUTION CONTROL BOARD

CONSENT ORDER NO. 170811726543 DATED: 05/12/2017.

PROCEEDINGS NO.T1/TNPCB/F.0250CHN/RL/CHN/W/2017 DATED: 05/12/2017

SUB: Tamil Nadu Pollution Control Board - RENEWAL OF CONSENT – M/s. CMWSSB (54 MLD STP) , S.F.No. 33,55,54,56,58,60,69,59, NESAPPAKKAM village, Mambalam Taluk and Chennai District - Renewal of Consent for the operation of the plant and discharge of sewage and/or trade effluent 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.Proc. No. F.CHN1850/RL/DEE/TNPCB/CHN/W&A/2014 dt. 10/02/2014
2. IR.No : F.0250CHN/RL/DEE/CHN/2017 dated 10/10/2017

RENEWAL OF CONSENT 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

Superintending Engineer
M/s.CMWSSB (54 MLD STP),
S.F.No. 33,55,54,56,58,60,69,59,
NESAPPAKKAM Village ,
Mambalam Taluk ,
Chennai District .

Authorising the occupier to make discharge of sewage and /or trade effluent.

This is subject to the provisions of the Act, the rules and the orders made there under and the terms and conditions incorporated under the Special and General conditions stipulated in the Consent Order issued earlier and subject to the special conditions annexed.

This RENEWAL OF CONSENT is valid for the period ending March 31, 2018.

R. KANNAN Digitally signed by R. KANNAN Date: 2017.12.10 07:07:37 +05'30'

For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai

TAMILNADU POLLUTION CONTROL BOARD

SPECIAL CONDITIONS

1. This renewal of consent is valid for operating 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.	Sewage Treatment Plant	54	MLD

2. This renewal of consent is valid for operating 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	54000.0	Adayar River
Effluent Type : Trade Effluent			

TAMILNADU POLLUTION CONTROL BOARD

Additional Conditions:

1. The Municipality shall ensure that the sewage treatment plant shall be operated effeiently and continuously so as to bring the quality of the treated sewage to satisfy the standards prescribed by the Board at all times.
2. The grit and other wastes collected shall be disposed then and there without any accumulation.
3. The Municipality shall achieve the revised standards for sewage treatment plants prescribed by MoEFCC through Notification dated 13.10.2017 (pH: 6.5 to 9.0; B.O.D: 20 mg/L, T.S.S:<50 mg/L and Fecal Coliform (FC): <1000 MPN/100ml) before 12.10.2022.
4. The Municipality shall disinfect the treated sewage by physical means such as UV radiation/ozonation before discharge into River Adayar.
5. The Municipality shall install flow meters with computer recording arrangement at the inlet and the outlet of the STP.

Digitally signed by R. KANNAN
R. KANNAN Date: 2017.12.10 07:08:03 -05'30'

For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai

To
Superintending Engineer,
M/s.CMWSSB (54 MLD STP),
No:68, Anna main road, MGR nagar, Chennai,
Pin: 600078

Copy to:
1.The Commissioner, CHENNAI-Corporation, Maniyalam Taluk, Chennai District .
2. The District Environmental Engineer, Tamil Nadu Pollution Control Board, CHENNAI.
3. The JCEE-Monitoring, Tamil Nadu Pollution Control Board, Chennai.
4. File

QUALITY OF RAW SEWAGE AND TREATED SEWAGE STP AT KODUNGAIYUR(110 MLD CAPACITY)

Month: Nov-17

Date	Qty		Raw Sewage			Primary		Aeration		Effluent treated sewage		
	Received	Treated	BOD mg/L	TSS mg/L	Coliform MPN/100 ml	BOD mg/L	TSS mg/L	D.O.	MLSS	BOD mg/L	TSS mg/L	Coliform MPN/100 ml
1	97.23	97.23	170	106	$1.38x\ 10^{6}$	96	42	3.48	2368	8	16	7310
2	96.76	96.76	150	94	$1.45x\ 10^{6}$	87	36	1.65	2116	6	16	6192
3	101.34	101.34	145	114	$1.41x\ 10^{5}$	84	44	2.75	2196	2	13	6624
4	101.92	101.92	125	84	$1.43x\ 10^{5}$	72	32	2.24	2038	3	13	7391
5	96.86	96.86	80	98	$1.52x\ 10^{5}$	45	34	2.24	2038	4	13	7232
6	101.68	101.68	146	146	$1.71x\ 10^{6}$	84	52	1.35	2398	5	18	7511
7	104.53	104.53	165	142	$1.63x\ 10^{6}$	93	52	1.14	2238	7	15	6259
8	98.67	98.67	155	220	$1.65x\ 10^{6}$	90	82	1.13	2430	6	18	7063
9	100.99	100.99	170	228	$1.67x\ 10^{6}$	96	88	1.08	2462	7	21	7158
10	88.56	88.56	145	184	$1.70x\ 10^{5}$	81	70	1.13	2226	7	16	7391
11	90.88	90.88	175	280	$1.76x\ 10^{5}$	75	106	1.66	2448	8	19	7578
12	99.82	99.82	158	294	$1.88x\ 10^{5}$	68	114	1.68	2482	5	19	8490
13	104.32	104.32	185	116	$1.72x\ 10^{6}$	65	44	1.14	2308	8	17	7511
14	95.63	95.63	140	150	$1.63x\ 10^{6}$	64	58	1.70	2076	5	17	6624
15	87.56	87.56	144	162	$1.67x\ 10^{5}$	62	62	1.66	2396	2	17	7156
16	98.14	98.14	235	239	$1.85x\ 10^{5}$	130	150	1.60	2296	10	22	8458
17	89.22	89.22	220	277	$1.95x\ 10^{6}$	126	172	1.45	2192	10	19	9422
18	91.54	91.54	345	380	$1.91x\ 10^{6}$	201	138	1.40	2684	14	24	9527
19	82.39	82.39	320	374	$1.63x\ 10^{6}$	141	130	1.35	2747	17	21	7232
20	90.44	90.44	295	374	$1.88x\ 10^{6}$	171	144	1.46	2566	11	19	9333
21	85.03	85.03	375	366	$1.71x\ 10^{5}$	222	132	1.45	2596	16	21	7578
22	83.57	83.57	255	372	$1.61x\ 10^{5}$	164	138	1.35	2699	15	19	7156
23	84.40	84.40	350	352	$1.67x\ 10^{6}$	195	138	1.40	2782	16	21	9422
24	93.01	93.01	365	442	$1.76x\ 10^{6}$	210	166	1.40	2798	17	22	6624
25	91.58	91.58	370	398	$1.70x\ 10^{6}$	216	142	1.45	2767	17	22	7310
26	90.38	90.38	340	418	$1.52x\ 10^{6}$	198	162	1.12	2606	16	22	9321
27	93.90	93.90	275	351	$1.92x\ 10^{6}$	153	154	1.25	2473	16	20	9208
28	86.54	86.54	315	348	$1.66x\ 10^{5}$	183	130	1.50	2361	15	21	8458
29	98.56	98.56	350	370	$1.74x\ 10^{5}$	180	130	1.38	2570	15	21	6978
30	97.59	97.59	140	216	$1.95x\ 10^{6}$	81	80	1.65	2530	7	19	7941
Total	2823.04	2823.04										
Monthly Average	94.10	94.10	227	257	$1.69x\ 10^{6}$	125	101	1.57	2430	10	19	7716

QUALITY OF RAW SEWAGE AND TREATED SEWAGE AT KOYAMBEDU STP (120 MLD CAPACITY)

Month: Nov 17

Date	Qty		Raw Sewage			Primary		Aeration		Effluent treated sewage		
	Received MLD	Treated MLD	BOD mg/L	TSS mg/L	Coliform MPN/100 ml	BOD mg/L	TSS mg/L	D.O.	MLSS	BOD mg/L	TSS mg/L	Coliform MPN/100 ml
1-Nov	68.76	68.76	205	260	1.5 10^6	108	95	1.6	3185	19	21	7000
2-Nov	84.11	84.11	200	240	1.6	102	90	1.7	3195	18	20	7400
3-Nov	86.11	86.11	210	236	1.5 10^6	105	100	1.8	3020	19	18	7000
4-Nov	74.89	74.89	220	239	1.6 10^6	108	105	1.7	3015	20	19	7400
5-Nov	68.99	68.99	210	230	1.7 10^6	105	110	1.6	3040	19	17	7900
6-Nov	64.92	64.92	220	240	1.6 10^6	108	120	7.3	3035	19	18	7800
7-Nov	53.17	53.17	204	220	1.7 10^6	110	100	1.6	3050	18	16	8400
8-Nov	61.61	61.61	216	230	1.6 x10^6	116	105	1.7	3060	15	17	8000
9-Nov	54.25	54.25	210	240	1.5 x10^6	110	110	1.6	3040	18	18	7000
10-Nov	61.48	61.48	220	230	1.4 x10^6	120	105	1.5	3035	18	19	6000
11-Nov	61.73	61.73	230	220	1.5 x10^6	125	110	1.6	3045	19	20	6700
12-Nov	68.22	68.22	226	226	1.6 x10^6	116	122	1.5	3010	15	18	6900
13-Nov	84.26	84.26	228	234	1.5 x10^6	120	130	1.6	3020	16	17	8000
14-Nov	68.15	68.15	220	242	1.6 x10^6	110	126	1.7	3010	15	16	8400
15-Nov	63.11	63.11	230	246	1.5 x10^6	114	130	1.6	3030	18	17	7000
16-Nov	67.91	67.91	220	250	1.4 x10^6	100	140	1.7	3040	15	18	8000
17-Nov	59.48	59.48	240	240	1.5 x10^6	110	126	1.6	3010	18	16	7000
18-Nov	60.77	60.77	250	250	1.4 x10^6	118	130	1.7	3015	15	17	6000
19-Nov	69.04	69.04	260	236	1.5 x10^6	100	122	1.6	3030	16	15	7000
20-Nov	55.58	55.58	250	252	1.6 x10^6	105	120	1.5	3010	17	16	7400
21-Nov	55.64	55.64	240	256	1.7 x10^6	115	126	1.6	3040	16	15	7600
22-Nov	59.37	59.37	220	262	1.6 x10^6	110	120	1.5	3020	15	16	7400
23-Nov	60.92	60.92	210	274	1.5 x10^6	100	132	1.6	3050	18	15	7000
24-Nov	61.34	61.34	230	279	1.4 x10^6	104	138	1.7	3085	15	16	6000
25-Nov	62.02	62.02	235	280	1.5 x10^6	105	140	1.6	3055	14	17	7000
26-Nov	59.77	59.77	220	270	1.6 x10^6	100	135	1.5	3040	15	18	7200
27-Nov	78.37	78.37	200	282	1.5 x10^6	120	130	1.6	3020	12	16	7000
28-Nov	69.05	69.05	220	260	1.4 x10^6	140	124	1.7	3010	15	15	6000
29-Nov	71.23	71.23	200	252	1.3 x10^6	120	120	1.6	3020	18	16	7000
30-Nov	85.21	85.21	205	256	1.4 x10^6	125	125	1.5	3025	19	17	6000
AVERAGE	**66.65**	**66.65**	**222**	**248**	1.5 x10^6	**112**	**120**	**2**	**3041**	**17**	**17**	**7150**

