

Initial Environmental Examination

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India: Tamil Nadu Urban Flagship Investment Project
(Tranche 3) – Underground Sewerage System for
Added Areas of Coimbatore Corporation – Zone V
(Vadavalli and Veerakeralam) [Wards 16 to 19] and
Zone VII (Kavundampalayam and Thudiyalur) [Wards
1 (Part) 2 to 9 & 43 (Part)]

Prepared by Tamil Nadu Water Supply and Drainage Board on behalf of Coimbatore City
Municipal Corporation of the Government of Tamil Nadu for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 25 April 2022)

Currency Unit	–	Indian rupee (₹)
₹1.00	=	\$0.0131
\$1.00	=	₹76.464

ABBREVIATIONS

ADB	–	Asian Development Bank
ASI	–	Archaeological Survey of India
BOD	–	Biochemical Oxygen Demand
CBO	–	Community Based Organisation
CCMC	–	Coimbatore City Municipal Corporation
CMA	–	Commissionerate of Municipal Administration
CMSC	–	Construction Management and Supervision Consultant
CPCB	–	Central Pollution Control Board
CTE	–	Consent To Establish
CTO	–	Consent To Operate
DBOT	–	Design Build Operate Transfer
DWC	–	double wall corrugated
EAC	–	Expert Appraisal Committee
EC	–	Environmental Clearance
EHS	–	Environmental Health and Safety
EIA	–	Environmental Impact Assessment
ESS	–	Environmental and Social Safeguard
EMP	–	Environmental Management Plan
GOI	–	Government of India
GoTN	–	Government of Tamil Nadu
IEE	–	Initial Environmental Examination
MOEFCC	–	Ministry of Environment, Forest and Climate Change
NGO	–	Non-Government Organisation
NOC	–	No Objection Certificate
PIA	–	Project Implementing Agency
PIU	–	Project Implementation Unit
PMU	–	Project Management Unit
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 Watersupply and Drainage Board
WHO	–	World Health Organization

WEIGHTS AND MEASURES

°C	-	Degree Celsius
km	-	kilometer
LPCD	-	liters per capita per day
m	-	meter
Mgd	-	million gallons per day
MLD	-	million litres per day
mm	-	millimeter
nos	-	numbers
km ²	-	square kilometer
m ²	-	square meter

NOTE

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

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CONTENTS

	Pages
EXECUTIVE SUMMARY	i
I. INTRODUCTION	1
A. Background	1
B. Purpose of this Initial Environmental Examination Report :	3
C. Report Structure	3
II. DESCRIPTION OF THE PROJECT	5
A. Project Area	5
B. Existing Sewerage System :	5
C. Proposed Project :	7
D. Implementation Schedule :	23
III. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK	24
A. ADB Policy	24
B. National Environmental Laws :	24
C. International Treaties/Conventions/Declarations on Environment Management	33
IV. DESCRIPTION OF THE ENVIRONMENT	34
A. Methodology Used for Baseline Study :	34
B. Physical Resources :	34
C. Ecological Resources	55
D. Economic Development :	56
E. Socio-Cultural Resources	60
F. Sub-project Site Environmental Features :	63
V. ANALYSIS OF ALTERNATIVES	92
VI. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES :	94
A. Pre-Construction Impacts – Design and Location :	95
B. Construction Impacts	104
C. Operation and Maintenance Impacts	120
VII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE	125
A. Overview	125
B. Public Consultation	125
a. Consultation during Project Preparation	125
b. Consultation during construction	126
C. Information Disclosure	126
VIII. GRIEVANCE REDRESS MECHANISM	127
IX. ENVIRONMENTAL MANAGEMENT PLAN	130
A. Environmental Management Plan	130
B. Implementation Arrangements	175
C. Training Needs	178
D. Monitoring and Reporting	179

E.	Environmental Management Plan Implementation Cost	180
X.	CONCLUSION AND RECOMMENDATIONS	181

LIST OF TABLES

Table 2 (a): Proposed Underground Sewerage Scheme - Sewer System	7
Table 2 (b): Proposed Underground Sewerage Scheme - STP	10
Table 3: Applicable Environmental Regulations	25
Table 4: Effluent Disposal Standards of Sewage Treatment Plants	26
Table 5: Clearances and Permissions Required for Construction	27
Table 6: National Ambient Air Quality Standards and WHO Guidelines	29
Table 7: National Noise Standards and WHO Guidelines	31
Table 8: National Drinking Water Quality Standards and WHO Guidelines	31
Table 9: Standards for Composting as manure	32
Table 10: International Treaties/ Conventions/ Declarations on Environment	33
Table 11: Water Quality Data of Lakes, 2016	39
Table 12 : Salient Features of Selvachinthamani Lake	42
Table 13 : Water Quantity / Quality of Selvachinthamani Lake	43
Table 14: Salient Features of Periyakulam Lake	43
Table 15: Water Quantity / Quality of Periyakulam Lake	44
Table 16: Values of Water Quality Parameter and Water Quality Index of River Noyyal Connected Ponds during Summer Season (2018)	47
Table 17: Values of Water Quality Parameter and Water Quality Index of River Noyyal Connected Ponds during Rainy Season (2018)	47
Table 18: Groundwater Quality	49
Table 19: Annual Average Concentrations of Air Pollutants, 2018 -2019	49
Table 20: Annual Average Concentrations of Air Pollutants, 2008 -2009	50
Table 21: Annual Average Concentrations of Air Pollutants, 2009 -2010	50
Table 22: Ambient Air Quality Monitoring Results of Coimbatore between 2012& 2020	51
Table 23: Ambient Air Quality Monitoring Results of Coimbatore between 2012& 2020	52
Table 24: Ambient Air Quality Monitoring Results of Coimbatore between 2012& 2020	53
Table 26: Ambient Day-time Noise Levels in Coimbatore	54
Table 27: Demographic Characteristics (2011 Census)	61
Table 28: Site Environmental Features – Zone V (Vadavalli & Veerakeralam areas)	63
Table 29 : Details of Land in Vadavalli & Veerakeralam Areas	81
Table 30 : Details of Lift Station Land in Kavundampalayam, Thudiyalur & Vellakinar (Part) Areas	85
Table 31: Site Environmental Features–Zone VII (Kavundampalayam & Thudiyalur)	89
Table 32: Analysis of Alternatives	92
Table 33: Standards for Sewage Treatment Plants (STPs)	95
Table 34: Standards for Sludge Reuse as Manure	97

Table 35: Sewer Construction (Zone V)	105
Table 36: Sewer Construction (Zone VII)	106
Table 38: Environmental Impacts and Mitigation Measures - Sewage Treatment Plant	154
Table 39: Environmental Monitoring Plan – Sewer System	170
Table 40: Environmental Monitoring Plan – Sewage Treatment Plant	172
Table 41: Outline Capacity Building Program on EMP Implementation	178
Table 42: Cost Estimates to Implement the Environmental Management Plan	180

LIST OF FIGURES

Figure 1: Subproject Area	6
Figure 2: Location of Subproject	7
Figure 3: Location of Lifting and Pumping Stations (Zone V & VII)	11
Figure 4: Location of Lifting and Pumping Stations (Zone V)	12
Figure 5: Location of Lifting and Pumping Stations (Zone VII)	13
Figure 6: Sewage Treatment Plant Site (Zone V)	14
Figure 8:	16
Figure 9: Sewage Treatment Plant and 1km radius	17
Figure 10 a: Sewage Treatment Plant – Tentative Layout Map	19
Figure 10 b: Sewage Treatment Plant – Tentative Layout Map	20
Figure 11: Sewage Treatment Plant and Alignment of Outfall Sewer (Zone V)	21
Figure 12: Sewage Treatment Plant and Alignment of Outfall Sewer (Zone VII)	22
Figure 13: Geomorphology of Project Area	37
Figure 14: Annual Seasonal Rainfall in Project Area	38
Figure 15: Monthly Max and Min Average Temperature in Project Area	38
Figure 16: Location of 8 Lakes in Coimbatore Corporation	40
Figure 17: Tanks and Anaicuts Connecting Noyyal River	40
Figure 18: Connectivity of Lakes and Joining into River Noyyal	41
Figure 19: Details of Selvachinthamani Lake	42
Figure 20: Details of Periyakulam Lake	43
Figure 21: Graphical Representation of WQP of River Noyyal Connected Ponds during Summer and Rainy Seasons – 2018	45
Figure 22: Ground Water Prospects in Project Area	48
Figure 23: Annual Average Concentrations of Air Pollutants	50
Figure 24: Ambient Air Quality of Coimbatore 2012 to 2020 (Mixed Area)	52
Figure 25: Ambient Air Quality of Coimbatore 2012 to 2020 (Industrial Area)	53
Figure 26: Ambient Air Quality of Coimbatore 2012 to 2020 (Residential Area)	54
Figure 27: Salim Ali Centre for Ornithology and Natural History [SACON]	56
Figure 28: Map Showing Proposed land use plan for CMC 2021	57
Figure 29: Proposed land use for Coimbatore LPA 2021	58
Figure 30: Map Showing Land Use and Land Cover in the Project Area	58
Figure 31: Nearest Archaeological Survey of India Protected Monument	62

Figure 32 :Site Set out Plans – Zone V (Vadavalli & Veerakeralam)	69
Figure 33 :Site Set out Plans – Zone V (Onnampalayam)	70
Figure 34 :Site Set out Plans – Zone V (Near Sundaram palayam drainage crossing)	71
Figure 35 :Site Set out Plans – Zone V (Sri Ram Gardens)	72
Figure 36 :Site Set out Plans – Zone V (Vadavalli Stream Crossing)	73
Figure 37 : Site Set out Plans – Zone V (Maharani Avenue)	74
Figure 38 : Site Set out Plans – Zone V (GKS Avenue)	75
Figure 39 : Site Set out Plans – Zone V (Maharani Avenue)	76
Figure 40:Site Set out Plans – Zone VII (Siva Csatile)	77
Figure 41:Site Set out Plans – Zone VII (Lakshmi Garden)	78
Figure 42:Site Set out Plans – Zone VII (Easwaran Nagar)	79
Figure 43:Site Set out Plans – Zone VII (Cheran Colony)	80
Figure 44: Proposed TNUFIP Grievance Redress Mechanism	128

LIST OF APPENDICES

Appendix 1 : Rapid Environmental Assessment Checklist	184
Appendix 2: Salient Features of Major Labor Laws Applicable to Establishments Engaged In Construction of Civil Works	189
Appendix 3: Sample Outline Spoils (Construction Waste) Management Plan	191
Appendix 4: Public Information Notice Template	192
Appendix 5: Sample Grievance Registration Form	193
Appendix 6: Sample Outline Traffic Management Plan	194
Appendix 7: Sample Environmental Site Inspection Report	201
Appendix 8: Semi-Annual Environmental Monitoring Report Template	203
Appendix 9: Public Consultation Details	209
Appendix 10: COVID - 19 Health & Safety Plan/ SOP	234
Appendix 11: Mechanical Odour Control Devices	237

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 impact: urban livability and climate resilience in cities of economic importance improved. TNUFIP will have the following outcomes: smart and climate resilient urban services delivered in ten cities in priority industrial corridors.

The TNUFIP is structured under three outputs: (i) sewage collection and drainage improved and climate-friendly sewage treatment systems introduced, (ii) access to reliable and smart drinking water services improved, and (iii) Institutional capacity, public awareness, and urban governance strengthened. TNUFIP will be implemented over an 8-year period beginning in 2018, and will be funded by Asian Development Bank (ADB). via its multitranche financing facility (MFF).

Tranches. TNUFIP MFF comprises of three tranches sequenced based on readiness, absorptive capacity, and logical progression of investments. Tranche 1 (Project 1), approved in September 2018, is supporting water supply and sewerage facilities in six cities (Chennai, Coimbatore, Rajapalayam, Tiruchirappalli, Tirunelveli, and Vellore), capacity development of the DMA and ULBs and improvement in urban governance and financial management in all 135 ULBs. A transactional technical assistance approved in 2018 will strengthen capacity of the DMA to better support ULBs in preparing urban infrastructure projects and implement urban governance improvement programs. Tranche 2 (Project 2), approved in November 2019, is supporting water supply and sewerage facilities in five cities (Ambur, Madurai, Tiruchirappalli, Tiruppur, and Vellore) and facilitating reforms for improved service delivery and innovation in the program ULBs. A periodic financing request for the third last tranche under the TNUFIP MFF is submitted to ADB and is under processing. Tranche 3 (Project 3) will support water supply in Madurai, sewerage in Coimbatore and storm water drainage in Thoothukudi.