54MLD Sewage Treatment Plant-Nesapakkam
Monthly Quality Report

MONTH: NOVEMBER'17

Date	Raw Sewage Characteristics				Aeration Tank			Treated Sewage			
	pH	COD mg\L	BOD mg\L	TSS mg/L	pH	D.O	MLSS mg/L	pH	COD mg\L	BOD mg\L	TSS mg/L
1-Nov-17	7.05	552	240	274	7.45	2.1	2420	7.62	55	14	16
2-Nov-17	7.07	528	260	284	7.46	2.3	2520	7.6	53	12	19
3-Nov-17	7.01	514	259	242	7.40	2.5	2390	7.54	38	15	16
4-Nov-17	7.03	620	280	230	7.41	2.9	2520	7.56	40	16	18
5-Nov-17	6.89	704	250	240	7.40	2.6	2480	7.59	60	15	20
6-Nov-17	6.91	652	239	274	7.29	2.4	2420	7.50	65	14	18
7-Nov-17	6.86	576	250	268	7.28	2.3	2506	7.46	58	15	17
8-Nov-17	6.89	600	240	288	7.30	2.4	2510	7.48	60	18	20
9-Nov-17	6.91	730	276	279	7.23	2.3	2340	7.50	65	18	19
10-Nov-17	6.96	756	238	290	7.24	2.5	2420	7.49	80	14	18
11-Nov-17	7.11	762	246	286	7.44	2.1	2390	7.56	74	14	20
12-Nov-17	7.07	704	307	260	7.46	2.4	2392	7.56	70	18	17
13-Nov-17	6.80	640	298	285	7.35	2.9	2320	7.60	60	17	20
14-Nov-17	7.01	760	280	360	7.40	2.5	2421	7.61	70	15	15
15-Nov-17	7.05	768	282	350	7.56	2.5	2524	7.68	77	16	20
16-Nov-17	7.07	800	310	398	7.61	2.4	2539	7.72	50	16	24
17-Nov-17	7.05	700	280	409	7.48	2.2	2510	7.63	80	15	16
18-Nov-17	7.06	784	322	396	7.48	2.1	2510	7.67	88	16	23
19-Nov-17	7.07	768	326	404	7.43	1.9	2515	7.64	77	18	22
20-Nov-17	7.06	832	256	396	7.45	2.2	2516	7.66	96	14	19
21-Nov-17	7.09	780	300	400	7.48	2.0	2481	7.68	76	18	21
22-Nov-17	7.12	806	282	439	7.51	1.8	2520	7.70	77	16	22
23-Nov-17	7.13	832	313	421	7.45	2.4	2520	7.68	70	15	19
24-Nov-17	7.17	853	237	439	7.47	1.8	2475	7.70	82	15	22
25-Nov-17	7.05	807	290	388	7.44	2.0	2416	7.69	60	18	21
26-Nov-17	7.06	760	313	416	7.47	1.9	2429	7.62	80	17	23
27-Nov-17	7.01	720	248	268	7.40	2.5	2459	7.68	60	14	16
28-Nov-17	6.90	528	220	242	7.36	2.8	2380	7.58	53	13	16
29-Nov-17	6.92	600	246	250	7.38	2.3	2430	7.52	40	13	18
30-Nov-17	6.87	576	240	284	7.40	2.4	2392	7.59	58	12	19
Average	7.01	704	271	325	7.42	2.3	2459	7.60	65	15	19

SAMPLE GRIEVANCE REGISTRATION FORM

(To be available in Tamil and English)

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

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

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

FOR OFFICIAL USE ONLY

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

SAMPLE OUTLINE SPOILS (CONSTRUCTION WASTE) MANAGEMENT PLAN

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

I. Spoils information

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

II. Spoils management

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

III. Documentation

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

SAMPLE OUTLINE TRAFFIC MANAGEMENT PLAN

A. Principles for Traffic Management Plan around the Sewerage scheme implementation Sites

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

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

B. Operating Policies for Traffic Management Plan

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

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

3. **Figure A6.1 to Figure A6.12** illustrates the operating policy for TMP for the construction of water pipes and the sewers along various types of roads.

C. Analyze the impact due to street closure

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

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

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

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

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

D. Public awareness and notifications

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

6. The awareness campaign and the prior notification for the public will be a continuous activity which the project will carry out to compensate for the above delays and minimize public claims as result of these problems. These activities will take place sufficiently in advance of the

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

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

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

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

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

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

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

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

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

11. Procedures for installing traffic control devices at any work zone vary, depending on road configuration, location of the work, construction activity, duration, traffic speed and volume, and pedestrian traffic. Work will take place along major roads, and the minor internal roads. As such,

the traffic volume and road geometry vary. The main roads carry considerable traffic; internal roads in the new city areas are wide but in old city roads very narrow and carry considerable traffic. However, regardless of where the construction takes place, all the work zones should be cordoned off, and traffic shifted away at least with traffic cones, barricades, and temporary signs (temporary “STOP” and “GO”).

12**.** **Figure 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. Flagggers/ personnel should be equipped with reflective jackets at all times and have traffic control batons (preferably the LED type) for regulating the traffic during night time.

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

Figure A6.2 and A6.3: Work on shoulder or parking lane and Shoulder or parking lane closed on divided road

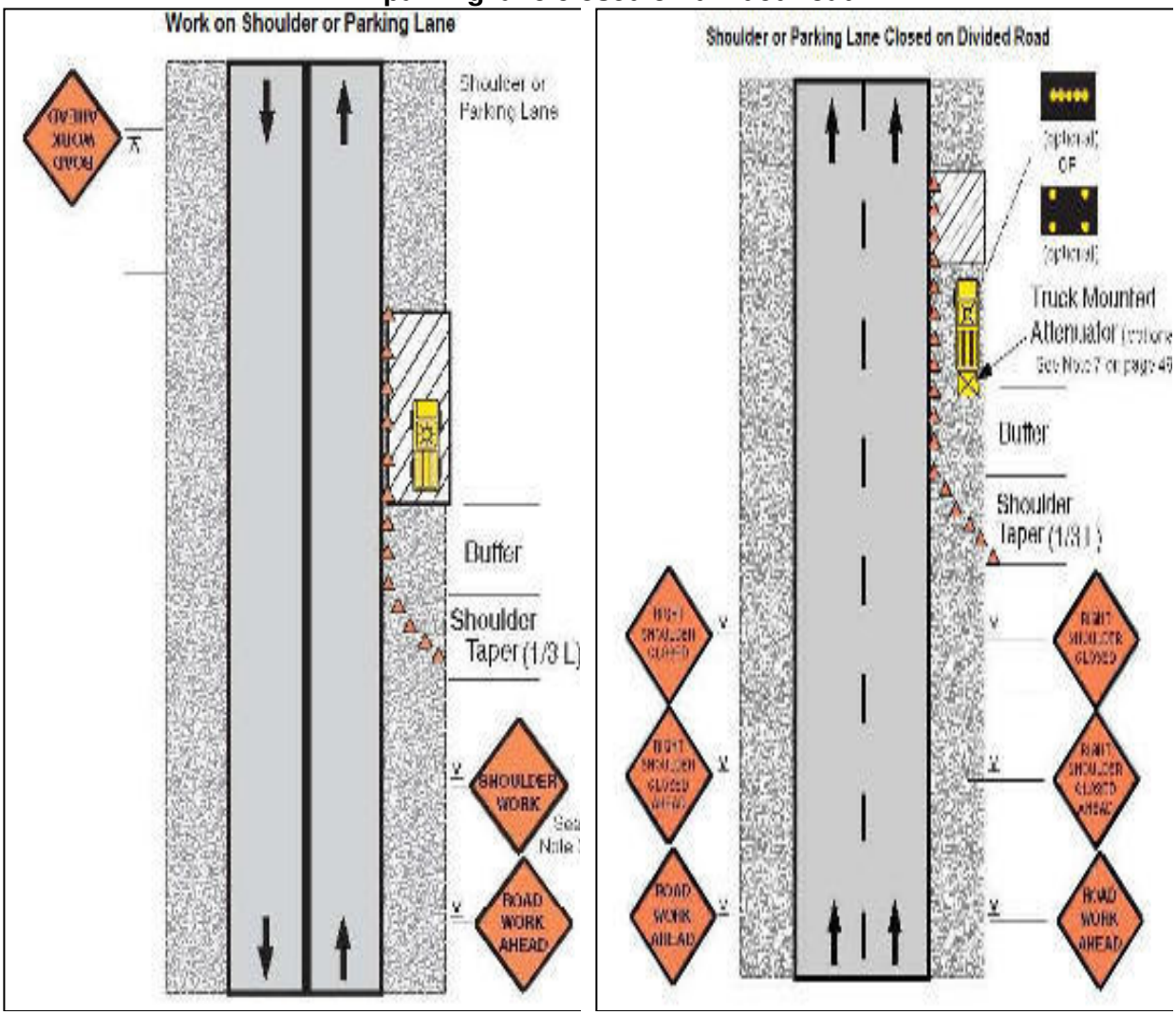


Figure A6.4 and A6.5: Work in Travel lane and Lane closure on road with low volume

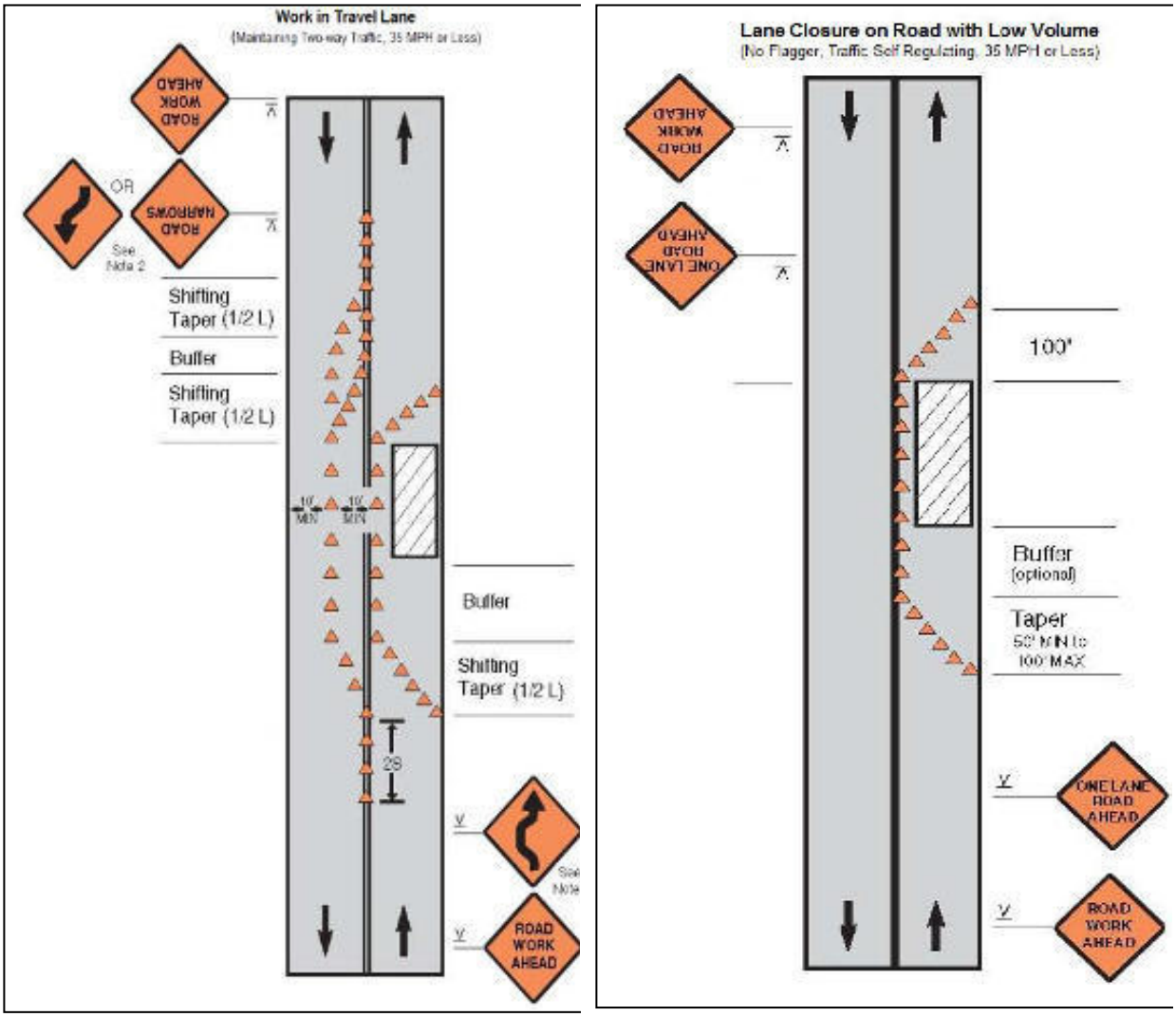
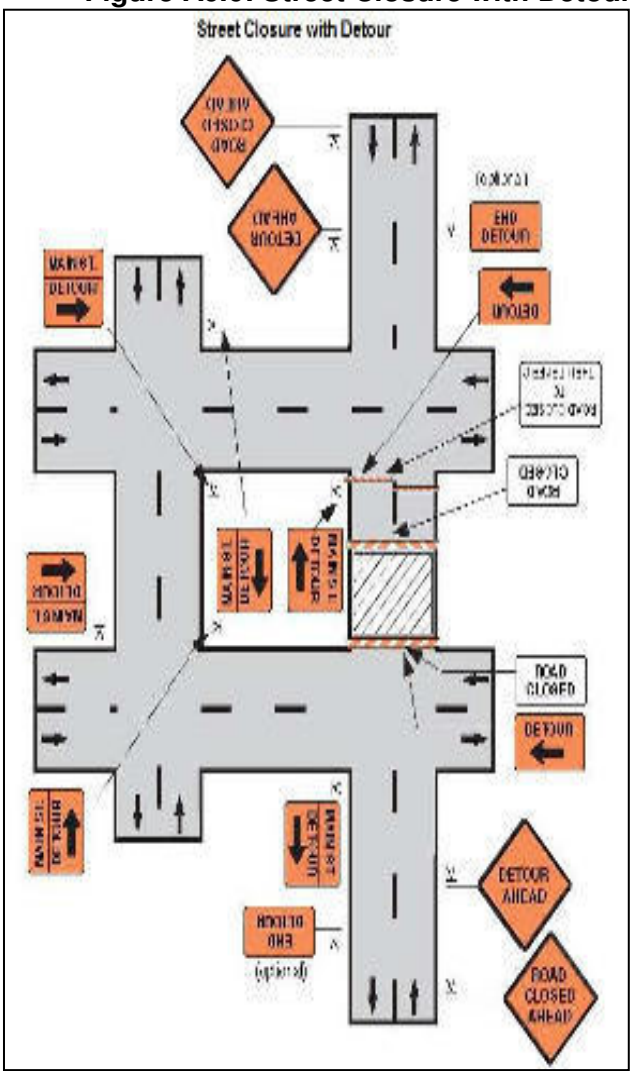


Figure A6.6: Street Closure with Detour



SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name
Contract Number

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

WEATHER:

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

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

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

Signature

_____

Sign off

_____ _____

Name **Name**

Position **Position**

QUARTERLY REPORTING FORMAT FOR CMWSSB /PIU

1. Introduction

- Description of sub-project implemented by PIU
- Environmental category of the sub-project
- Details of site personnel and/or consultants responsible for environmental monitoring
- Sub-project status

No.	Sub-Project Name	Subproject status	List of Works	Progress of Works
		Design☐ Pre-Construction☐ Construction☐ Operational Phase☐		

2. Compliance status with National/ State/ Local statutory environmental requirements

No.	Sub-Project Name	Statutory Environmental Requirements	Status of Compliance	Action Required

3. Compliance status with environmental loan covenants, if any

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

4. Compliance status with the environmental management and monitoring plan

- Provide the monitoring results as per the parameters outlined in the EMP. Append supporting documents where applicable, including Environmental Site Inspection Reports.
- There should be reporting on the following items which can be incorporated in the checklist of routine Environmental Site Inspection Report followed with a summary in the semi-annual report send to ADB. Visual assessment and review of relevant site documentation during routine site inspection needs to note and record the following:
    - What are the dust suppression techniques followed for site and if any dust was noted to escape the site boundaries;
    - If muddy water was escaping site boundaries or muddy tracks were seen on adjacent roads;
    - adequacy of type of erosion and sediment control measures installed on site, condition of erosion and sediment control measures including if these were intact following heavy rain;
    - Are their designated areas for concrete works, and refuelling;

- Are their spill kits on site and if there are site procedure for handling emergencies;
- Is there any chemical stored on site and what is the storage condition?
- Is there any dewatering activities if yes, where is the water being discharged;
- How are the stockpiles being managed;
- How is solid and liquid waste being handled on site;
- Review of the complaint management system;
- Checking if there are any activities being under taken out of working hours and how that is being managed.

Summary Monitoring Table

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

Overall Compliance with EMP

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

5. Approach and methodology for environmental monitoring of the project

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

6. Monitoring of environmental impacts on project surroundings (ambient air, water quality and 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 µS/cm	BOD mg/L	TSS mg/L	TN mg/L	TP mg/L

Noise Quality Results

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

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

7. Summary of key issues and remedial actions

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

8. Appendixes

- Photos
- Summary of consultations conducted, if any
- Copies of environmental clearances and permits
- Sample of environmental site inspection report
- Other

PUBLIC INFORMATION NOTICE TEMPLATE

Public Announcement
Chennai Metropolitan Water Supply & Sewerage Board
Providing Underground Sewerage System for Manali, Chinnasekkadu, Karambakkam and Manapakkam in Chennai City

Under this project, works are being conducted by xxxxxxxx Contractor to provide sewerage network for Manali, Chinnasekkadu, Karambakkam and Manapakkam in Chennai city

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.

DETAILS OF PUBLIC CONSULTATION

A. Stakeholder Consultation/Focused Group Discussion for Providing Underground Sewerage Scheme To Manali, Chinnasekkadu, Karambakkam and Manapakkam

1. At the outset of the meeting, Area Engineers welcomed the stakeholders, CMWSSB officials and representatives of the consultants.

2. Superintending Engineer (P&D), CMWSSB, Chennai, briefed about the background of the proposed project and details of fund sanctioned under AMRUT and ADB.

3. Executive Engineer (P&D) explained the salient features of project area informing the geographical area, total length of streets, Population for 2011 and 2050, length of sewer pipeline, No. of Manholes, No. of Lift stations, No. of Pumping stations, length of force main, sewage generation, and disposal point of sewage i.e STP to be connected with.

4. The stakeholders were also informed about the location of lift station and sub pumping station and main pumping station.

5. Further, the stakeholders were welcomed for opinions and suggestions regarding the project proposals.

6. Stakeholders in general welcomed the project proposal and appreciated the initiative undertaken to inform the public and seek opinions from them through stakeholders consultation meeting.

7. Various general public association / individuals have given their feedbacks in writing. Representation of about 12 Nos for Manali, 1 No for Chinnasekkadu, 16 Nos for Karambakkam and 29 Nos for Manapakkam were received during the stakeholders meeting.

8. The details of the questions raised by the general public association / public and clarification provided by CMWSSB Engineers are summarized in the Table 1, 2, 3, and 4.