The Subproject. Coimbatore, located in the central western part of Tamil Nadu, is second largest city in the state after capital Chennai. In this subproject to be implemented under the ADB funded TNUFIP, it is proposed to provide underground sewerage system in added areas (Zone V (Vadavalli & Veerakeralam) and Zone VII (Kavundampalayam & Thudiyalur)) of Coimbatore City Municipal Corporation (CCMC). These areas are located in the western/ northern outskirts of the city. Subproject includes the following civil works components: (i) sewer network (528.557 kilometre (km) length of sewers and 20,079 No. of Manholes), (ii) 10 No. of Lift Stations, (iii) 4 Nos. of Sub-pumping / Main-pumping Station, (iv) Pumping Mains (14.070 km), (v) 2 Nos. of Sewage Treatment Plant (STP) of 15.43 Million Litres per Day (MLD) and 19.49 MLD capacity respectively and (vi) 71,778 House Service Connections. This subproject is split into three contract packages for implementation: (i) sewer system in Zone 5, (ii) sewer system in Zone 7, and (iii) two STPs. Sewer system packages are of 'Works' type contract while STP contract is of Design-Build-Operate (DBO) modality, where in which contractor will design STP, build and operate for a duration agreed in the contract.

Project implementation arrangements. The Municipal Administration and Water Supply Department (MAWS) of GoTN acting through the Tamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL) is the state-level executing agency. A Project Management Unit (PMU) is established in TNUIFSL which is headed by a Project Director and Deputy Project

Director (senior official from Commissionerate of Municipal Administration, CMA), and comprising dedicated full-time staff from TNUIFSL for overall project and financial management. The beneficiary of this project is Coimbatore City Municipal Corporation (CCMC). CCMC is the Project Implementing Agency (PIA) for this subproject. A Project Implementation Unit (PIU) is established in Tamilnadu Water supply and Drainage Board (TWAD Board) which is headed by a full-time Project Manager (Executive Engineer or above) and comprising dedicated full-time staff of the TWAD Board for day-to-day implementation of the subproject. Environmental and Social Safeguards (ESS) Managers in PMU/TNUIFSL will coordinate all the safeguard related activities of the subproject and will ensure the compliance with Environmental Management Plan (EMP) and Environmental Assessment and Review Framework (EARF). Environmental Expert (Environmental Engineers in TWAD Board) will ensure implementation of subproject in compliance with EMP and EARF, and will carry out all necessary tasks at PIU level. At the contractor's level, the EHS personnel will carry out necessary actions in the site to ensure compliance to EMP and EARF requirements.

Screening and assessment of potential impacts. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. As per the Government of India (GOI) Environmental Impact Assessment (EIA) Notification, 2006, this subproject does not require EIA study or environmental clearance (EC). For the STP sub-component, the consent to establish would be obtained prior to commencement of works from the Tamil Nadu Pollution Control Board¹. The potential environmental impacts of the subproject have been assessed using ADB Rapid Environmental Assessment Checklist for Sewerage and accordingly the potential negative impacts were identified in relation to pre-construction, construction and operation.

Categorisation. Based on the outcome 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. For category "B" projects an initial environmental examination (IEE) is required.

Description of the Environment. The subproject components are located in Vadavalli (16 & 17 wards) & Veerakeralam (18 & 19 wards) areas in the western suburbs and Kavundampalayam (5 to 9 wards) & Thudiyalur (1(Pt), 2 to 4 & 43(Pt) wards) areas in North-western part of Coimbatore City. Vadavalli, Veeraleralam and Thudiyalur are erstwhile Town panchayats and Kavundampalayam is erstwhile Municipality, added to Coimbatore City Municipal Corporation in 2011. Vadavalli & Veerakeralam areas are located on Coimbatore – Maruthamalai & Coimbatore – Anaikatti Roads. Veerakeralam is a suburb of Coimbatore City located 7 km from the main city. The wards in Vadavalli & Veerakeralam (16 to 19) are rapidly growing in terms of settlement, Industries and Institutions. Kavundampalayam & Thudiyalur areas are situated on either side of the Mettupalayam Road, which is leading to Ooty, called as Queen of Hills, familiar tourism centre possessing botanical garden, lakes, etc.,. Coimbatore district forms part of upland plateau region of Tamil Nadu with many hill ranges, hillocks and undulating topography with a gentle slope towards east except for the hilly terrain in the west. Vadavalli, Veeraleralam, Kavundampalayam and Thudiyalur areas have a predominantly plain terrain interspersed by Noyyal River and numerous water bodies. Generally, a sub-tropical climatic condition prevails in this area with average maximum and minimum temperature in the range of 36°C to 41°C and 14°C to 25°C

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

respectively. The average annual rainfall is 940 mm (for last 10 years), and most of the rain is received during south-west and north-east monsoon seasons. Proposed sub project components are located within the urban area of Vadavalli and Veeraleralam, except one of the STP site, which is located in the adjoining wards of 15, 20 & 21 (Chokkampudur and Ponniyarajapuram areas). In Kavundampalayam & Thudiyalur areas, proposed sub project components are located within the urban area itself. Sewers will be under the public roads, pumping stations are located on small government vacant land parcels in the project area, and the STP site are allotted and earmarked in the F.M. Sketch by the CMCC along with their enter upon permission (Lr.No.UGSS to added areas of Cbe Corpn/2017/MH.5/dt.23.7.2020 of The Commissioner, Coimbatore Corporation, Coimbatore-1) copy annexed in the land particulars. The allotted sites are vacant, and away from habitations. It is proposed to dispose the treated effluent of Vadavalli & Veerakeralam areas into the outlet stream of Kumarasamy Lake which flows to Selva Chinthamani Kulam and thereon to Periyakulam at Ukkadam and has its final outfall into the River Noyyal. The treated effluent of Kavundampalayam & Thudiyalur areas will be discharged to Sanganur pallam stream, leading to River Noyyal, which is about 11.48 kms from the site. As all the subproject components are located within or adjoining an urban area, there are no sensitive environmental features like forests. The nearest sensitive location is the Western Ghats, which is located at a distance of 5 km away from the beginning subproject area of Vadavalli. There are 4 water bodies in the subproject areas (Narasampathi, Krishnampathi, Selvampathy & Kumaraswamy Lakes) and they are seasonal.

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 along the alignment and controlled blasting in some stretches of the alignment and PS/STP sites.

Sewerage system performs a crucial function of safely collecting, transporting, treating and disposing domestic wastewater including human excreta (designed as a separate system). Subproject is likely to have numerous positive impacts on the environment and public health. In this IEE, negative impacts were identified in relation to pre-construction, construction, and operation phases. Planning principles and design considerations have been reviewed and incorporated into the site planning and design process wherever possible; thus, environmental impacts as being due to the project design or location were not significant. Sewage pumping and lifting stations, which collect sewage to further pump to a higher elevation manhole, pump station or STP, are likely to generate odour. Although, utmost care is taken to locate these away from the houses, due to design considerations and land constraints, some sites are located close to the houses. Appropriate odour mitigation measures have been proposed in the sub-project. Further Consultations as necessary would be carried out to explain about the uninterrupted pumping without storage of sewage and provisions towards mitigating the odour.

Sewage treatment facility would be designed to meet the preset disposal standards notified by CPCB/TNPCB for disposal of treated wastewater from STP. The treated sewage effluent from Zone-5 would be disposed into the outlet stream of Kumarasamy Lake which flows to Selva Chinthamani Kulam and thereon to Periyakulam at Ukkadam which has its final outfall into the River Noyyal and from Zone-7 the treated wastewater will be discharged to Sanganur pallam stream, leading to River Noyyal. Except monsoon seasons, River Noyyal carries wastewater from the villages and urban areas it flows through. It ultimately meets River Cauvery at Village Noyyal

in Karur District, over 100 km east of Coimbatore. With the implementation of subproject, disposal of untreated wastewater from Vadavalli, Veerakeralam, Kavundampalayam and Thudiyalur areas (subproject areas) will be prevented, and also treated wastewater will be disposed into River Noyyal. This will infact improve the water quality, and therefore no adverse impacts envisaged. Another impact is that of STP operation from malfunction or decrease in treatment efficiency and sludge handling and disposal. This will result in release of untreated or partially treated wastewater that will pollute environment and cause public health issues. From the site observations, there are pumpset manufacturing industries and other engineering industries are located in the added zones, which are not intended to let the industrial waste into this network. Accumulation of silt in sewers in areas of low over time, overflows, blockages, power outages, harmful working conditions for the workers cleaning sewers etc. may create nuisance, unhealthy and hazardous conditions.

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 odour control including: appropriately locating sewage wells within site as far as away from the houses; developing tree cover; covered facilities; gas collection and treatment facilities, and design and operation measures to prevent odour build up; Standard Operating Procedures(SOP's) for operation and maintenance; imparting necessary training; safety and personal protection equipment for workers, measures to maintain the STP treatment efficiency, and development of green buffer zone around the STPs etc.. Apart from green belt provision, mechanical odour control device has also been proposed in the Lift / Pumping / Main Pumping Stations.

Potential impacts during construction are considered significant but temporary, and are common impacts of construction in urban areas, and there are well developed methods to mitigate the same. Except sewer works, all other construction activities (lifting/pumping stations and STP) will be confined to the selected sites and the interference with the general public and community around is minimal. In these works, the temporary negative impacts arise mainly from construction dust and noise, hauling of construction material, from the existing government licensed mining areas, waste and equipment on local roads (traffic, dust, safety etc.), mining of construction material, occupation health and safety aspects. Sewer works will be conducted along public roads in an urban area congested with people, activities and traffic. Therefore these works will have significant impacts arising mainly from the disturbance of residents, businesses and traffic due to construction work; safety risk to workers, public and nearby buildings due to deep trench excavations in the road, especially in narrow roads; with STP sites involving controlled blasing, 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 (EMP). 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. Hard rock removal through controlled blasting for excavation, in case encountered, for some sections of the pipeline alignment and in the pumping station sites

and STP site. Mitigation measures to ensure safety of humans and structures within the area of influence and impacts due to controlled blasting during the implementation have been included in the EMP. The EMP will guide the environmentally sound construction of the subproject. The EMP also includes a monitoring program to measure the effectiveness of EMP implementation and include observations on-and-off-site, document checks, and interviews with workers and beneficiaries.

The EMP will be included in the bid and contract documents to ensure compliance with the conditions set out in this document. The contractor will be required to submit to PIU, for review and approval, 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; (iii) reflecting the associated mitigation and monitoring measures for the controlled blasting activities and (iv) monitoring program as per EMP. No works are allowed to commence prior to approval of SEMP. A copy of the EMP/approved SEMP will be kept on site during the construction period at all times.

Consultation, Disclosure and Grievance Redress Mechanism. The stakeholders were involved in developing the IEE through discussions on-site and a public consultation workshop at city level, after which, views expressed were incorporated into the IEE and in the planning and development of the project. The IEE will be made available at public locations and will be disclosed to a wider audience via the ADB, CCMC and TNUIFSL websites following ADB SPS and Access to Information Policy 2018. The consultation process will be continued during project implementation. A grievance redress mechanism is described within the IEE to ensure any public grievances are addressed quickly. GRM includes provisions for complainants to register complaints, and receive feedback, via phone, emails etc. remotely and safely, which is suitable in the current COVID-19 pandemic also.

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 environmental monitoring reports to ADB, semiannually during construction and annually during operation, until a project completion report (PCR) is issued by ADB. Following ADB's SPS 2009 and Access to Information Policy, 2018, environmental monitoring reports will be publicly disclosed.. ADB will post the environmental monitoring reports on its website. Monitoring reports will also be posted on CCMC 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. However, to conform to government guidelines STP requires Consent to Establish (CTE) and Consent to Operate (CTO) from Tamil Nadu Pollution Control Board (TNPCB), which shall be obtained for the 2 proposed STPs ((i) At Chokkampudur and (ii) At Kavundampalayam) prior to construction and operation. In addition, before commissioning of the scheme, permission will be obtained from the CCMC for letting the treated effluent into the existing surplus stream of Kumaraswamy lake leading to Selvachinthamani Lake & Periyakulam and from PWD for letting the treated effluent into the River Noyyal. This draft IEE will be updated during the detailed design phase of STP, and if required further during the implementation to reflect any changes in sewer system or STPs. Updated IEE will be submitted to ADB for review, clearance and disclosure.

I. INTRODUCTION

A. Background

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

2. TNUFIP will be implemented over an 8-year period beginning in 2018, and will be funded by Asian Development Bank (ADB) via its Multi-tranche Financing Facility (MFF). The Executing Agency is the Department of Municipal Administration and Water Supply (MAWS) of the State acting through the Tamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL) who has established a Program Management Unit (PMU). The Thoothukudi City Municipal Corporation (TCMC) will be the Project Implementing Agency (PIA) of this sub-project and a Project Implementing Unit (PIU) will be established within the TCMC for executing the subproject.

3. **Tranches.** TNUFIP MFF comprises of three tranches sequenced based on readiness, absorptive capacity, and logical progression of investments. Tranche 1 (Project 1), approved in September 2018, is supporting water supply and sewerage facilities in six cities (Chennai, Coimbatore, Rajapalayam, Tiruchirappalli, Tirunelveli, and Vellore), capacity development of the DMA and ULBs and improvement in urban governance and financial management in all 135 ULBs. A transactional technical assistance approved in 2018 will strengthen capacity of the DMA to better support ULBs in preparing urban infrastructure projects and implement urban governance improvement programs. Tranche 2 (Project 2), approved in November 2019, is supporting water supply and sewerage facilities in five cities (Ambur, Madurai, Tiruchirappalli, Tiruppur, and Vellore) and facilitating reforms for improved service delivery and innovation in the program ULBs. A periodic financing request for the third last tranche under the TNUFIP MFF is submitted to ADB and is under processing. Tranche 3 (Project 3) will support water supply in Madurai, sewerage in Coimbatore and storm water drainage in Thoothukudi.

4. TNUFIP Project 3 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 achieved. Project 3 will have the following outcome: livability and climate resilience in selected cities in priority industrial corridors enhanced. Outputs of the Project 3 are:

- (i) **Output 1:** Climate-resilient sewage collection and treatment, and drainage systems developed in two cities. Sewerage works in Coimbatore include: (i) two new STPs with a combined treatment capacity of 34.92 million liters per day (MLD) constructed (zone 5: 15.43 MLD, zone 7: 19.49 MLD); (ii) 529 km of new sewage collection pipelines constructed (zone 5: 230.2km, zone 7: 298.9km) with 100% households connected (Total 67,545 households - zone 5: 24,969, zone 7: 42,576); (iii) 14 pump/lift stations (combined capacity of 348 kW) constructed (zone 5: 9 and 108 kW, zone 7: 5 and 240 kW); and (iv) 14.2 km of sewage pumping mains built (zone 5: 9.8 km, zone 7: 4.4 km). Climate-resilient stormwater drainage systems (36.3 km of tertiary drains and enhancement of an existing stormwater pump station) will be established in Thoothukudi. In Coimbatore and Madurai, two

all-female self-help groups (one in each city) will be trained on benefits of household connection to sewage collection system, water conservation, sanitation, health and hygiene and in areas of leadership.

- (ii) **Output 2:** Water supply system in one city improved with smart features. Works in Madurai include: (i) 813 km of new distribution pipelines commissioned with 100% households connected (163,958 households) in 115 newly established district metering areas with smart water features to reduce nonrevenue water; and (ii) 15 booster pumps (combined capacity of 70 kW) constructed.
- (iii) **Output 3:** Institutional capacity, public awareness, and urban governance strengthened. This output includes targets to improve awareness of students, teachers and women's groups on water conservation and hygiene and develop capacity of stakeholders on gender mainstreaming in urban governance. The governance improvement and awareness consultants engaged under Project 1 for the program will continue to support output 3 under Project 3.

5. **Scope of the subproject.** Coimbatore located in the central western part of Tamil Nadu is second largest city in the state after capital Chennai and It is an industrial hub. Existing underground sewerage system covers the core area of Coimbatore City. The city limits were expanded in the year 2011 and surrounding municipalities, town panchayats and villages were added, increased the area from 105.60 Sq.Km to 257.04 Sq.Km. At present there is no sewerage system in these added areas (comprising of 40 wards) and it is proposed to provide Under Ground Sewerage System in 14 wards, comprising erstwhile Vadavalli, Veerakeralam & Thudiyalur Town Panchyats and erstwhile Kavundampalayam Municipality. Under TNUFIP(T3), 12 wards and 2 wards (Pt) out of 40 new wards [(i)16 & 17 wards from erstwhile Vadavalli TP and 18 & 19 wards from erstwhile Veerakeralam TP under Zone V and (ii) 5-9 wards from erstwhile Kavundampalayam Municipality and 1(Pt), 2 – 4 wards from erstwhile Thudiyulur TP and 43(Pt) ward from erstwhile Vellakinaru TP under Zone VII] are taken up for provision of comprehensive Under Ground Sewerage System (UGSS). The proposed project interventions are given in the following table.

Table 1: Proposed Sewerage Subproject Components (Overall Abstract)

Sl. No.	Infrastructure Components	Zone 5 (Vadavalli &Veerakeralam) (4 wards)	Zone 7 Kavundampalayam, Thudiyalur & Vellakinaru (Pt) (8 + 2(Pt) wards)
(i)	Sewer Network 200-700 mm DWC / CI Pipes	230.233 km	298.944 km
(ii)	Manholes (Brick-11229+ RCC-7418 + Pre cast RCC - 1401 = 20048)	5203 + 3158 +376 = 8737	6206 +4260+ 1025 = 11491
(iii)	Pumping Mains 150-600 mm CI Pipes	9.81 km	-
	150-700 mm CI Pipes	-	4.40 km
(iv)	Main Pump Station	1	1
	Sub-Pump Station	1	1
(v)	Lift Station	7	3
(vi)	Lift Manholes	1	12
(vii)	STP	15.43 MLD	19.49 MLD
(vii)	Outfall 600 mm CI Pipe (into the outlet stream of Kumarasamy Lake which flows to Selva	1.50 km	-

Sl. No.	Infrastructure Components	Zone 5 (Vadavalli & Veerakeralam) (4 wards)	Zone 7 Kavundampalayam, Thudiyalur & Vellakinaru (Pt) (8 + 2(Pt) wards)
	Chinthamani Kulam and thereon to Periyakulam at Ukkadam)		
	600 mm CI Pipe (into Sangapur Pallam Stream leading to River Noyyal)	-	0.50 km
(ix)	House Service Connections	24969 No.	42576 No.

6. Together the Zones 5 and 7 includes : (i) Sewer network to a length of 528.557 kilometres and 20,079 No. of Manholes; (ii) 13 No. of Lift Manholes, 10 No. of Lift Stations, 2 No. of Sub-Pump Station and 2 No. of Main Pump Station; (iii) pumping mains (14.070 km); (iv) 2 No. of Sewage Treatment Plant (STP) of 15.43 million litres per day (MLD) and 19.49 MLD capacities and (v) 71,778 house service connections.

B. Purpose of this Initial Environmental Examination Report :

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

8. This IEE report is based on the Detailed Project Report (DPR) prepared by TWAD Board for Coimbatore City Municipal Corporation (CCMC), adding to reflect the inclusion of controlled blasting as one of the construction methodologies, in case if any encountered in due course of implementation. However the STP and disposal system is proposed under Design-Build-Operation-Transfer (DBOT) Type implementation. 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 reports submitted to ADB (semi-annually during construction, and annually during operation, until a project completion report is issued by ADB) and will be the basis to ensure no degradation will happen during subproject implementation. Stakeholder consultation was an integral part of the IEE. This draft IEE will be updated during the detailed design phase of STP, and if required further updation can be done during the implementation to reflect any changes in sewer system or STPs. Updated IEE will be submitted to ADB for review, clearance and disclosure.

C. Report Structure

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

- (i) Executive summary;

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

II. DESCRIPTION OF THE PROJECT

A. Project Area

10. Project area comprises 14 municipal wards located in the western and northern outskirts of Coimbatore City, in Coimbatore District in the central western part of Tamil Nadu State (Figure 1). These areas were originally part of three town panchayats – Vadavalli, Veerakeralam and Thudiyalur and one municipality - Kavundampalayam which were added to Coimbatore City Corporation limit in 2011. Total population of subproject area is 1,81,803(2011 census) and has a geographical area of 13 Square Kilometer(Sq.Km), 5.8 Sq.Km, 8.7 Sq.Km and 10.5 Sq.Km respectively.

B. Existing Sewerage System :

11. The existing underground sewerage system covers almost entire area of Coimbatore City Corporation limit prior to its expansion in 2011. This area is divided into 3 sewerage zones with respect to sewage treatment works. Zone-I forms the heart of the city and the sewage from this Zone (20.143 MLD) is pumped to the anaerobic lagoon STP at Vellalore. Zone-II comprises original Corporation limits in North and West. Sewage collected from Zone-II (16.62 MLD) is also pumped to the anaerobic lagoon at Vellalore. Zone-III covers Tatabad, Sivananda Colony, Gandhipuram, Sidthapudur, Puliyakulam, Trichy Road and Ramanathapuram areas. Sewage from Zone-III (23.625 MLD) is pretreated at Nanjundapuram Pumping Station and pumped to anaerobic lagoon at Vellalore. To cover the uncovered area in the old city corporation limit, a project is being implemented under a centrally sponsored scheme. Old Corporation area is divided into eight (sewer network) zones, and the work is taken up in all zones to cover the uncovered areas with 2010 as base year and 2040 as ultimate design year. Sewer collection system works have been completed in Zones 1, 2,3,5,6 and 7. Of 3 STPs, 2 STPs (at Ukkadam and at Ondipudur) have been completed, and the third one at Nanjundapuram which was held up due to litigation, now received clearance from court to proceed with the work, and will be completed soon.

12. In 2011, government through a notification included 3 municipalities (Kurichi, Kuniyamuthur and Kavundampalayam) and 7 Town Panchayats (Chinnavedampatty, Kalapatti, Saravanampatti, Vellakinaru, Thudiyalur, Vadavalli, and Veerakeralam) and a village panchayat (Vilankurichi) in the Coimbatore Corporation limits, increasing the corporation area from 105.60Sq.Km to 257.04 Sq.Km. Municipal wards reorganised and increased from 72 to 100, with newly added areas constituting 40 wards.

13. At present there is an execution of underground sewerage scheme is in progress in the added areas of Kurichi & Kuniyamuthur (wards 87 to 100), located in southern outskirts of the city. This ongoing scheme comprising of (i) sewer network (435.19 kilometre (km) length of sewers and 17,748 No. of Manholes), (ii) 19 Nos. of Lift Stations, (iii) 5 Nos. of Lift Manholes, (iv) 11 Nos. of pump stations (including 4 main pumping stations) (v) pumping mains (42.985 km), (vi) sewage treatment plant (STP) of 30.53 million litres per day (MLD) capacity, (vii) 2 megawatt (MW) photo voltaic solar power plant at STP site, and (viii) 69,668 house service connections.

14. In the 4 added areas covered in this present subproject, road side drains are carrying both the sullage and the rain water. About 2/3rd of the houses have septic tanks. The houses in the slum areas do not have latrines and depend on community toilets and open spaces. Drains carrying wastewater join water bodies (Krishnampathy, Narasampathy, Selvampathy,

Kumarsamy, Selvasinthamani, Periakulam and finally leading to River Noyyal) around the city. Overflowing of drains during rainy, water pooling in low lying areas is not uncommon, creating unhealthy conditions.

15. In the present subproject it is proposed to provide underground sewerage system in 14 of 40 wards in added area, and 2 Nos. of STPs. These wards (16-19) comprise Zone-V. Wards 16 & 17 comprise the erstwhile Vadavalli Town panchayat. Wards 18 & 19 comprise the erstwhile Veerakeralam Town panchayat. Wards 1(Part), 2 to 9 & 43(Part) under Zone-VII, wherein, 1 to 4 wards of Thudiyalur area and 5 to 9 & 43 of Kavundampalayam area. Due to lack of sewerage system at present, wastewater from houses flow in the open drains, which dispose into the lakes viz., Narasampathi, Krishnampathi, Selvampathy, Kumaraswamy, Selva Chinthamani, Periyakulam lakes and Sanganur pallam stream and finally leading to River Noyyal, polluting them.

16. Although, Detailed Project Report for the underground sewage scheme in Vadavalli, Veerakeralam, Kavundampalayam and Thudiyalur has been prepared by Tamil Nadu Water Supply and Drainage (TWAD) Board, Coimbatore City Municipal Corporation (CCMC) is the responsible agency for providing basic urban services including sewerage in the City, and is the implementation agency for this subproject.