9. The attendance of stakeholders, photographs of stakeholders consultation meeting, notices/ pamphlets issued to public, salient features, letters addressed Area Engineers are enclosed in the appendix.

Table A10.1. Stakeholder Consultation / Focused Group Discussion for Providing Underground Sewerage Scheme to Manali

No.	Name/Designation Address	Queries / Suggestion /Opinion	Clarification
1	Mr. S.Palani, 1 A, Sir. C.V. Raman Street	The work should be carried out without any disturbance to general public	All efforts will be taken to complete the project without any disturbance to general public
2	Mr. Ramachandran, 1, Sannathi street	The proposed SPS at Kamaraj street should be constructed without any disturbance to the nearby burial ground	The SPS will not cause any disturbance to the nearby burial ground.
3	Mr. Sarathi Parthiban 2, Chokkammal Kulam	Welcome the proposed sewerage scheme. But the	For SPS near by residential areas

No.	Name/Designation Address	Queries / Suggestion /Opinion	Clarification
	street	pumping stations should be constructed away from residential areas and the work should be completed on time without any disturbance to the free flow of traffic	mitigation measures, with regard to odor control will be undertaken and every efforts will be taken to complete the project on time without any disturbance to the free flow of traffic
4	Mr.B.Shankaran, 45, SP Koil street, Periathopu	The proposed SPS should not be located in the existing head works or any other residential area	As no other vacant site is available in Periathopu area the SPS has been proposed in the Headworks site belonging to CMWSSB. If any alternate site is found to be suitable in Periathopu area the SPS will be shifted from Headworks site. However, mitigation measures, with regard to odor control will be undertaken.
5	Mr. M.Mani, Srinivasa Perumal Koil st.Periathopu	SPS should be constructed away from the residential area as the residence of periathopu object the construction of SPS in residential area	As no other vacant site is available in Periathopu area the SPS has been proposed in the Headworks site belonging to CMWSSB. If any alternate site is found to be suitable in Periathopu area the SPS will be shifted from Headworks site. However, mitigation measures, with regard to odor control will be undertaken.
6	Mr. S.Gajenderan, 29, Santhana Krishnan street	Request that the SPS be constructed at the outskirt of the village	UGSS scheme for Manali has been divided in to 5 zones due to restriction of depth of manhole.
7	Mr. E.Vinayagam 28, Srinivasa Perumal Koil st.Periathopu	The residents of Periathopu are against the construction of SPS near Kanniamman koil.	As no other vacant site is available in Periathopu area the SPS has been proposed in the Headworks site belonging to CMWSSB. If any alternate site is found to be suitable in Periathopu area the SPS will be shifted from Headworks site However, mitigation measures, with regard to

No.	Name/Designation Address	Queries / Suggestion /Opinion	Clarification
			odor control will be undertaken.
8	Mr. P.Prakash 2, Chokkammal Kulam street	SPS should be placed outside Periathopu residential area	As no other vacant site is available in Periathopu area the SPS has been proposed in the Headworks site belonging to CMWSSB. If any alternate site is found to be suitable in Periathopu area the SPS will be shifted from Headworks site. However, mitigation measures, with regard to odor control will be undertaken.
9	Mr.D.Durai, Puratch Kavi Barathiyar street	No commends	
10	Mr. R.Gnanaprakasam 7/12, Kuttiappan street, Edapalayam	Welcome the sewerage scheme. However there should be any inconvenience to the residence and the scheme should be completed in time.	All efforts will be taken to complete the project without any disturbance to general public and to complete the scheme on time.
11	Mr. N.Manimaran, 193, JJ Nagar, New MGR Nagar Extn.	The SPS should be located outside the village limit without any hindrance to public.	UGSS scheme for Manali has been divided in to 5 zones due to restriction of depth of manhole.
12	Mr. R.Velu, 23, 2nd street, New MGR Nagar.	On implementation of the scheme the residence will not be suffered from dengue fever.	No commends

Table A10.2. Stakeholder Consultation/Focused Group Discussion for Providing Underground Sewerage Scheme to Chinnasekkadu

No	Name/ Designation Address	Queries / Suggestion /Opinion	Clarification
1	R.Prakasam, 139- B, Thiruvalluvar street	Scheme was well explained. However before construction the stakeholders may be contacted.	Will be considered.

Table A10.3. Stakeholder Consultation / Focused Group Discussion for Providing Underground Sewerage Scheme to Karambakkam

No	Name / Designation Address	Queries / Suggestion /Opinion	Clarification
1	Mr.Purushothaman, Karambakkam	To consider the proposal near to Cooum river near to PH road	UGSS for Karambakkam has been divided in to 5 zones due to restriction of depth of manhole.

2	Mrs.Ellammal , Thundalam, Karambakkam	More people are living near to Burial ground in Thundalam area and hence the proposal of PS is not needed.Moreover, Water will get polluted.	The wells are constructed with RCC and hence there is no seepage. Moreover water will not be be polluted.
3	Mr.R.Sivaguru, Chettiyaragaram, Karambakkam	Near to the Chettiyar Agaram, site considered for construction of Pumping Station lies Muthumariamman Temple, Corporation School, and residential houses. Hence location of PS will affect groundwater and produce odor and thereby cause health hazard.	The wells are constructed with RCC and hence there is no seepage and no water pollution Moreover, mitigation measures like green plantation with regard to odor control will be undertaken.
4	Mr.P.Balachandaram, Sivabootham, PH road, Karambakkam.	This project is a welcoming and a needy one for the people. To Consider the available govt porambokku lands for this project as the maharishi nagar site already consists of Ration shop and balance land is available for development for Park. Instead, the above proposal could be considered near to Bye Pass road.	Construction of pumping station will be carried out at one corner of the land and balance land be developed for park.
5	Mr.N.Krishnaswamy, Sribalaji Nagar, Thundalam , Karambakkam	CMWSSB should keep inform EB & PWD to avoid delay and quick completion of work without much hardship to residents during digging. Digging pipe line laying and road laying all should be in time bound to reduce difficulties to road users and residents. Manhole height to be maintained for road level to avoid accidents and easy passage of cars & Vans.	All efforts will be taken to complete the project with safety and on time without any disturbance to public and free flow of traffic. Manhole height will be maintained at road level. Road restoration will be carried out by GCC. Name Board with scheme details will be displayed at SPS site.
		Responsibility to be fixed for the road cut created by residents on latter date who is applying for connection so that the road laying restoration will be done immediately.	
		During digging while starting to keep a Board indicating contractor Name & Phone No and CMWSSB officials to be comstructed, Name & Phone no board to be kept in every street corner.	

6	Mr.G.N.Narasimhan, Thundalam, Karambakkam.	To coordinate with TNEB , Telephone . Any damage done to tneb or telephone , CMWSSB will be responsibility to rectify. Road laying to be made after immediate execution. One supervisor from CMWSSB should be present at the time of execution.	All efforts will be taken to complete the project on time . Prior intimation will be given to other service departments before taking up pipelaying work and damage done will be restored by contractor in coordination with other departments. Road restoration will be carried out by GCC. The work will be supervised by CMWSSB Engineers.
7	Mr.K.Ganapathy, Brahmin street, Karambakkam	The PS location considered at Gandhi Nagar, Burial ground should be relocated to CMWSSBs site. The PS location considered at Chettiyar Agaram should be relocated to vacant site available inside Ramachandra Medical College.	The UGSS for Karambakkam has been designed as 5 zones due to restriction of depth of manhole. Accordingly site has been identified for SPS location.
		The PS location considered at Maharsihi Nagar is allotted for Park development and hence vacant lands available at Survey No 72 and at 112 belonging to TamilNadu Government to be considered	
8	Mr.Janarthanam, 1st Main road, Karambakkam	The land available inside the Ramachandra Medical College or site at Survey No. 47 , 2.37 acres belonging to Government could be considered for Karanbakkam UGSS.	The SPS location has been identified inccoordination with GCC and Revenue officials.
9	Mr.E.T.Vijayakumar, Murthy Nagar, Chettiyaragraram, Karambakkam	Request to start the scheme at the earliest considering the welfare of the people.	All efforts will be taken to complete the project on time .
10	Mr.S.Gunasekaran, Vijayalakshmi Nagar, Karambakkam	Request to start and complete the scheme at the earliest without affecting public.	All efforts will be taken to complete the project on time .
11	Mr.M.Subramani, Kamatchi Nagar, Sivabootham, Karambakkam	The Maharish Nagar consists of Ration shop and Metrowater tank and in need of Park for the people. Hence, the bund site near to Jesus calls , Bye pass road could be considered for this scheme.	Construction of pumping station will be carried out at one corner of the land and balance land be developed for park.

12	Mr.A.Ramadoss Naidu, Kamatchi Nagar, Sivabootham, Karambakkam	The Maharish Nagar consists of Ration shop and Metrowater tank and in need of Park for the people. Hence, the bund site near to Jesus calls , Bye pass road could be considered for this scheme.	Construction of pumping station will be carried out at one corner of the land and balance land be developed for park.
13	Mr.Araivu, Andal Nagar, Sivabootham, Karamabakkam	The sewerage dept is doing project works and most of soil not filled properly. During rainy season , the soil spreads in the road and make inconvenient to public .	All efforts will be taken to complete the resoration work on time without affecting public.
14	Mr.Prasad, 1st street, Chettiyar Agaram, Karambakkam	Pumping station should not be located at any of the Burial ground.	The site belongs to corporation and the SPS location has been identified in coordination with GCC officials.
15	Mr.I.R.A Ananda Ramesh, Gandhi Nagar, Karambakkam	No objection for the Gandhi Nagar site considered for Pumping station construction. But pumping station should not affect public health.	Mitigation measures like green plantation to control the odor will be undertaken.
16	Mr.E.Murugan, Ponni Nagar, Karambakkam	The burial ground site at Gandhinagar considered for construction of pumping station is being used by Hindu People for longer period. Hence, this site should not be considered for location of pumping station.	The site belongs to corporation and the SPS location has been identified in coordination with GCC officials.