Figure 1: Subproject Area

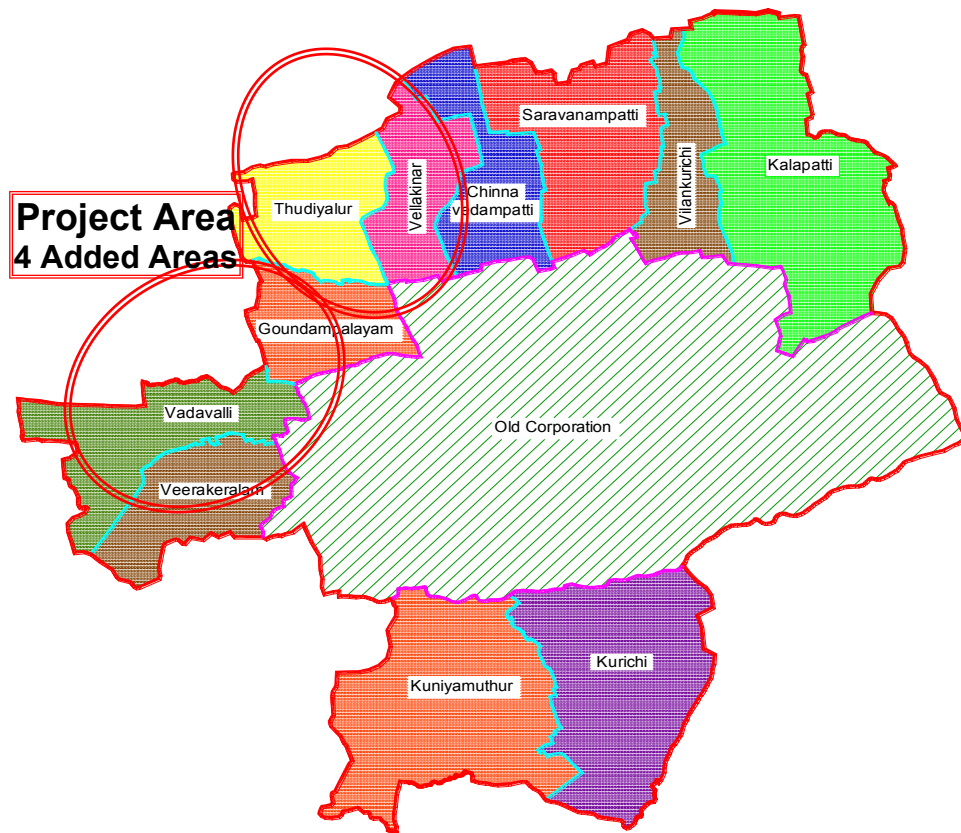
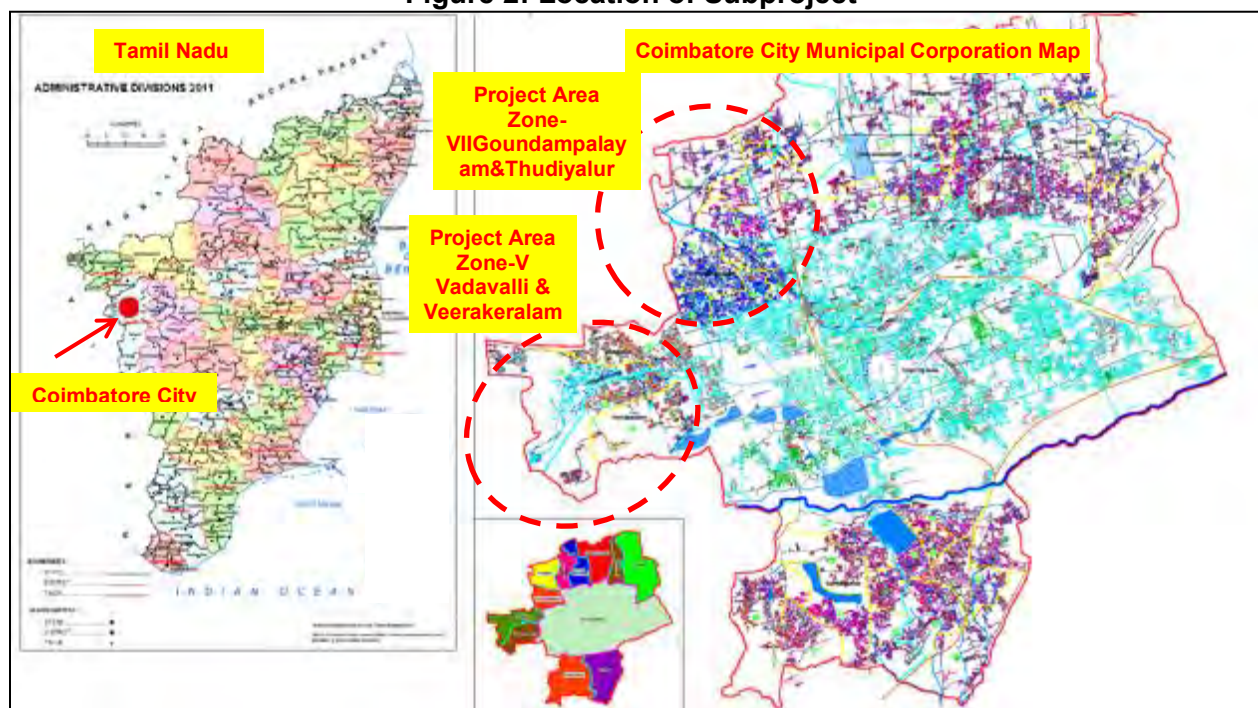


Figure 2: Location of Subproject



C. Proposed Project :

17. Following Table shows the nature and size of the various components of the subproject. Location of subproject components and conceptual layout plans are shown in Figure 3 to Figure 12. System is designed as a separate underground system catering only to domestic wastewater; storm runoff generated during rains will be carried by existing open drains and dispose into natural streams/ water bodies. Industrial wastewater will not be disposed into sewers. System is designed for 115 liters per capital per day, based on sewage generation rate of 80% of water supply. System is designed 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 2 (a): Proposed Underground Sewerage Scheme - Sewer System

Infrastructure	Function	Description				Location
Sewer Network	Collected waste water from houses and conveyed by a combination of gravity and pressure pumping to STP	New-528.557km (230.233+298.324)				Sewers will be laid underground in the roads and internal streets in the project area comprising Vadavalli,Veerakeralam, Kavundampalayam and Thudiyalur in the westernand northernoutskirts of Coimbatore City.
		150mmUPVC : 2 km; 200-300 mm dia : DWC (Double Wall Corrugated) Pipes – 436.964 km; 200-700 mm dia : CI(Cast Iron)Pipes-89.593 km.				
		Dia(mm)	Material	Length(m)	%	
		150	UPVC	2,000	0.38%	
		200	DWC	4,28,656	81.10%	
		250	DWC	4,806	0.91%	
		300	DWC	3,502	0.66%	
		200	CI	49,694	9.40%	
		250	CI	4,901	0.93%	
		300	CI	3,196	0.60%	

Infrastructure	Function	Description	Location																																								
		<table> <tr> <td>350</td><td>CI</td><td>3,960</td><td>0.75%</td></tr> <tr> <td>400</td><td>CI</td><td>4,304</td><td>0.81%</td></tr> <tr> <td>450</td><td>CI</td><td>3,576</td><td>0.68%</td></tr> <tr> <td>500</td><td>CI</td><td>6,473</td><td>1.22%</td></tr> <tr> <td>600</td><td>CI</td><td>2,626</td><td>0.50%</td></tr> <tr> <td>700</td><td>CI</td><td>10,863</td><td>2.06%</td></tr> <tr> <td colspan="2">TOTAL</td><td>5,28,557</td><td>100%</td></tr> <tr> <td colspan="2">Manholes :</td><td colspan="2">20,079 No.</td></tr> <tr> <td colspan="2">Brickwork :</td><td colspan="2">11,585 No.</td></tr> <tr> <td colspan="2">Reinforced Cement Concrete :</td><td colspan="2">8,494.No.</td></tr> </table>	350	CI	3,960	0.75%	400	CI	4,304	0.81%	450	CI	3,576	0.68%	500	CI	6,473	1.22%	600	CI	2,626	0.50%	700	CI	10,863	2.06%	TOTAL		5,28,557	100%	Manholes :		20,079 No.		Brickwork :		11,585 No.		Reinforced Cement Concrete :		8,494.No.		
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Lift Manholes	Pump sewage from lower level manhole to higher level sewer or pumping station	13 nos. (Zone5 –1no + Zone 7 –12 nos) Lift Manholes – Pump will be fixed inside manhole.	Manholes are located along the roads within the RoW. Pumps will be fixed inside manhole and covered.																																								
Sewage Lift Stations (LS)	Collect Sewage from low level sewer and pump to higher level sewer or to Pumping Stations	10 nos. (Zone5- 7 nos.+Zone7– 3nos.) Components of LS - Suction Well : 1.5 m – 2.0 m dia and 1.9 m – 5.0 m depth - Non-Clog Submersible Pump sets - Control Panel Box	Lift Well will be constructed on the road shoulder (and in the road itself when there is no earthen shoulder) where the sewer ends / terminates into the lift well. Pumps will be installed in the well, and a control panel box will be installed near the well. Lift stations are proposed at following locations : 1) Kamatchi Nagar (IOB Colony near Maruthamalai) 2) Onappalayam (Burial Ground near Sowdeswari College, Thondamuthur Road) 3) S.M.R.Nagar, Sundappalayam near drainage crossing 4) Jothi Park Lands of Sri Ram Garden near Ajjanur 5) Maharani Avenue–Phase IV 6) GKS Avenue/Lawyers' Colony 7) Pothigai Residency and CTC Depot Junction at Maruthamalai. 8) Siva Castle 9) Adhirshita Lakshmi Garden 10) Easwaran Nagar																																								
Sewage Pumping Stations (PS)	Collect sewage and pump to Main Pumping Stations	2nos. (Zone5 –1 no. + Zone7 –1no.) Components of LS - Screen Well : (3.9m dia x 4.2m depth) & (4.5m dia x 6.29m depth) - Grit Well : (2.5m dia x 5.4m depth) & (3m dia x 7.44m depth) - Suction Well : (5.0m dia x 6.2m depth) & (6m dia x 8.7m depth) - Pump room : 12m x 8m - Non-Clog Submersible Pumpsets	Sewage Pumping Stations are proposed at following locations: 1. Crematorium premises near Vadavalli Stream(DrainageCrossing). 2. Cheran Colony.																																								

Infrastructure	Function	Description	Location		
Main Sewage Pumping Station	Collect sewage from lift stations& pumping stations and pump to sewage treatment plant.	2 nos. (Zone5 – 1no. + Zone7 - 1no.) Components of LS • Screen Well : (9.2m dia x 2.5m depth) & (14m dia x 7.32m depth) • Grit Well : (6.5m dia x 3.8m depth) & (10m dia x 8.6m depth) • Suction Well : (9.0mdia x 5.6m depth) & (18m diax9.7m depth) • Pump room : 12m x 8m • Non-Clog SubmersiblePumpSets	Main Sewage Pumping Stations are proposed at following locations: 1. Chokkampudur near STP site 2. Kavundampalayam near STP site		
Sewer Mains Pumping	Transfer sewage from lift stations, pumping stations to MPS and finally to STP	14.07 km (Zone5 9.81 + Zone7 4.26) C.I.Pipes of dia 150, 200, 250, 600 & 900 mm	Mains will be laid underground along the roads; large dia mains are located on wider roads in the project area		
		Dia		Length	%
		(mm)		(m)	
		150		8,440	59.99%
		200		3,540	25.16%
		250		2,000	14.21%
		600		30	0.21%
		900		60	0.43%
		Total		14,070	100%
House Service Connections	Collect sewage from individual houses and convey into network	71778 No. (Zone V - 28815 No. + Zone VII - 42963 No.)	At each household, connected to wastewater outlet drain and convey to network		

Table 3 (b): Proposed Underground Sewerage Scheme - STP

Infrastructure	Function	Description	Location
Sewage Treatment Plant	Treatment of collected wastewater to comply with disposal standards.	<u>New – 2 No.</u> STP of capacity 15.43 MLD (Zone5) & 19.49 MLD (Zone7) Proposed process : SBR (Sequential Batch Reactor). This is indicative, as both the STPs have been proposed to be executed by means of "DBOT" system of contract. Hence actual process will be designed by the Design-Build contractor after the bid award. Components : • Mechanical Screens • Grit removal • Flow measurement and flow splitter box • Batch reactors with individual inlet flow control and a fully automated process Sludge management system	<u>STP-1(15.43MLD)</u>: Site is located at Chokkampudur in south zone of Coimbatore City Municipal Corporation. The total land extent of around 5 acres was allotted for the construction of new STP. Selected sites is located ideally away from the residential areas. Few residential colonies are located near the boundary of this site; STP will be constructed sufficiently inside the compound maintaining at least a distance of 200 m from the boundary. At present within the CCMC site, the STP site is accessible via internal roads near crematorium/burial ground and from the Compost yard. The road near crematorium is narrow (about 3-4 m wide), abutted with graves, and used primarily by general public for crematorium purposes. Hence may not be suitable for using as access road to STP construction or operation. Therefore, it is proposed to use road next to compost plant as an access with necessary clearance upto STP site. The access road alignment will be finalized by the PIU in consultation with CCMC prior to start of works. <u>STP-2(19.49MLD)</u>: Site is located at Koundampalayam Compost yard on western side of Mettupalayam road. Site is located within a large campus, wherein a compost yard, solar panel and muslims' burial ground are available, remaining area vacant. Total area of this campus is 36 acres, of which 10 acres allocated to the new STP. The site is located ideally away from the residential areas Sanganur pallam odai is running adjacent to the site, into which the treated effluent is proposed to be discharged.

Infrastructure	Function	Description	Location
Outfall sewer	Zone V: Disposal of treated effluent from STP into outlet stream of Kumaraswamy Lakewhich flows to SelvaChintha-mani Kulam & thereon to Periyakulam which has its final outfall into River Noyyal	1500 m length of 400 mm dia DI (ductile iron) pipe	Pipe will be laid underground in S.B.O.A.School Road, along the Kumaraswamy Lake.
	ZoneVII: Disposal of treated effluent let into Sanganur pallam adjacent to the site, leading to River Noyyal.	500 m length of 700 mm dia DI (ductile iron) pipe	Pipe will be laid underground in the stream poromboke along the sanganur stream.