Table A10.4.Stakeholder Consultation / Focused Group Discussion for Providing Underground Sewerage Scheme to Manapakkam

No.	Name / Designation Address	Queries / Suggestion /Opinion	Clarification
1	Mr.C.Thangaswamy, Lakshminagar Mainroad, Manapakkam	The proposal of construction of Sewage Pumping Station at Lakshmi Nagar will cause health hazard and pollute the ground water.	The wells are constructed with RCC and hence there is no seepage.Moreover water will not be be polluted. Moreover, mitigation measures like green
		Hence, the above proposal may be dropped and a suitable alternate site be identified.	plantation with regard to odor control will be undertaken.
2	Mr.Dr.J.Lionel John, Lakshmi Nagar, Manapakkam	Request for changing of the area suggested for sewage recycling plant at manapakkam Lakshminagar, as it	No recycling plant has been proposed and only pumping station has been proposed. Mitigation measures with regard to

No.	Name / Designation Address	Queries / Suggestion /Opinion	Clarification
		has multiple hazards in that area basically health of children and also ground portable water system in residential area. This recycling plant c an cause air pollution also thereby affecting multiple aged people also. Kindly consider the above request.	odor control will be undertaken.
3	Mr.N.S.Gopalakrishnan, Lakshmi Nagar Manapakkam	The proposed site surrounded by 100 residents. Request to consider a park or playground.	The site was identified in coordination with revenue and GCC officials.
4	Mr.S.Karthikeyan, Jayaram gardens Manapakkam .	The plot is near to the site proposed for SPS at Sethulakshmi Nagar. Requested no construction to be undertaken in the proposed site.	It's only a road side pumping station and not located near to plot.
5	Mr.P.SenthilVel, Lakshmi Nagar Manappakam.	It is closed to 70 Houses and can effect groundwater and cause air pollution. Kindly find an alternate location.	The wells are constructed with RCC and hence there is no seepage.Moreover water will not be be polluted. Moreover, mitigation measures like green plantation with regard to odor control will be undertaken.
6	Mr.P.Mohan, Lakshmi Nagar Manappakam.	The proposal of construction of Sewage Pumping Station at Lakshmi Nagar will pollute ground water as the people depend on ground water only. Moreover there is a proposal for the development of school at that place.	The wells are constructed with RCC and hence there is no seepage. Moreover, mitigation measures like green plantation with regard to odor control will be undertaken
7	Mr.Unni Krishnan Lakshmi Nagar Manappakam	The proposed site is close to 100 residents and we have requested this area for a park or playground as there is no venue now. Our kids are playing there. We request you to propose some other site for this.	The site was identified in coordination with revenue and GCC officials.

No.	Name / Designation Address	Queries / Suggestion /Opinion	Clarification
8	Mr.B.Karthick Lakshmi Nagar Manappakam	I would like to bring to notice that we are dependent on groundwater. If this is implemented then our water source will be disturbed. Odor in pumping station is an menace and we are living to the proposed area which is very hazarders to health. Please consider to move to this to an different location.	The wells are constructed with RCC and hence there is no seepage.Moreover water will not be be polluted. Moreover, mitigation measures like green plantation with regard to odor control will be undertaken.
9	Mr.VijayaKumar Lakshmi Nagar Manappakam	Ground water will get contaminated as we live in lakshmi nagar which is an residential area. Please do not precede sewage pumping station here.	The wells are constructed with RCC and hence there is no seepage. Moreover water will not be be polluted. Moreover, mitigation measures like green plantation with regard to odor control will be undertaken.
10	Mr.Mohammed Shahid BashaLakshmi Nagar Manappakam	Request to kindly not to plan sewage pumping station .Kindly consider for play area.	The site was identified in coordination with revenue and GCC officials.
11	Mr.Pandi Durai II nd Main road, Manappakam	Restoration charges paid to corporation and would like to know the extent of charge by CMWSB to the occupant/ owner of the property	Road restoration charges will be paid by CMWSSB to GCC from the project cost.
12	Mr.Victor Rajish Sathya nagar Manappakam	It is learnt that there is a proposal for construction of sewage pumping station at existing OHT location. Instead of this site kindly consider the site near to burial ground.	The site belongs to CMWSSB and identified based on the design feasibility.
13	Mr S, Raja and Ramanathan, MGR Nagar Manapakkam	Please revise the proposal at some other place.	The site was identified in coordination with revenue and GCC officials and on design feasibility.
14	Mr. Kriba Shanker L & T Colony Manapakkam	Time Bounded completion of the project. People ate already frustrated with storm water drain works.	All efforts will be undertaken to complete the project on time.
15	Mr.Nobel John Lakshmi Nagar Manappakam	The proposed site is closed to a colony where about only 70 households are there. The smell will be within 100 M and all homes	The site was identified in coordination with revenue and GCC officials. mitigation measures like green plantation with

No.	Name / Designation Address	Queries / Suggestion /Opinion	Clarification
		are within that limit. So all will be affected. The proposed land is allotted for recreation purpose.	regard to odor control will be undertaken.
16	MrA.Krishna Moorthy Marvel River View Colony Manapakkam	A water tank of 1.00 lakh liter is being constructed encroaching part of the land meant for our colony park. The sewage pumping station is constructed adjacent to the water tank which will have a sump also leakage will contaminate the drinking water. Proposed pumping station is at the north west of the colony, and as the actual slope is toward the adyar river in south, sewerage flow to the north west is doubtful.	Roadside Lift station will be proposed in the Macro marvel instead of existing OHT site.
17	Mr.Sridhar Babu Lakshmi Nagar Manapakkam	The proposal of construction of Sewage Pumping Station at Lakshmi Nagar will pollute ground water as the people depend on ground water only.	The wells are constructed with RCC and hence there is no see page. Moreover water will not be polluted.
18	Mr.Siva Kumar Marvel River View Colony Manapakkam	We appreciate your efforts towards waste management. But keeping our resident area and we request you to consider shifting of this pumping station as this proposal will contaminate ground water and also bad odor.	Roadside Lift station will be proposed in the Macro marvel instead of existing OHT site. Moreover, wells are constructed with RCC and hence there is no seepage
19	Mr.N.R.prabhakar Marvel River View Colony Manapakkam	The place is not appropriate for this scheme. Not possible for cleaning or treatment of over flowing sewage. No proper entry/exist for lorries and also outlet for sewerage. Other places are available as this place is in the midst of the thickly populated residential area .	The request will be considered and Roadside Lift station will be proposed in the Macro marvel instead of existing OHT site.
20	Mr.Murali IIIrd colony MRVC , Manapakkam	This place is located near the overhead supply tank and it is near the park area where the children will be	The request will be considered and Roadside Lift station will be proposed in the Macro

No.	Name / Designation Address	Queries / Suggestion /Opinion	Clarification
		playing. There will be lot transport movement in 30 feet road. Therefore it is pumping station is not required in this place.	marvel instead of existing OHT site.
21	Mr.Brinda Brighlony Marvel River View Colony Manapakkam	Severe health hazard to be caused due to sewage pumping station in residential area .Hence sewage pumping station should not be constructed at this place.	Mitigation measures with regard to odor control will be undertaken.
22	Mr.V.Ramakrishnan MRVC , Manapakkam	Location of pumping station is not desirable at the proposed location as it will make the place dirty and foul smelling. This will be a nuisance to this colony. It may be located at some other point away from this colony.	The request will be considered and Roadside Lift station will be proposed in the Macro marvel instead of existing OHT site.
23	Mr. Harmis Jose Marvel River View Colony Manapakkam	The proposed sewage pumping station in a thickly populated area will greatly inconvenience the nearby residence in general and MRVC in particular in terms of bad smell and mosquito menace which is a sure health hazard. In addition to water supply pumping station the proposed sewage station will eventually increase noise pollution and their by effect peaceful dwelling of nearby residents.	The request will be considered and Roadside Lift station will be proposed in the Macro marvel instead of existing OHT site.
24	Mr.Balakrishnan MRVC , Manapakkam	Selection of sewage pumping station in the midst of residential area is questionable. More so when poramboke grounds are available .Chances of sewage getting mixed with drinking water facility close by are great especially when pumps / other equipments becomes non function able. This area is close to the children park and chances of spreading infection to children playing there much.	The request will be considered and Roadside Lift station will be proposed in the Macro marvel instead of existing OHT site.
25	Mr. Prvijayaiwnan MRVC , Manapakkam	It is an OSR given by MRVC is specifically for park area. Other options for land should have been looked into. Water tank and sewage cannot be located together. MRVC is highly populated close to the site and ecological imbalances and smell	The request will be considered and Roadside Lift station will be proposed in the Macro marvel instead of existing OHT site.

No.	Name / Designation Address	Queries / Suggestion /Opinion	Clarification
26	Mr. Manikavasagam MRVC , Manapakkam	The site marked for the pumping station is very close to the water tank under construction. It is very close to the park area. There is a possibility of contamination of drinking water if sewage pumping station is constructed and will be air pollution. Please consider other location.	The request will be considered and Roadside Lift station will be proposed in the Macro marvel instead of existing OHT site.
27	Mr R.Natrajan MRVC, Manapakkam.	Several health hazards will likely to be caused in event of pumping station being proposed. The place of pumping station is likely to affect the ecological balance of the entire campus.	The request will be considered and Roadside Lift station will be proposed in the Macro marvel instead of existing OHT site.
28	Mr. R.Senthil Kumar Sathya Nagar Manapakkam	Please consider the relocation of proposed pumping station at sathya nagar as there will be bad odor and live hood will be affected.	The site belongs to CMWSSB and identified based on the design feasibility. Mitigation measures regard to odor control will be undertaken.
29	Mr. Arulayutham Sathya Nagar Manapakkam	Please avoid the location of pumping station at sathya nagar.	The site belongs to CMWSSB and identified based on the design feasibility.