Figure 3: Location of Lifting and Pumping Stations (Zone V & VII)



Figure 4: Location of Lifting and Pumping Stations (Zone V)



Figure 5: Location of Lifting and Pumping Stations (Zone VII)

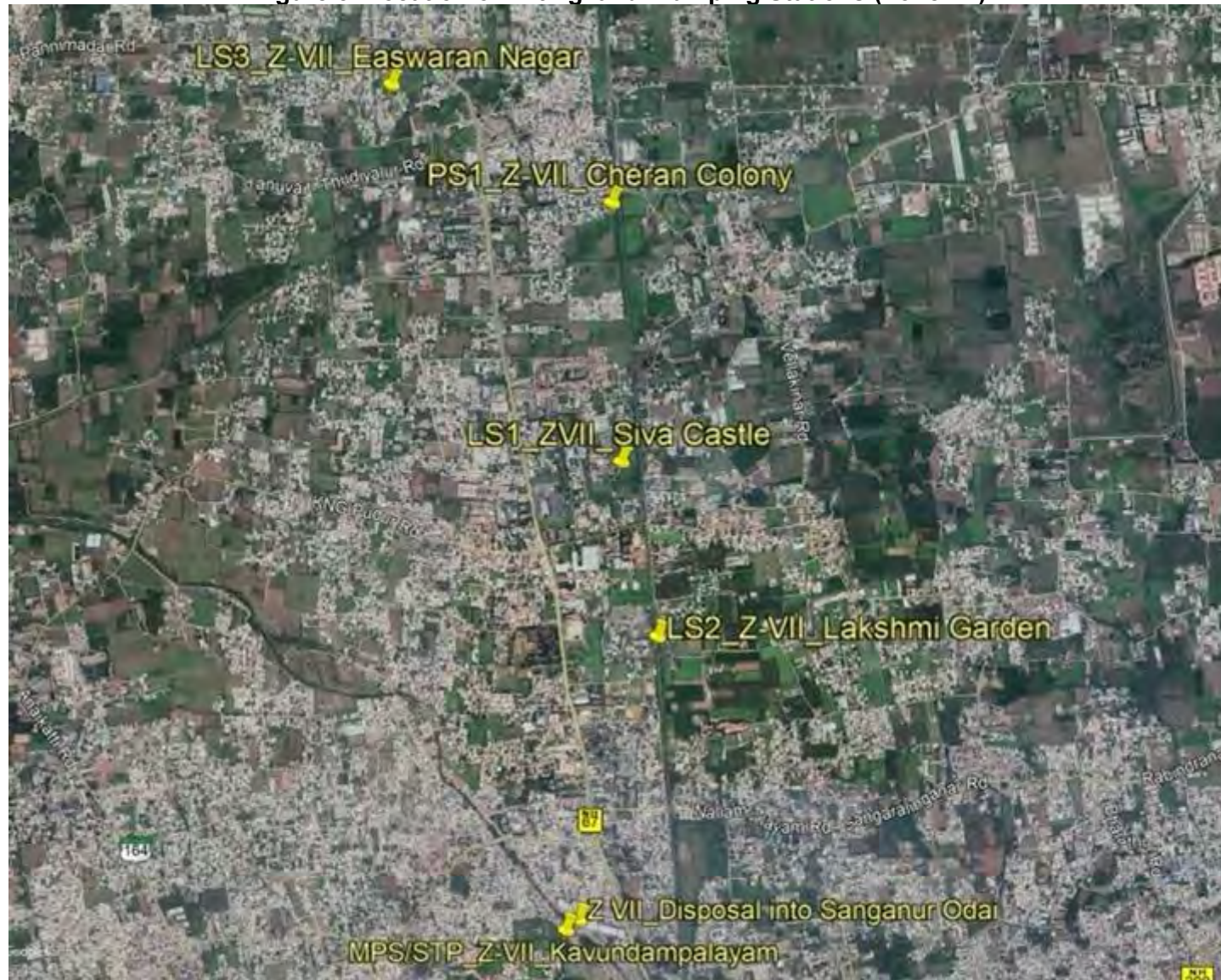


Figure 6: Sewage Treatment Plant Site (Zone V)



Figure 7: Sewage Treatment Plant Site (Zone V)



Figure 8: Sewage Treatment Plant Site (Zone VII)



Figure 9: Sewage Treatment Plant and 1km radius

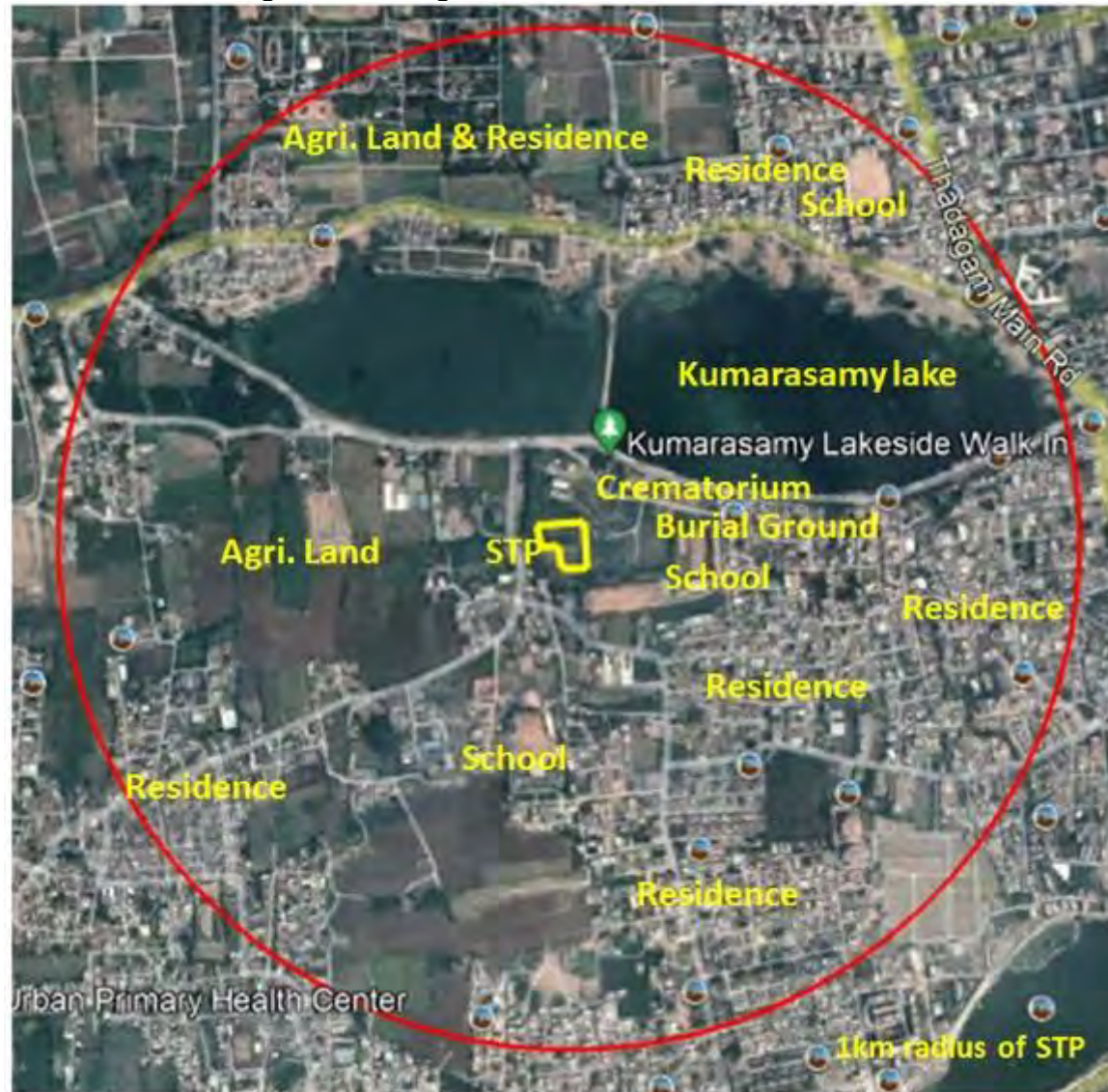




Figure 10 a: Sewage Treatment Plant – Tentative Layout Map

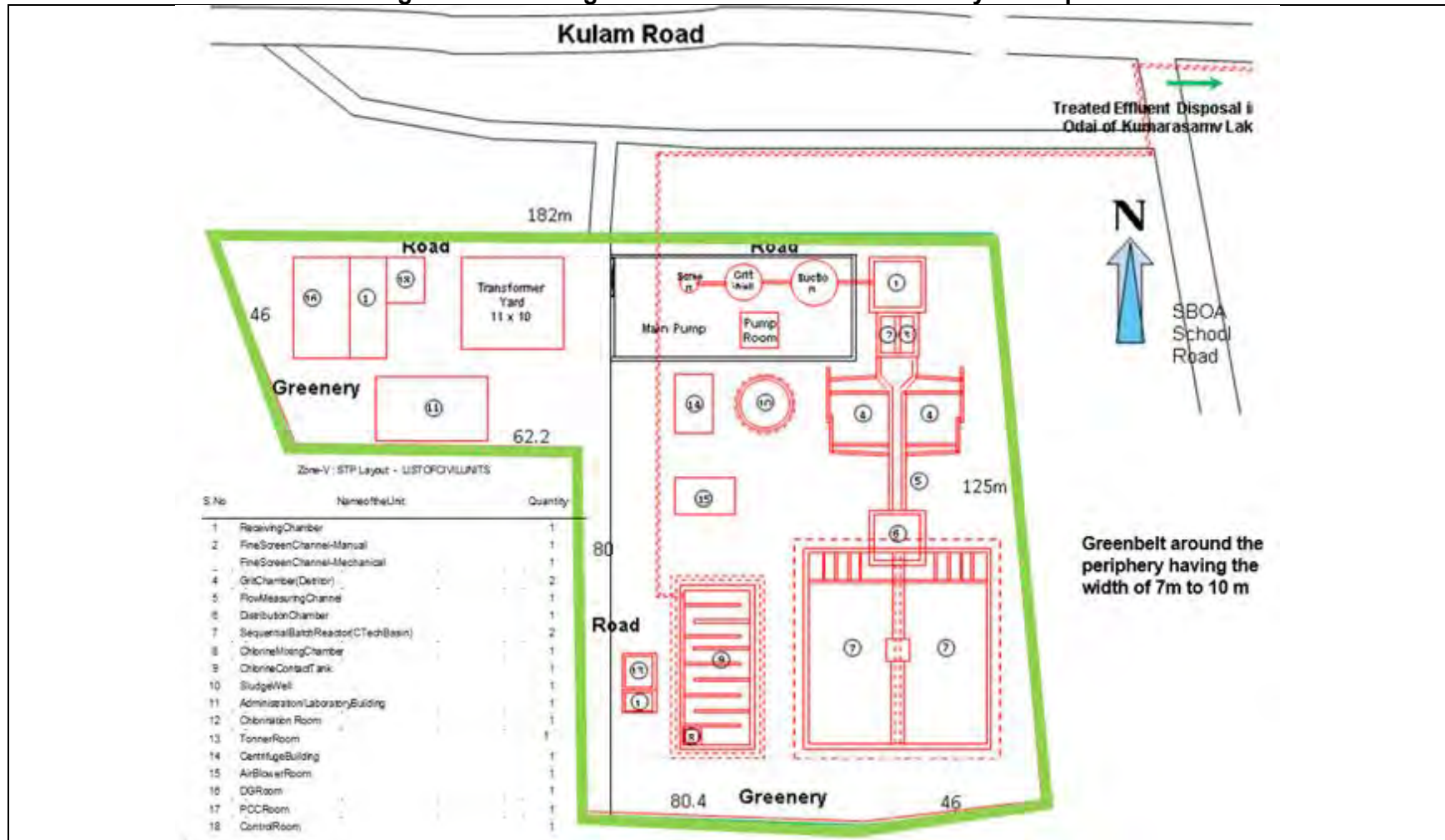


Figure 11 b: Sewage Treatment Plant – Tentative Layout Map

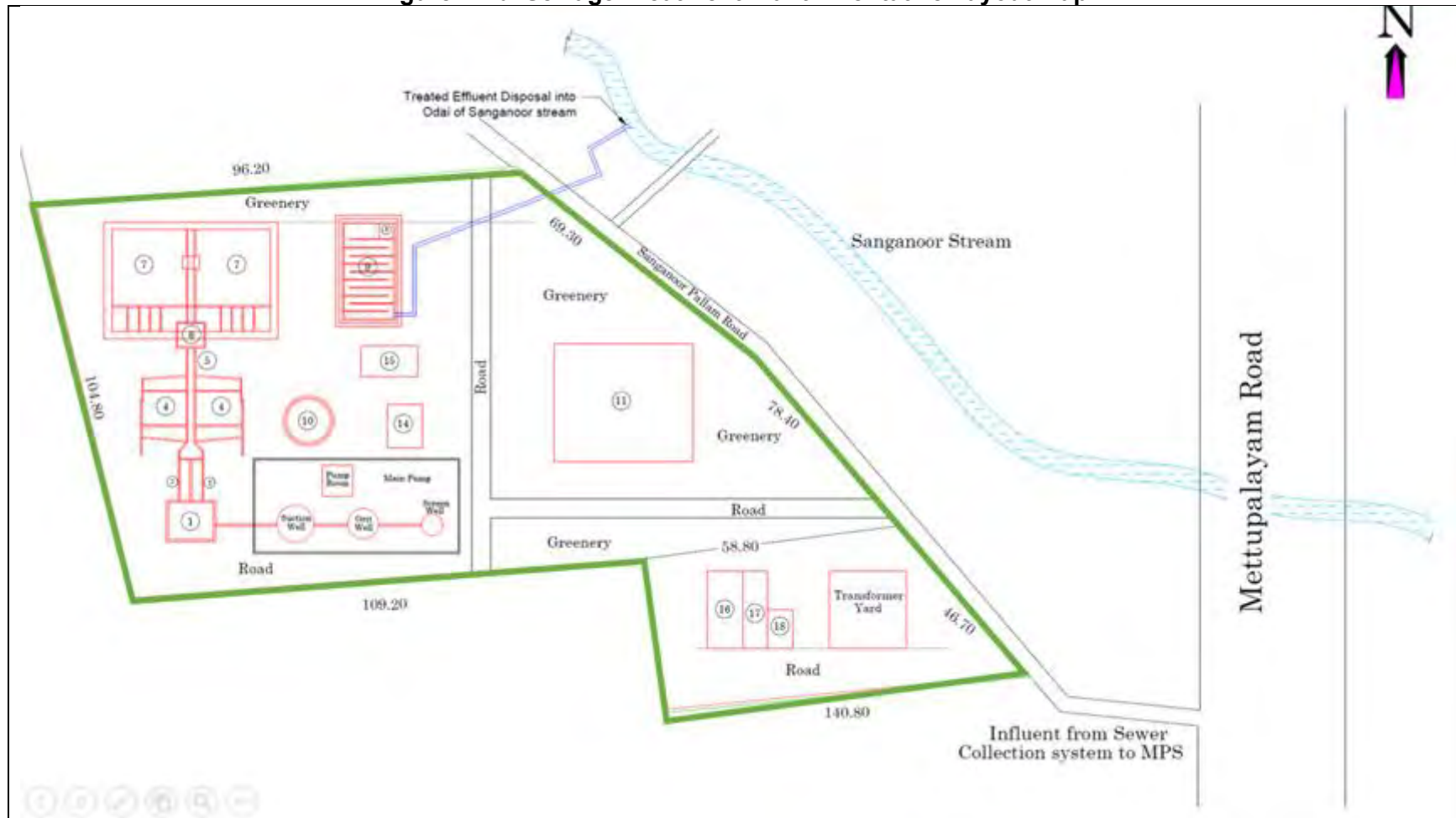


Figure 12: Sewage Treatment Plant and Alignment of Outfall Sewer (Zone V)

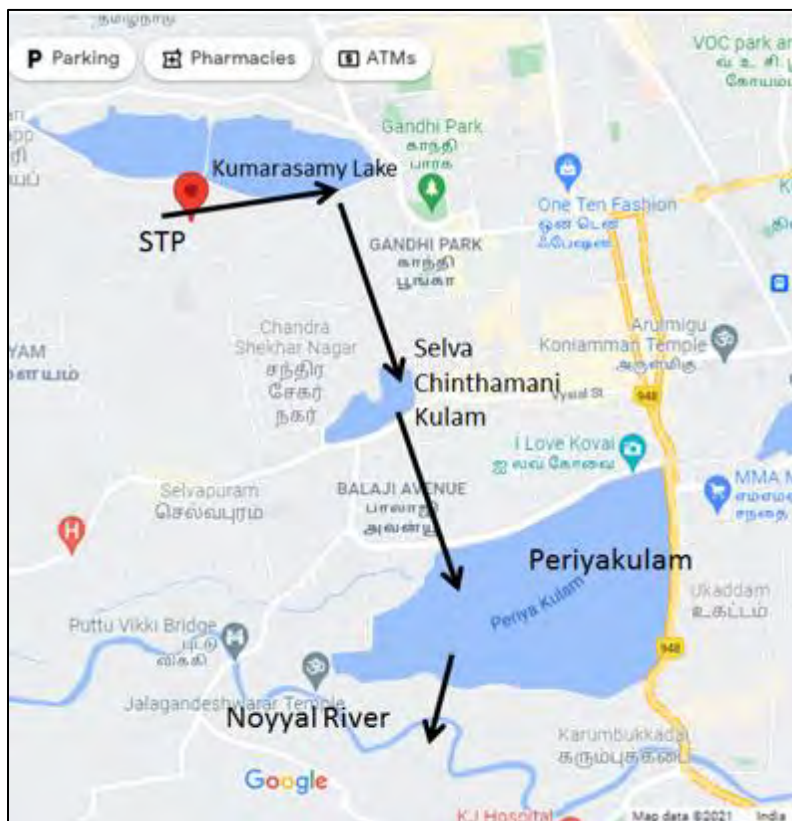
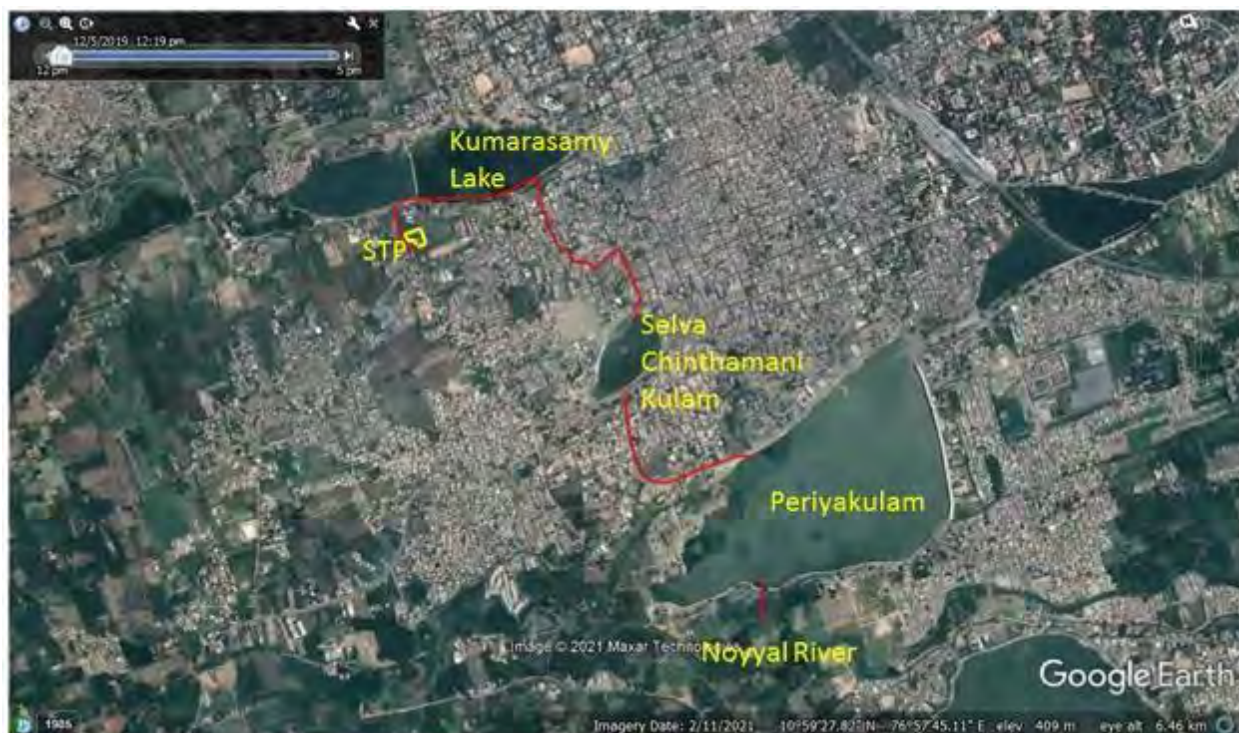
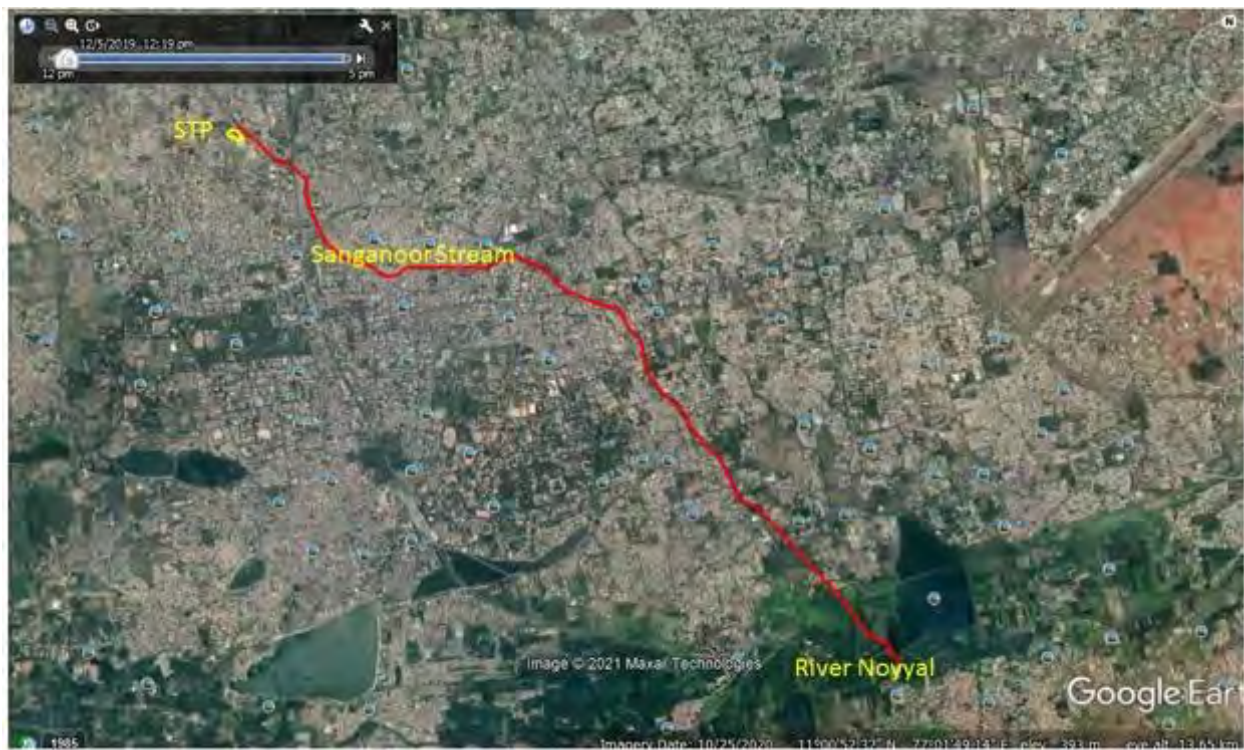


Figure 13: Sewage Treatment Plant and Alignment of Outfall Sewer (Zone VII)



D. Implementation Schedule :

18. This subproject is split into three contract packages for implementation:

- (i) Sewer system in Zone 5,
- (ii) Sewer system in Zone 7, and
- (iii) Two STPs.

19. Sewer system packages are of 'Works' type contract while STP contract is of Design-Build-Operate (DBO) modality, where in which contractor will design STP, build and operate for a duration agreed in the contract. The Bids for civil works were invited in February 2022, and are currently under evaluation. Contract is likely to be awarded in June 2022. Construction is likely to start in July/August 2022 and will take about 36 months to complete the project. Detailed implementation schedule (including design/pre-construction, construction, commissioning, and operation phases) will be provided in the updated IEE as per detailed design.

Sl.no	Packages	Construction Period (Months)
1	Sewer system in Zone 5	36
2	Sewer system in Zone 7	36
3	Two STPs	36

III. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. ADB Policy

20. 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.

21. **Screening and Categorisation:** 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).

22. **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.

23. **Public Disclosure:** ADB will post the safeguard documents on its website as well as disclose relevant information in accessible manner in local communities following ADBs SPS 2009 and Access to Information Policy 2018:

- (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:

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

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

26. **Category B.** projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State level EAC categorises 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.

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

28. **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 3. Treated effluent will be disposed into the said disposal points strictly adhering to the “Effluent Disposal Standards of Sewage Treatment Plants Applicable to All Modes of Disposal” as per NGT order, dt.30.4.2019, shown in Table 4.

Table 4: Applicable Environmental Regulations

Acts and Rules	Description	Requirement
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Act was enacted to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water. Control of water pollution is achieved through administering conditions imposed in consent issued under to this Act. All pollution potential activities will require consent to establish (CTE) from Tamil Nadu Pollution Control Board (TNPCB) before starting implementation and consent to operate (CTO) before commissioning.	Construction of proposed STP requires CTE and CTO from TNPCB before starting of construction and before commissioning of STP respectively. Application has to be submitted online at http://tnocmms.nic.in/OCMMS/
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.

Acts and Rules	Description	Requirement
Noise Pollution (Regulation and Control) Rules, 2000 amended up to 2010.	Rule 3 of the Act specifies ambient air quality standards in respect of noise for different areas/zones.	To comply with the noise standards.
Air (Prevention and Control of Pollution) Act, 1981, amended 1987 and its Rules, 1982.	- Applicable for equipment and machinery's potential to emit airpollution (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. Mentioned in the Table 16 (Community Health and Safety item(xv) of EMP as required)
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 be complied with by the project.