STAKEHOLDERS MEETING FOR MANALI UGSS HELD ON 13.11.2017

S.No.	Name & Address	Phone No.	Signature
1	B. [illegible] [illegible] [illegible]	No. 45 S.P. [illegible] [illegible]	B. [illegible] 9841501495
2	[illegible] M. [illegible] 9840919939.	No-19. S. P. Koil St Periya thoppu Manali	M. [illegible] 9840919939
3	S. GAJENDRAN	No-29. S. K. [illegible] Periya thoppu manali ch..	[illegible] 9962411806
4	K [illegible]	28, S. P. Koil St Periya thoppu	[illegible] 9840753752
5	S. [illegible]	No 1A [illegible] [illegible] 9884223669	S [illegible] 13-11-17
6	E. [illegible]	9600011626 [illegible]	[illegible]
7	Saravathy Parthiban. B.Sc	Ex. vice chairman Manali 9884988455	P. [illegible]
8	P. Prakash B.E, B.Ed	9840555017 [illegible]	[illegible]
9	D. [illegible]	9094116403 [illegible]	D. [illegible]
10	R- [illegible]	8194344740 [illegible]	R. [illegible]
11	R. [illegible] ([illegible])	29 [illegible] [illegible]	R. [illegible]

9444317092 / 7418482587

S.No.	Name & Address	Phone No.	Signature
12	R [illegible] [illegible] 23.48 W. MGR [illegible] 2. [illegible]	938000107[illegible]	[illegible]
13	N. Manimaran 193, J. J. Nagar, New MGR Nagar Extn Manali. Ch[illegible]	9841116457	[illegible]

STAKEHOLDERS MEETING FOR CHINNASEKKADU UGSS HELD ON 13.11.2017

S.No.	Name & Address	Phone No.	Signature
1	R. பிரகாசம் 139/138 திருவள்ளுவர் தெரு சின்னசேக்காடு மணலி சென்னை 68	9444317092 7418482587	R. பிரகாசம்

STAKEHOLDERS MEETING FOR KARAMBAKKAM UGSS HELD ON 13.11.2017

S.No.	Name & Address	Phone No.	Signature
1	காரம்பாக்கம் [illegible] No-1. [illegible] காரம்பாக்கம், சென்னை-116	94441 49999	[signature]
2	C. [illegible] 1/63 [illegible]	9445266970	C. [signature]
3	A. [illegible] No-1/11, பாரதி சாலை [illegible], சென்னை-95	9444251405	[signature]
4	M. [illegible] No-10-A [illegible], சென்னை-95	9789013600	M. [signature]
5.	V. [illegible] No-1/13A பாரதி சாலை, [illegible], சென்னை-95	9444110424	V. [signature]
6.	K. பாஸ்கரன் [illegible] -39 [illegible], சென்னை-95	[illegible]5160	[signature]
7.	M. சுப்பரமணி [illegible] No-11, பாரதி சாலை, [illegible], சென்னை-95	9442593407	M. [signature]
8.	[illegible] 1/46 [illegible]	9840102442	[signature]
9	[illegible] 1/1 PH [illegible]-95	9840144490	[signature]
10	N. KRISHNA SWAMY No. 64, Ramanan Street Sri Balaji Nagar, [illegible] Chennai - 600077. Sri Balaji Nagar Residents Welfare Assn	9994340640	[signature]
11	G N [illegible], Plot No 63 Raman ST, Balaji Nagar [illegible] Ch-600077	7358607558	[signature]

S.No.	Name & Address	Phone No.	Signature
12.	M. [illegible] [illegible] [illegible]	9445366422	[illegible]
13.	E.T. Vijayakumar, 43, Murthy Nagar, 3rd Street, Chettiyar Agaram, Chennai-77	9381015370	[illegible]
14	S. Gunasekaran, No. 8 Vijayalakshmi Nagar, Chennai-77	9444351114	[illegible]
15.	I. Vijaya Kumar (President), S&P Garden Residents Welfare Association, Nolambur, Chennai 95	9383632887	[illegible]
16.	D. Balaraman, S&P Garden Welfare Association Nolambur, [illegible]	9381518181.	[illegible]
17	M. Sankaran Kutty, Plot No 9 - Brahmin Street Extension, Karambakkam, Chennai-600116	9677073109	[illegible] 13/11/17
18	C.M. Damodhan, 3/5A Rajeswari Nagar Annex, Karambakkam Porur [illegible]	9840989884	[illegible]
19	M. Sathya, No-5/64, First Street, Karambakkam, Ch-116	9840989880	[illegible]
20	R. [illegible], 3/A [illegible], [illegible]-116 9444039619		
21	Shanmugam, Chettiar Agaram, Chennai-600077	9841913834	[illegible]
22	C. [illegible], 1/34 [illegible], [illegible]		[illegible]
23	R. Sivaguru [illegible], [illegible], [illegible], [illegible]-77	9940677855	[illegible]

S.No.	Name & Address	Phone No.	Signature
24	S [illegible] 1/8, [illegible]	77080 26030	S [illegible]
25	D. [illegible] 1/10 [illegible]	9941397649	D. [illegible]
26	[illegible]	9841823026	[illegible]
27	G. [illegible] 2/10 [illegible] 116	9840003848	G. [illegible]
28	I.R.A. ANANDA RAMESH 2/4, ANNA SALAI, GANDHI NAGAR KARAMBAKKAM PORUR, CH-116	99400 68251	I.R.A [illegible]
29	G. [illegible] 4. [illegible] 77.	9884691539	G. [illegible]
30	R. [illegible] (D. [illegible]) 6. [illegible] -77.	9841995469	R. [illegible]
31	V. [illegible] No. 2/4, [illegible] - 77.	9841314636	E. [illegible]
32	E. [illegible] 2) [illegible] 77.	9566210661	E. [illegible]
33	V. [illegible] 2/1 [illegible] 77.	8489836049	S. Divya
34	M.S. [illegible] 11 [illegible] 77.	9444349859	R. [illegible]
35	P. Umadevi [illegible] No - 1 [illegible] 77		P. Umadevi

S.No.	Name & Address	Phone No.	Signature
36	NO. 15. [illegible]	9444484919	H. Reena
37	No 9/2. S. [illegible] -77	9176762261	S. [illegible]
38	G. Palani NO. 2/14. Senthamil Street Thendral Anna nagar	9840118731	G. Palani
39	A. [illegible] 7. [illegible] 77	9884691539	A. [illegible]
40	P.MATHIVANAN No-1/4. [illegible] Chettiyara [illegible] Ch77	9840574076	P.mathivan
41	N.GANDHARAN No-1/2 [illegible] -77	9840199427	N.GANDHARAN
42	N. ARIVU / ANSIM FLATS 28, Andal Nagar, Varagaram ch-95.	9840848855	[illegible]
43	M [illegible] 1/14 [illegible] 9840519553	9840519553	[illegible]
44	N. [illegible] 1/13 [illegible]	7299310091	N [illegible]
45	E. [illegible] B.J.P. 4/16 V.O.C Street. [illegible]	9092621076	[illegible]
46.	V.S. [illegible] H.M.K. [illegible] -116.	9840557999 9841541999 58	V.S. [illegible]

STAKEHOLDERS MEETING FOR MANAPAKKAM UGSS HELD ON 13.11.2017

S.No.	Name & Address	Phone No.	Signature
1	R. Natarajan, 102 and 103, 5th cross Road, Marvel River View County, Manapakkam	9884379958	[signature]
2.	Mrs. Brindha Broghton, No. 50, 5th cross, Marvel River View County, Manapakkam, Chennai - 125.	9962519229	[signature] 13/11/2017
3.	Col Balaram Sharma 7/72, MRVC Manapakkam, Ch - 125	9444556660	[signature] 13/11/2017
4.	V. Ramakrishnan 25, M.R.V.C., Manapakkam - 600125	9884556921	[signature] 13/11
5.	T. HARMIS JOSE No: 13, 1ST CROSS STREET MARVEL RIVER VIEW COUNTY, MARIAMMAN KOIL STREET, MANAPAKKAM, CHENNAI-125	9840024064	[signature]
6.	N.R. PRABAKER Plot 82, 5th street Marvel River View County Manapakkam - Chennai - 125	9600516302	[signature]
7	B. Krishnamurthy [illegible] 5th Cross St, Marvel Riverview County, Manapakkam, Ch - 600 125	9884633634	[signature]
8	R. MURALI Plot No: 35, 3rd CROSS Street MRVC Manapakkam - 12	9940453963	R. Murali
9	P.R. VIJAYAKUMAR Plot 59, 7th Street MRVC	9840145314	[signature]
10	K. MANICKAVASAGAM Plot No 64, 7th Street Marvel River View County Manapakkam	9884500044	[signature]
11.	M. Sivashanmugam 7, O.F-2, Cosy Orchid, Lakshmi Nagar, Manapakkam - Ch. 125	9840379789	[signature]

S.No.	Name & Address	Phone No.	Signature
12	M. Rathinasabapathi 45, V cross st Marvel River View County Manapakkam	044-49524268	M. Rathinasabapathi
13	M. Pandi Durai CRR Puram 2nd Main Road Manapakkam-600125.	9962389325	
14	Kripa Sankar CRR PURAM 3rd main Road Manapakkam - 600125	9765548229	
15	P. SENTHILVEL AF1, COSY OF CHID, LAKSHMI NGR, MANAPAKKAM - 600125	9884802601	
15	UNNIKRISHNAN-S 1/266B, PLOT B, 1ST CROSS ST, LAKSHMI NAGAR MANAPAKKAM. CH-.	9962001540	
16.	C.VIJAYA KUMAR PLOT 30, ..., RAVIS VILLAS LAKSHMI NAGAR, MAIN, MANAPAKKAM	99,62463315	
17	S. Karthikeyan 21509, Jayaram Reddiar Garden Ambalkar Nagar, Manapakkam.	9500151491	S Karthikeyan
18	B. Athreyan Plot 2,3,4 Lakshmi nagar IInd cross st off near Indian nagar main road 600114	98846-72727	B Athreyan
19	T. Thomas Raj 1/266A, Lakshmi Nagar Manapakkam Chennai -125	9884076596	Thomas Raj
20	Y. Noble John 1/266 B, Lakshmi Nagar	7401127777	
21	Lionel John 1/266, Lakshmi Nagar	94447315 16	
2	Sivakumar. J 87, 6th cross st, Marvel riverview county, Manapakkam	9962-540-348	

S.No.	Name & Address	Phone No.	Signature
22	Mohamed Shahid Basha 1/263, Laxmi Nagar, Mangadu chennai	9566276288	
23	P. mohan Laxmi Nagar 28 [illegible]	9840223588	
24	Ramesh Gandhi Plot No: 19 1/2612 K2 Lakshmi nagar 1st Avenue CH 125	9884082230	
25	Gokul nanda kumar 1/261 K1, 1st cross street Lakshmi nagar CH-125	9600756972	
26	N S Gopalakrishnan 1/2614, 2nd Cross St. Lakshmi Nagar Manapakkam CH-125	9840856064	
27	C Arulprakasam Sathya nagar, ch. 116	9884708258	
28	P. SENTHIL KUMAR, 7th cross str, 29 Shanthi Avel Sathaya Nagar, Ramapuram	9489157731	

சென்னைப் பெருநகர் குடிநீர் வழங்கல் மற்றும் கழிவுநீரகற்று வாரியம்

மக்கள் கருத்து கேட்பு கூட்டம்

பெருநகர சென்னை மாநகராட்சிக்குட்பட்ட மணலி மற்றும் சின்னசேக்காடு ஆகிய பகுதிகளுக்கான கழிவுநீர் திட்டத்திற்கான விரிவான திட்ட அறிக்கை சென்னை குடிநீர் வாரியத்தால் தயாரிக்கப்பட்டுள்ளது.