Table 5: Effluent Disposal Standards of Sewage Treatment Plants

S.No.	Parameter	Standards (Applicable to all mode of disposal)
1.	pH	5.5 – 9.0
2.	Bio-Chemical Oxygen Demand (BOD) mg/l	10
3.	Total Suspended Solids (TSS) mg/l	20
4.	Chemical Oxygen Demand (COD) mg/l	50
5.	Nirtrogen – Total mg/l	10
6.	Phosphorus Total (For Discharge into Ponds, Lakes) mg/l	1.0

S.No.	Parameter	Standards (Applicable to all mode of disposal)
7.	Fecal Coliform (FC) (most Probable number per 100 milliliter (MPN/100mL)	Desirable 100 / Permissible-230

Source: The Hon'ble NGT Order, dt.30.4.2019 in O.A.No.1069/2018 & Govt. Lr.No.21355/EC.1/2019-4/dt.22.1.2020

29. 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 6: Clearances and Permissions Required for Construction

S. No	Construction Activity	Statutory Authority	Statute under which Clearance is Required	Implementation	Supervision
1	Construction of new sewage treatment plant (STP)	Tamil Nadu Pollution Control Board (TNPCB)	Consent To Establish and Consent To Operate under Water Act, 1974	Contractor / PIU	PIU
2	Tree Cutting	Department of Forest and District Collector	Clearances from the authorities as per the Tamil Nadu Timber Transit Rules, 1968 or latest.	PIU	PIU
3	Hot mix plants, Crushers and Batching plants	TNPCB	Consent To Establish and Consent To Operate under Air Act, 1981	Contractor	PIU
4	Discharges from construction activities	TNPCB	Consent To Establish and Consent To Operate under Water Act, 1974	Contractor	PIU
5	Storage, handling and transport of hazardous materials	TNPCB	Hazardous Wastes (Management and Handling) Rules, 1989 Manufacturing, Storage and Import of Hazardous Chemicals Rules, 1989	Contractor	PIU
6	Sand mining, quarries and borrow areas	Department of Geology and mining, Govt. 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 particular source as per legislations from authorized quarries with valid clearance through the District Collector, Coimbatore. PIU to review and approve only existing licensed mines that are compliant with prevailing environmental regulations of India.	Contractor	PIU
7	NOC for Controlled	District Collector, Coimbatore.	Explosives Rules, 2008	Contractor	PIU

S. No	Construction Activity	Statutory Authority	Statute under which Clearance is Required	Implementation	Supervision
	Blasting for excavation				
8	For establishing new quarries and borrow areas	MOEF&CC	Not applicable No new quarries / borrow areas will be created for the subproject.	Contractor	PIU
9	Groundwater extraction	Public Works Department	(Groundwater) Tamil Nadu Groundwater Development and Management Act 2000	Contractor	PIU
10	Disposal of bituminous wastes	Tamil Nadu State Pollution Control Board	Hazardous Wastes (Management and Handling) Rules, 2016 as amended	Contractor	PIU
11	Temporary traffic diversion measures	Traffic Police and Coimbatore Corporation	MoRTH 112SP 55 of IRC codes	Contractor	PIU
12	Consent for the disposal of C&D waste from the ULB	CCMC	Construction and Demolition Waste Management Rules, 2016	Contractor	PIU
13	Consent from the railways or NH or SH for pipeline crossings	Southern Railway. NHAI.State Highways	MoRT&HW-National Highways Act 1956 and NHAI Act 1988 IRC Act 1997	Contractor	PIU

30. **ADB SPS Requirements.** During the design, construction and operation of the project the PMU and Project Implementation Unit (PIU) will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the International Finance Corporation's (IFC) Environmental, Health and Safety (EHS) Guidelines Guidance Notes and standards of the World Health Organization (WHO). 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 PIU will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the PMU and PIU will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS, 2009.

31. The following IFC (World Bank Group) EHS and WHO Guidelines will be adopted in the EMP for the subprojects such as:

- (i) WHO Guidelines on Air Emissions and Ambient Air Quality, Noise Management, Wastewater and Ambient Water Quality,
- (ii) Guidelines for Construction and Decommissioning (2007)
- (iii) Guidelines for Hazardous Material Management and Waste Management

- (iv) ADB Good Practice Guidance for the Management and Control of Asbestos Protecting Workplaces and Communities from Asbestos Exposure Risks (March 2022)²
- (v) Guidance Note on Workers Accommodation: Processes and Standards, August 2006³
- (vi) Guidelines on Occupational Health and Safety and Community Health and Safety (2007)

32. Comparison of national emissions standards and International Standards / Best Practices are provided in Table 6 and Table 7. Due to different measuring conditions, the emission values are not directly comparable. However, IFC Guidelines / WHO standards are stricter than the national standards if converted to comparable values. The relevant standards applicable to this sub-project is identified in the column “applicable per ADB SPS”.

Table 7: National Ambient Air Quality Standards and WHO Guidelines

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

² <https://www.adb.org/sites/default/files/publication/783636/good-practice-management-control-asbestos.pdf>

³ IFC Guidance Note: Workers Accommodation

Monoxide CO ($\mu\text{g}/\text{m}^3$)	Residential, Rural and Other Areas	4,000 (1-hr)		100,000 (15- min)	4,000 (1-hr) 100,000 (15-min)
	Sensitive Area	2,000 (8-hr) 4,000 (1-hr)	-	10,000 (8-hr) 100,000 (15- min)	2,000 (8-hr) 4,000 (1-hr) 100,000 (15-min)
Ozone (O ₃) ($\mu\text{g}/\text{m}^3$)	Industrial	100 (8-hr)	100 (8-hr)	-	100 (8-hr)
	Residential, Rural and Other Areas	180 (1-hr)			180 (1-hr)
	Sensitive Area	100 (8-hr) 180 (1-hr)	100 (8-hr)	-	100 (8-hr) 180 (1-hr)
Lead (Pb) ($\mu\text{g}/\text{m}^3$)	Industrial,	0.5 (Annual)	-	0.5 (Annual)	0.5 (Annual)
	Residential, Rural and Other Areas	1.0 (24-hr)			1.0 (24-hr)
	Sensitive Area	0.5 (Annual) 1.0 (24-hr)	-	0.5 (Annual)	0.5 (Annual) 1.0 (24-hr)
Ammonia (NH ₃) ($\mu\text{g}/\text{m}^3$)	Industrial	100 (Annual)	-		100 (Annual)
	Residential, Rural and Other Areas	400 (24-hr)			400 (24-hr)
	Sensitive Area	100 (Annual) 400 (24-hr)	-	-	100 (Annual) 400 (24-hr)
Benzene (C ₆ H ₆) ($\mu\text{g}/\text{m}^3$)	Industrial	5 (Annual)	-	-	5 (Annual)
	Residential, Rural and Other Areas				
	Sensitive Area	5 (Annual)	-	-	5 (Annual)
Benzo(o) Pyrene (BaP) (ng/m^3)	Industrial	1 (Annual)	-	-	1 (Annual)
	Residential, Rural and Other Areas				
	Sensitive Area	1 (Annual)	-	-	1 (Annual)
Arsenic (As) (ng/m^3)	Industrial	6 (Annual)	-	-	6 (Annual)
	Residential, Rural and Other Areas				
	Sensitive Area	60 (Annual)	-	-	60 (Annual)
Nickel (Ni) (ng/m^3)	Industrial	20 (Annual)	-	-	20 (Annual)
	Residential, Rural and Other Areas				
	Sensitive Area	20 (Annual)	-	-	20 (Annual)

^a Sensitive area refers to Ecologically sensitive areas notified by the India Central Government

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

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

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

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

Table 8: National Noise Standards and WHO Guidelines

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

^a Noise Pollution (Regulation and Control) Rules, 2002 as amended up to 2010
(<http://cpcb.nic.in/displaypdf.php?id=Tm9pc2UtU3RhbmRhcmRzL25vaXNIX3J1bGVzXzlwMDAucGRm>)

^b Guidelines for Community Noise. WHO. 1999.

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

Table 9: National Drinking Water Quality Standards and WHO Guidelines

Group	National Standards for Drinking Water ^{a, b}			WHO Guidelines for Drinking Water Quality, 4th Edition, 2011 ^c	Applicable Per ADB SPS ^{d, e}
	Parameter	Unit	Max. Concentration Limit		
Physical	Turbidity	NTU	1 (5)	-	1 (5)
	pH		6.5 – 8.5	None	6.5 – 8.5
	Color	Hazen Units	5 (15)	None	5 (15)
	Taste and Odor		Agreeable	-	Agreeable
	TDS	mg/l	500 (2,000)	-	500 (2,000)
	Iron	mg/l	0.3	-	0.3
	Manganese	mg/l	0.1 (0.3)	-	0.1 (0.3)
	Arsenic	mg/l	0.01 (0.05)	0.01	0.01
	Cadmium	mg/l	0.003	0.003	0.003
	Chromium	mg/l	0.05	0.05	0.05
	Cyanide	mg/l	0.05	None	0.05
	Fluoride	mg/l	1 (1.5)	1.5	1 (1.5)
	Lead	mg/l	0.01	0.01	0.01
	Ammonia	mg/l	0.5	none established	0.5
Chemical	Chloride	mg/l	250 (1,000)	none established	250 (1,000)
	Barium	mg/l	0.7	None	0.7
	Sulphate	mg/l	200 (400)	None	200 (400)
	Nitrate	mg/l	45	50	45
	Copper	mg/l	0.05 (1.5)	2	0.05 (1.5)
	Total Hardness	mg/l	200 (600)	-	200 (600)
	Calcium	mg/l	75 (200)	-	75 (200)
	Zinc	mg/l	5 (15)	none established	5 (15)
	Mercury	mg/l	0.001	0.006	0.001
	Aluminum	mg/l	0.1 (0.3)	none established	0.1 (0.3)
	Anionic Detergents	mg/l	0.2 (1.0)	None	0.2 (1.0)
	Phenolic Compounds	mg/l	0.001(0.002)	None	0.001(0.002)
	Residual	mg/l	0.2	5	0.2

Group	National Standards for Drinking Water ^{a, b}			WHO Guidelines for Drinking Water Quality, 4th Edition, 2011 ^c	Applicable Per ADB SPS ^{d, e}
	Parameter	Unit	Max. Concentration Limit		
Microbial indicator	Chlorine				
	E-coli	MPN/100ml	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml Sample
	Total Coliform	MPN/100ml			

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

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

^c Health-based guideline values.

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

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

Table 10: Standards for Composting 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/	5	5
Chromium	mg/kg	50	50
Copper	mg/kg	300	300
Lead	mg/kg	100	100
Mercury	mg/kg	0.15	0.15
Nickel	mg/kg	50	50
Zinc	mg/kg	1000	1000
C/N ratio	-	<20	<20:1
pH	-	6.5 – 7.5	(1:5 solution) maximum 6.7
Moisture, percent by weight, maximum		15.0 – 25.0	25.0
Bulk density	g/cm ³	<1	Less than 1.6
Total Organic Carbon, percent by weight, minimum	percent by weight	12	7.9
Total Nitrogen (as N), percent by weight, minimum	percent by weight	0.8	0.4
Total Phosphate (as P ₂ O ₅) percent by weight, minimum	percent by weight	0.4	10.4
Total Potassium (as K ₂ O), percent by weight, minimum	percent by weight	0.4	-
Odour		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.

FCO = Fertilizer Control Order, Department of Agriculture, Government of India

C. International Treaties/Conventions/Declarations on Environment Management

33. India is a signatory to the following international treaties/ conventions/ declarations on environment, social, safety and occupational issues that are relevant for the subproject. The list of international agreements is provided in Table 10.

Table 11: International Treaties/ Conventions/ Declarations on Environment

Sl. no	International Treaties/ Conventions/ Declarations	Description
1.	United Nations Conference on the Human Environment - Stockholm 1972	To coordinate global efforts to promote sustainability and safeguard the natural environment
2.	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1975	Its aim is to ensure that international trade in specimen of wild animals and plants does not threaten their survival
3.	Ramsar Convention, 1971, 1975	The Convention on Wetlands is the inter governmental treaty that provides the framework for the conservation and wise use of wetlands and their resources
4.	The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes, 1989	The Convention aims to protect human health and the environment against the adverse effects resulting from the generation, transboundary movements and management of hazardous wastes and other wastes
5.	Strategic Approach to International Chemicals Management (SAICM)	SAICM is an international non-binding policy framework to support efforts to achieve the Johannesburg Plan of Implementation (WSSD) goal for chemicals, notably “achieve by 2020 that chemicals are used & produced in ways that lead to the minimization of adverse effects on human health & the environment”
6.	United Nations Conference on Environment and Development (UNCED), 1992, 2002	The conference had three objectives (Agenda – 21, Rio Declaration and Millennium Development Goals), to secure renewed political commitment for sustainable development, to assess the progress and implementation gaps in meeting previous commitments, and to address new and emerging challenges
7.	United Nations Framework Convention on Climate Change (UNFCCC), 1992 • Kyoto Protocol, 1997	It operationalizes the United Nations Framework Convention on Climate Change by committing industrialized countries to limit and reduce greenhouse gases (GHG) emissions in accordance with agreed individual targets
8.	The Vienna Convention, 1985 • Montreal Protocol on Ozone depleting substances, 1992	It sets binding progressive phase out obligations for developed and developing countries for all the major ozone depleting substances, including chlorofluorocarbons (CFCs), halons and less damaging transitional chemicals such as hydrochlorofluorocarbons (HCFCs)

Sl. no	International Treaties/ Conventions/ Declarations	Description
9.	Convention on Biological Diversity, 1992 Cartagena Protocol on Biosafety, Ratified on 17th January, 2003	It is an international treaty governing the movement of living modified organism (LMO) resulting from modern biotechnology from one country to another
10.	Convention to Combat Desertification, 1996	It is the only binding international agreement linking environment and development to sustainable soil management
11.	Rotterdam Convention on Prior Informed Consent Procedure for certain Hazardous Chemicals in International Trade, 2002	It is a multilateral treaty to promote shared responsibilities in relation to importation of hazardous chemicals
12.	Stockholm Convention on Persistent Organic Pollutants (POPs), 2001	It aims to eliminate or restrict the production and use of Persistent Organic Pollutants (POPs)

IV. DESCRIPTION OF THE ENVIRONMENT

A. Methodology Used for Baseline Study :

34. **Data collection and stakeholder consultations:** Data for this study has been primarily collected through comprehensive literature survey, discussion with stakeholder agencies, and field visits to the proposed subproject sites.