இத்திட்டங்களுக்கான மக்கள் கருத்து கேட்பு கூட்டம் 13.11.2017 அன்று காலை 11.00 மணி முதல் 1.00 மணி வரை "எண்.162, நெடுஞ்செழியன் சாலை, மணலி, சென்னை–600068–ல்" அமைந்துள்ள சென்னைப் பெருநகர் குடிநீர் வழங்கல் மற்றும் கழிவுநீரகற்று வாரியத்தின் (CMWSS Board) பகுதி அலுவலகம் –2ல் நடைபெற உள்ளது. இக்கூட்டத்தில் பொது மக்கள் கலந்து கொண்டு தங்களின் மேலான கருத்துக்களை பதிவு செய்யுமாறு கோரப்படுகிறது.

மேற்பார்வை பொறியாளர்

(திட்டம் மற்றும் வடிவமைப்பு)

சென்னைப் பெருநகர் குடிநீர் வழங்கல் மற்றும் கழிவுநீரகற்று வாரியம்

மக்கள் கருத்து கேட்பு கூட்டம்

பெருநகர சென்னை மாநகராட்சிக்குட்பட்ட காரம்பாக்கம் பகுதிக்கான கழிவுநீர் திட்டத்திற்கான விரிவான திட்ட அறிக்கை சென்னை குடிநீர் வாரியத்தால் தயாரிக்கப்பட்டுள்ளது.

இத்திட்டத்திற்கான மக்கள் கருத்து கேட்பு கூட்டம் 13.11.2017 அன்று காலை 11.00 மணி முதல் 1.00 மணி வரை "எண். 8–B, கங்கையம்மன் கோயில் தெரு, ஆலப்பாக்கம், சென்னை – 600116–ல்" அமைந்துள்ள சென்னைப் பெருநகர் குடிநீர் வழங்கல் மற்றும் கழிவுநீரகற்று வாரியத்தின் (CMWSS Board) பகுதி அலுவலகம் –11ல் நடைபெற உள்ளது. இக்கூட்டத்தில் பொது மக்கள் கலந்து கொண்டு தங்களின் மேலான கருத்துக்களை பதிவு செய்யுமாறு கோரப்படுகிறது.

மேற்பார்வை பொறியாளர்
(திட்டம் மற்றும் வடிவமைப்பு)

சென்னைப் பெருநகர் குடிநீர் வழங்கல் மற்றும் கழிவுநீரகற்று வாரியம்

மக்கள் கருத்து கேட்பு கூட்டம்

பெருநகர சென்னை மாநகராட்சிக்குட்பட்ட மணப்பாக்கம் பகுதிக்கான கழிவுநீர் திட்டத்திற்கான விரிவான திட்ட அறிக்கை சென்னை குடிநீர் வாரியத்தால் தயாரிக்கப்பட்டுள்ளது.

இத்திட்டத்திற்கான மக்கள் கருத்து கேட்பு கூட்டம் 13.11.2017 அன்று மாலை 3.00 மணி முதல் 5.00 மணி வரை ஆலந்தூர் "மேல் நிலை நீர்தோக்க தொட்டி வளாகம், புது தெரு, ஆலந்தூர், சென்னை – 600016 –ல்" அமைந்துள்ள சென்னைப் பெருநகர் குடிநீர் வழங்கல் மற்றும் கழிவுநீரகற்று வாரியத்தின் (CMWSS Board) பகுதி அலுவலகம் –12ல் நடைபெற உள்ளது. இக்கூட்டத்தில் பொது மக்கள் கலந்து கொண்டு தங்களின் மேலான கருத்துக்களை பதிவு செய்யுமாறு கோரப்படுகிறது.

மேற்பார்வை பொறியாளர்
(திட்டம் மற்றும் வடிவமைப்பு)

NOTE FOR AREA ENGINEER- II / III

Sub: CMWSSB - P&D – lands identified by CMWSSB for the construction of Sewage Pumping Stations in newly added areas of Chennai city – Name Board to be fixed – Stake Holder's Meeting to be conducted - Reg.

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The following lands have been identified by CMWSSB for the construction of Sewage pumping station for providing comprehensive Sewerage scheme to Manali and Chinnasekkadu.

Sl. No.	Location of land and village name	Survey No	Classification	Extent of land given in m	Div no/Area
1	Srinivasa Perumal Koil Street			24.6m x 9.20m	20 / Area II
2	CPCL Layout	168	OSR	30m x 18m	18 / Area II
3	Bharathiyar street	230/2A	Burial Ground	30m x 30m	18 / Area II
4	Kamarajar Street			70m x 70m	20 / Area II
5	Chinna Mathur Road (Road side pumping station)	182/1A	Manali Eri	15m x 10m	20 / Area II
6	Inside Kodungaiyur STP			30m x 30m	29 / Area III

As mandated by the Asian Development Bank, Name Boards have to be erected specifying the purpose for which the lands are to be used. Moreover the Stake Holder's Consultation Meeting has to be conducted by CMWSSB to detail the proposal involved in each Underground Sewerage Scheme to the local people.

In this connection, it is proposed to conduct Stake Holder's Consultation Meeting on 13.11.2017 for Manali and Chinnasekkadu Underground Sewerage scheme at Area II office at No.127, Padasalai street, Manali. The notices to be served to the local residents are herewith enclosed. The same may be distributed and the distribution should be

O/C

3/11/17 3/11/17

documented through acknowledgement and photos. It is requested to arrange for refreshment to the participants of the Stake Holder's Meeting.

The Area Engineers are requested to erect Name Boards in the above mentioned sites on or before 09.11.2017. The details to be furnished in the name board is enclosed. On erection of the Name Board, a photo taken at site may please be furnished to P&D Wing for submission to ADB. Further a banner detailing a Stake Holder's Consultation Meeting has to be erected in the Area office for which the details are also enclosed.

This may be treated as " MOST URGENT".

A.E. (P&D)

3/11/17
Executive Engineer II(P&D)

Copy: Submitted to S.E(P&D), S.E(North), E.D/c

3/11/17

NOTE FOR AREA ENGINEER- XI

Sub: CMWSSB - P&D – lands identified by CMWSSB for the construction of Sewage Pumping Stations in newly added areas of Chennai city – Name Board to be fixed – Stake Holder's Meeting to be conducted - Reg.

******

The following lands have been identified by CMWSSB for the construction of Sewage pumping station for providing comprehensive Sewerage scheme to Karambakkam.

Sl. No.	Location of land and village name	Survey No	Classification	Extent of land given in m	Div no/Area
1	Avvai street Samayapuram	69/1	Vaikal Porambokke	15m x 15m	150 / Area XI
2	Chettiyar agaram	30	Grama Natham	30m x 30m	150 / Area XI
3	Maharishi Nagar	68/1A, 1B	OSR	20m x 20m	150 / Area XI
4	Gandhi Nagar	146	Burial Boomi	30m x 30m	150 / Area XI
5	Erikarai street			15m x 15m	150 / Area XI

As mandated by the Asian Development Bank, Name Boards have to be erected specifying the purpose for which the lands are to be used. Moreover the Stake Holder's Consultation Meeting has to be conducted by CMWSSB to detail the proposal involved in each Underground Sewerage Scheme to the local people.

In this connection, it is proposed to conduct Stake Holder's Consultation Meeting on 13.11.2017 for Karambakkam Underground Sewerage scheme at Area XI office at No.33, Arcot Road, Valasaravakkam. The notices to be served to the local residents are herewith enclosed. The same may be distributed and the distribution should be

O/C 3/11/17 3/11/17 3/11/17

documented through acknowledgement and photos. It is requested to arrange for refreshment to the participants of the Stake Holder's Meeting.

The Area Engineer is requested to erect Name Boards in the above mentioned sites on or before 09.11.2017. The details to be furnished in the name board is enclosed. On erection of the Name Board, a photo taken at site may please be furnished to P&D Wing for submission to ADB. Further a banner detailing a Stake Holder's Consultation Meeting has to be erected in the Area office for which the details are also enclosed.

This may be treated as ' MOST URGENT".

3/11/17
Executive Engineer II(P&D)

3/11/17
Asst (P&D)

Copy: Submitted to S.E(P&D), S.E(North), E.Di/c

NOTE FOR AREA ENGINEER- XII

Sub: CMWSSB - P&D – lands identified by CMWSSB for the construction of Sewage Pumping Stations in newly added areas of Chennai city – Name Board to be fixed – Stake Holder's Meeting to be conducted - Reg.

******

The following lands have been identified by CMWSSB for the construction of Sewage pumping station for providing comprehensive Sewerage scheme to Manapakkam.

Sl. No.	Location of land and village name	Survey No	Classification	Extent of land given in m	Div no/Area
1	Macrow Marvel (LS)	394 395 & 396		10m x 10m	157 / Area XII
2	River View Colony jn. Of Arcot Road and River View Colony Road (SPS)	115/2A, 116/2A	OSR	18m x 45m	157 / Area XII
3	Sathya Nagar (LS)			10m x 10m	157 / Area XII
4	MGR Nagar (LS)			10m x 10m	157 / Area XII
5	Sethulakshmi Nagar (Roadside PS)			10m x 10m	157 / Area XII
6	Indira Nagar (SPS)	327/2	Kalam Poramboke	40m x 40m	157 / Area XII

As mandated by the Asian Development Bank, Name Boards have to be erected specifying the purpose for which the lands are to be used. Moreover the Stake Holder's Consultation Meeting has to be conducted by CMWSSB to detail the proposal involved in each Underground Sewerage Scheme to the local people.

In this connection, it is proposed to conduct Stake Holder's Consultation Meeting on 13.11.2017 for Manapakkam Underground Sewerage scheme at Area XII office at No.1, New Street Near G.S.T Road, Alandur. The notices to be served to the local residents are herewith enclosed. The same may be distributed and the distribution should be

O/C 3/11/17 3/11/17 31/11/17.

documented through acknowledgement and photos. It is requested to arrange for refreshment to the participants of the Stake Holder's Meeting.

The Area Engineer is requested to erect Name Boards in the above mentioned sites on or before 09.11.2017. The details to be furnished in the name board is enclosed. On erection of the Name Board, a photo taken at site may please be furnished to P&D Wing for submission to ADB. Further a banner detailing a Stake Holder's Consultation Meeting has to be erected in the Area office for which the details are also enclosed.

This may be treated as " MOST URGENT".

Executive Engineer II(P&D)

Copy: Submitted to S.E(P&D), S.E(North), E.D/c

சின்னசேக்காடு – கழிவுநீர் திட்டம்
Underground Sewerage Scheme to Chinnasekkadu

முக்கிய அம்சங்கள் (Salient Features)

எண்	திட்ட கூறுகள் (Project Components)	சின்னசேக்காடு (Chinnasekkadu)
1	புவியியல் பரப்பளவு ச. கி.மீ. (Geographical area (sq.km)	3.00
2	தெருக்களின் மொத்த நீளம் கி.மீ (Total length of streets (Kms))	13.42
3	மக்கள் தொகை (Population) 2011	12396
4	மக்கள் தொகை (Projected Population) 2050	33655
5	கழிவுநீர் திட்ட குழாய்களின் நீளம் கி.மீ (Length of the Sewer Pipe Line (Kms))	12.647
6	கழிவு நீர் துளைகள் எண்ணிக்கை (Number of Manholes (Nos))	514
7	கழிவுநீர் ஏற்று நிலையங்களின் எண்ணிக்கை (Number of Lift stations (Nos))	--
8	கழிவுநீர் அசுற்று நிலையங்களின் எண்ணிக்கை (Number of Pumping stations (Nos))	1
9	உந்து குழாய் நீளம் (கி.மீ) (Length of Force main (Kms))	0.50
10	நாளொன்றுக்கு மீல்லியன் லிட்டர் கழிவுநீர் உற்பத்தி (Sewage generation in MLD)) 2050	4.04
11	எந்த கழிவுநீர் சுத்திகரிப்பு நிலையத்துடன் இணைக்கப்பட்டுள்ளது (Sewage Treatment Plant to be Connected with)	கொடுங்கையூர் (Kodungaiyur)

மணலி – கழிவுநீர் திட்டம்

Underground Sewerage Schemo to Manali

முக்கிய அம்சங்கள் (Salient Features)

வ.எ	திட்ட கூறுகள் (Salient Features)	மணலி (Manali)
1	புவியியல் பரப்பளவு ச. கி.மீ. (Geographical area (sq.km)	16.00
2	தெருக்களின் மொத்த நீளம் கி.மீ (Total length of streets (Kms))	30.00
3	மக்கள் தொகை (Population) 2011	35250
4	மக்கள் தொகை (Projected Populationectedion) 2050	79,640
5	கழிவுநீர் திட்ட குழாய்களின் நீளம் கி.மீ (Length of the Sewer Pipe Line (Kms))	29.271
6	கழிவு நீர் துளைகள் எண்ணிக்கை (Number of Manholes (Nos))	1,171
7	கழிவுநீர் ஏற்று நிலையங்களின் எண்ணிக்கை (Number of Lift stations (Nos))	1
8	கழிவுநீர் அகற்று நிலையங்களின் எண்ணிக்கை (Number of Pumping stations (Nos))	4
9	உந்து குழாய் நீளம் (கீ.மீ) (Length of Force main (Kms))	8.7
10	நாளொன்றுக்கு மில்லியன் லிட்டர் கழிவுநீர் உற்பத்தி (Sewage generation in MLD)) 2050	9.56
11	எந்த கழிவுநீர் சுத்திகரிப்பு நிலையத்துடன் இணைக்கப்பட்டுள்ளது (Sewage Treatment Plant to be Connected with)	கொடுங்கையூர் Kodungaiyur

காரம்பாக்கம் – கழிவுநீர் திட்டம்
Underground Sewerage Scheme to Karambakkam

முக்கிய அம்சங்கள் (Salient Features)

வ.எ	திட்ட கூறுகள் (Project Components)		முக்கிய அம்சங்கள் (Karambakkam)
1	புவியியல் பரப்பளவு ச. கி.மீ. (Geographical area (sq.km)		3.38
2	தெருக்களின் மொத்த நீளம் கி மீ (Total length of streets (Kms))		47.5
3	மக்கள் தொகை (Population)	2011	21376
4	மக்கள் தொகை (Projected Populationectedion)	2050	95,705
5	கழிவுநீர் திட்ட குழாய்களின் நீளம் கி.மீ (Length of the Sewer Pipe Line (Kms))		44.684
6	கழிவு நீர் துளைகள் எண்ணிக்கை (Number of Manholes (Nos))		1710
7	கழிவுநீர் ஏற்று நிலையங்களின் எண்ணிக்கை (Number of Lift stations (Nos))		2
8	கழிவுநீர் அகற்று நிலையங்களின் எண்ணிக்கை (Number of Pumping stations (Nos))		3+1 (Improvement works at Maduravoyal PS)
9	உந்து குழாய் நீளம் (கீ.மீ) (Length of Force main (Kms))		9.77
10	நாளொன்றுக்கு மில்லியன் லிட்டர் கழிவுநீர் உற்பத்தி (Sewage generation in MLD))	2050	11.48
11	எந்த கழிவுநீர் சுத்திகரிப்பு நிலையத்துடன் இணைக்கப்பட்டுள்ளது (Sewage Treatment Plant to be Connected with)		Koyambedu (கோயம்பேடு)

மணப்பாக்கம் – கழிவுநீர் திட்டம்
Underground Sewerage Scheme to Manapakkam

முக்கிய அம்சங்கள் (Salient Features)

நெ	திட்ட கூறுகள் (Project Components)		மணப்பாக்கம் (Manapakkam)
1	புவியியல் பரப்பளவு ச. கிமீ. (Geographical area (sq.km)		4.10
2	தெருக்களின் மொத்த நீளம் கி மீ (Total length of streets (Kms))		27.00
3	மக்கள் தொகை (Population)	2011	13333
4	மக்கள் தொகை (Projected Populationectedion)	2050	53,390
5	கழிவுநீர் திட்ட குழாய்களின் நீளம் கிமீ (Length of the Sewer Pipe Line (Kms))		25.913
6	கழிவு நீர் துளைகள் எண்ணிக்கை (Number of Manholes (Nos))		934
7	கழிவுநீர் ஏற்று நிலையங்களின் எண்ணிக்கை (Number of Lift stations (Nos))		4
8	கழிவுநீர் அகற்று நிலையங்களின் எண்ணிக்கை (Number of Pumping stations (Nos))		1
9	உந்து குழாய் நீளம் (கீமீ) (Length of Force main (Kms))		9.8
10	நாளொன்றுக்கு மில்லியன் லிட்டர் கழிவுநீர் உற்பத்தி (Sewage generation in MLD))	2050	6.41
11	எந்த கழிவுநீர் சுத்திகரிப்பு நிலையத்துடன் இணைக்கப்பட்டுள்ளது (Sewage Treatment Plant to be Connected with)		நெசப்பாக்கம் (Nesapakkam)

Site Details of Manali UGSS

No.	Location	Name of the village	Survey No	Land extent required	OwnerShip	Classification of Land
1	Srinivasa Perumal Koil Street	Manali		24.60 X 9.20	CMWSSB	
2	CPCL Layout	Manali	168	30 X 18	GCC	OSR
3	Bharathiyar street	Manali	230/2A	30 x30	GCC	Burial Ground
4	Kamarajar Street	Manali		70 X 70	GCC	
5	Chinna Mathur Road,(Road side pumping station)	Manali	182/1A	15x10	GCC	Manali Eri
6	Inside Kodungaiyur STP	Chinnasekkadu		30m x 30m	CMWSSB	

Site Details Of Chinnasekkadu UGSS

No.	Location	Name of the village	Survey No	Land extent required	OwnerShip	Classification of Land
1	Inside Kodungaiyur STP	Chinnasekkadu		30m x 30m	CMWSSB	

Site Details of Karambakkam UGSS

No.	Location	Name of the Village	Survey No	Land Extent Required	Ownership	Classification of Land
1	Avvai street Samayapuram	Karambakkam	69/1	15m x 15m	Government	Vaikal Porambokke
2	Chettiyar agaram	Chettiyar agaram	30	30m x 30m	Government	Grama Natham
3	Maharishi Nagar	Sivaboodham Village	66 / 1A,1B	20 m X 25 m	GCC	OSR
4	Gandhi Nagar	Karambakkam	146	30m x 30m	Corporation	Burial Boomi
5	Erikarai street	Karambakkam		15m x 15m	CMWSSB	

Site Details of Manapakkam UGSS

No.	Location	Name of the village	Survey No	Land extent required	OwnerShip	Classification of Land
1	Macrow Marvel (LS)	Manapakkam	394, 395 and 396	10m x 10m	CMWSSB / Corporation of Chennai	
2	River View Colony jn. of Arcot Road and River View Colony Road (SPS)	Manapakkam	115/2A, 116/2A	18m x 45m	Corporation of Chennai	OSR
3	Sathya Nagar (LS)	Manapakkam		10m x 10m	CMWSSB	
4	MGR Nagar (LS)	Manapakkam		10m x 10m	CMWSSB	
5	Sethulakshmi Nagar (Roadside PS)	Manapakkam		10m x 10m	Corporation of Chennai	
6	Indira Nagar (SPS)	Manapakkam	327/2	40m x 40m	Government	Kalam Poramboke

Photographs of Stakeholders Consultation Meeting held on 13 November 2017 for Chinnasekkadu and Manali UGSS






Photographs of Stakeholders Consultation Meeting held on 13 November 2017 for Karambakkam UGSS

Photographs of Stakeholders Consultation Meeting held on 13 November 2017 for Manapakkam UGSS