35. The literature survey broadly covered the following:

- Project details, reports, maps, and other documents prepared by TWAD Board, CCMC etc.;
- Discussions with Technical experts of the PPTA team, TNUIFSL, Implementing Agency (CCMC), the TWAD Board (PIU) and other relevant government agencies
- Secondary data from previous project reports and published articles; and
- Literature on land use, soil, geology, hydrology, climate, socioeconomic profiles, and other planning documents collected from Government agencies and websites.

36. **Ocular Inspection :** Several visits to the project sites were made during IEE preparation period in 2020 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 socioeconomic study was conducted to determine the demographic information, existing service levels, stakeholder needs and priorities.

B. Physical Resources :

1. Location, Area and Connectivity :

37. Situated in the central western part of Tamil Nadu, and about 500 km southwest of capital city Chennai, Coimbatore is the third largest city in Tamil Nadu after Chennai and Madurai. It is one of the fastest growing cities in India. This city serves as the District Headquarters for Coimbatore District.

38. The extent of Coimbatore city until recently was limited to 105.6 square km when it consisted of 72 administrative wards. In 2011 July, the Selection / Special Grade Municipalities

around the corporation including the current project areas of Vadavalli and Veerakeralam, were added to Coimbatore Corporation. The ward numbers of the corporation have since increased from 72 nos. to 100 No. and the geographical area to 257 km². Population of the Old municipal corporation area of Coimbatore city is 1,050,721 (2011 census).

- (i) Vadavalli Town panchayat, with population of about 39,906 (2011 census) is located adjacent to Coimbatore in the Northern Boundary (lies between Latitude : 11.024745° North & Longitude 76.898036° East with an elevation of 450 m) which was comprising of Lord Muruga Temple at Maruthamalai, Bharathiyar university on Maruthamalai Road in addition to Tamilnadu Agricultural University, Sugarcane Institute, Central Cotton Research Centre, markets, etc., before the merger. Vadavalli is about 9 km from the Coimbatore Railway Station, 14 km from Gandhipuram Bus Station and 19 km from Coimbatore International Airport.
- (ii) Veerakeralam Town panchayat lies between Latitude: 11.013056 North Longitude: 76.8975 East and has an elevation of 425 m. This is the first grade town panchayat from 8.12.1988 in Coimbatore District, before it became part of Coimbatore Corporation area. It covers an area of 6.2 Sq.Km. and is situated at a distance of 8 km from the district headquarters.
- (iii) Kavundampalayam (also spelled as Goundampalayam) erstwhile Municipality, is located adjacent to Coimbatore in the Northern Boundary, about 6 km north of the city centre (lies between Latitude 11.044995 North & Longitude 76.945517 East with an elevation of 330 m) and is along Mettupalayam Road in Coimbatore, one of the arterial roads of the city. In 1993 Kavundampalayam was a Selection Grade Town Panchayat and it was further upgraded to Third Grade Municipality. In 2011, it has become part of the Coimbatore City Municipal Corporation area and stretches around 10.56 Sq.km. Population of about 83,908 (2011 census). There are two ITI institutes for men and women individually, district employment office, TNSTC Head Office, more number of reputed pump manufacturers carrying out exports, vegetable market, diamond factory, etc. are adorning this area with prosperity and employment opportunities.
- (iv) Thudiyalur is an erstwhile town panchayat situated on North western side of Coimbatore City at a distance of 12 km from city center (11° 8' 24" N Latitude and 76° 57' 36" E Longitude) and north side of Kavundampalayam and west side of Vellakinar. Thudiyalur is ideally located on the famous Mettupalayam Road on the way from Coimbatore to Ooty. Thudiyalur is a fast developing urban centre. This town is well known for its industries of Textiles. People residing in Thudiyalur are mainly employed in industries. This area extends over an area of 8.69 Sq.Km. Thudiyalur was constituted on 1958 as village panchayat and further it was upgraded to second grade Town Panchayat in 1970. It was later upgraded to Selection grade Town Panchayat from 1974 and merged with Coimbatore Corporation in 2011. It is located on NH-67 connecting Coimbatore with Ooty via Mettupalayam. Area population as per 2011 census was 33,924. Thudiyalur has prominent industries in its vicinity such as Texmo, Aqua Pump, CR Spinners, Metal industries, Car showrooms, TUCAS – Thudiyalur Cooperative Agricultural Society, etc.

39. Coimbatore has a well-developed transport infrastructure and is well connected by Road, Rail and Air with most cities and towns in India. SH 167 passes through Vadavalli area. NH 67 leading to Ooty passing through Kavundampalayam and Thudiyalur areas. Coimbatore International Airport is at about 17 km and Coimbatore Railway Junction at about 19 km from Thudiyalur. The Nearest railway station to the Vadavalli area is Coimbatore Junction which is 9 km away.

2. Topography, Soils and Geology :

40. Coimbatore district forms part of the upland plateau region of Tamil Nadu with many hill ranges, hillocks and undulating topography with a gentle slope towards east except for the hilly terrain in the west. Both Vadavalli, Veerakeralam, Kavundampalayam and Thudiyalur areas have a predominantly plain terrain that is interspersed by Kousika stream and Noyyal river bed and numerous water bodies. The soil formation in Thudiyalur area is the combination of red loam, black soil, sandy and red sandy soil. The region is bounded on the west by steeply rising mountains of Western Ghats.

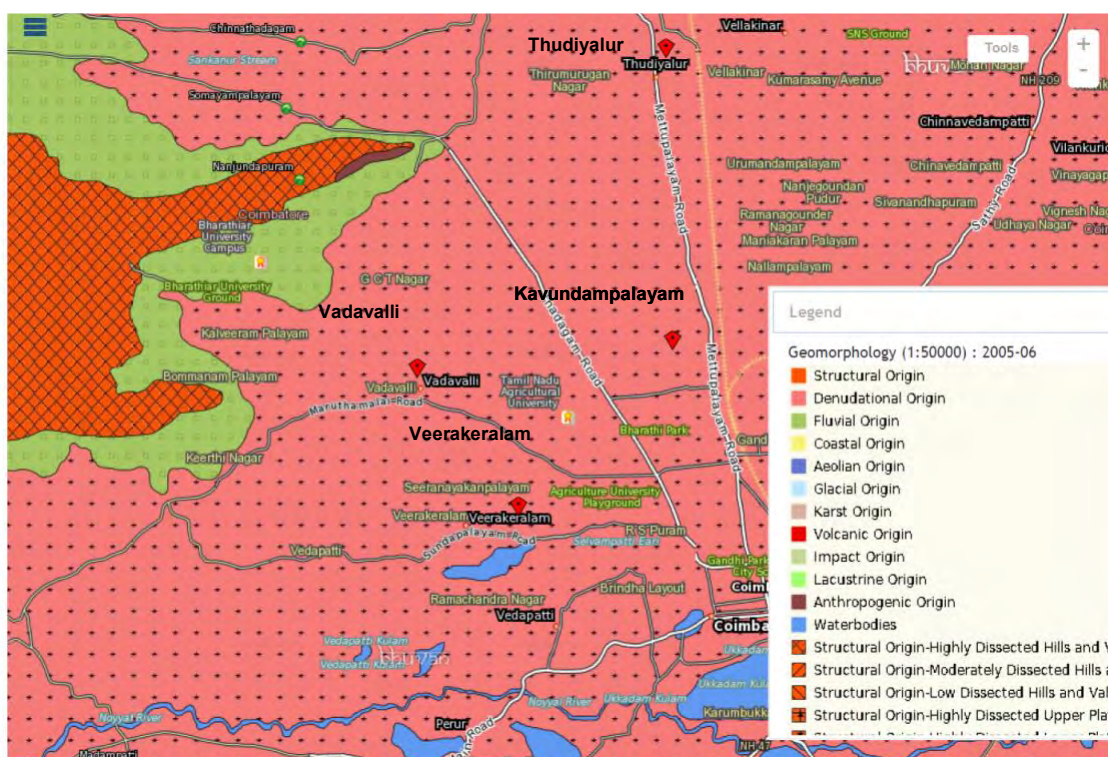
41. **(a) Geomorphology** : The undulating topography with innumerable depressions, are used as tanks for storage of rainwater for agriculture. The prominent geomorphic units identified in the district through interpretation of Satellite imagery are 1) Structural hills, 2) Ridges, 3) Inselbergs, 4) Bazada, 5) Valley fill, 6) Pediment, 7) Shallow Pediments and 8) Deep Pediments. The Nilgiris on the northwest and Anamalai on the south are the important ranges, which attain a heights of over 2513m above mean sea level (MSL) and the highest elevation in the valleys adjoining the hills is 600 M above MSL. The 'Palghat Gap', which is an east-west trending mountain pass, is an important physiographic feature is located in the western part of the district.

42. The soils of Coimbatore district can be broadly classified into 6 major soils types viz., Red calcareous Soil, Black Soil, Red non-calcareous, Alluvial and Colluvial Soil, Brown Soil, and Forest Soil. About 60% of the district is covered by red soils, of which red calcareous soil is predominant. They occupy most parts of Palladam, Coimbatore, Mettupalayam and Udumalpet taluks. The project areas of Vadavalli and Veerakeralam are covered by red soils, of which red calcareous soil is predominant. The Alluvial soils are found in small patches along the Noyyal river mainly in the upper reaches.

43. The geological formation of the district is classified as Gneissic complex or Gneissic granulites with and allied supra-crustal belt, which are believed to have occurred between 3400 to 3000 million years ago giving rise to an extensive group of grey gneisses designated as the "older gneiss complex". These gneisses act as the basement for a widespread belt of schist's. Sargur group comprises ultramafic rocks, amphibolites, Quartzite banded magnetite-quartzite occurring as small bands and lenses within the migmatites and gneisses.

44. **(b) Geology** : Coimbatore district is underlain by a wide range of high grade metamorphic rocks of the peninsular gneissic complex. Rocks are composed of minerals and amorphous solids. Since the geological set up controls the occurrence and movement of groundwater, the ability of the parent rock to store and transport groundwater is of great importance for its occurrence. The major rock types occurring in the district are fissile hornblende biotite gneiss, sand and silt, granite, amphibolites, metagabbro, pyroxenite, pyroxene granulite, charnockite, garnet sillimanite – graphite gneiss, calc-granulite and limestone and pink migmatite. There are no known or reported cases of land subsidence in or close to the subproject area.

Figure 14: Geomorphology of Project Area



3. Seismology

45. Per Bureau of Indian Standards (IS 1893: Par 1: 2002) earthquake zoning map of India, Tamil Nadu falls in Zones II & III (Low & Moderate Damage Risk Zones). Seismic hazard in the state is governed by Zone III in a few cities (for example, Chennai, Kancheepuram, Coimbatore, Cuddalore), and the rest of the state, which has few or no records of earthquakes, has been assigned to Zone II as shown in zoning map. Coimbatore falls under Zone III, which is the moderate earthquake risk zone in India. Structural design of infrastructure elements will be done with due consideration to relevant codes.

4. Climatic Conditions

46. It is located at the foothills of Western Ghats, Coimbatore is blessed with a pleasant, salubrious climate due to its proximity to the thickly forested mountain ranges and the cool breeze blowing through the Palghat gap which makes the consistently hot temperatures pleasant. The city has a tropical wet and dry climate, with the wet season being from October to December due to the northeast monsoon. Coimbatore is located at an elevation of about 411 meters, and enjoys pleasant climate throughout the year. Due to the presence of the mountain pass, major parts of the district benefit from the south-west monsoon.

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

monsoon sets in and provides most of the rains in this district. But after mid-December rain ceases. The temperature which was once set on the downward trend continues its course till the end of January.

48. The climatic condition of Coimbatore district is most conducive for people and cotton ginning and weaving Industries. The maximum temperature ranges from 36°C to 41°C and the minimum temperature varies from 14°C to 31°C. The mean daily temperature during summer varies from 33°C to 40°C and the mean daily temperature during winter varies from 15°C to 31°C. Rain occurs during South-West and North-East monsoons. North-east monsoon contributes the maximum of 328.2 mm during October to December. The average annual rainfall of this district is 647.2 mm from four distinct seasons.

Figure 15: Annual Seasonal Rainfall in Project Area

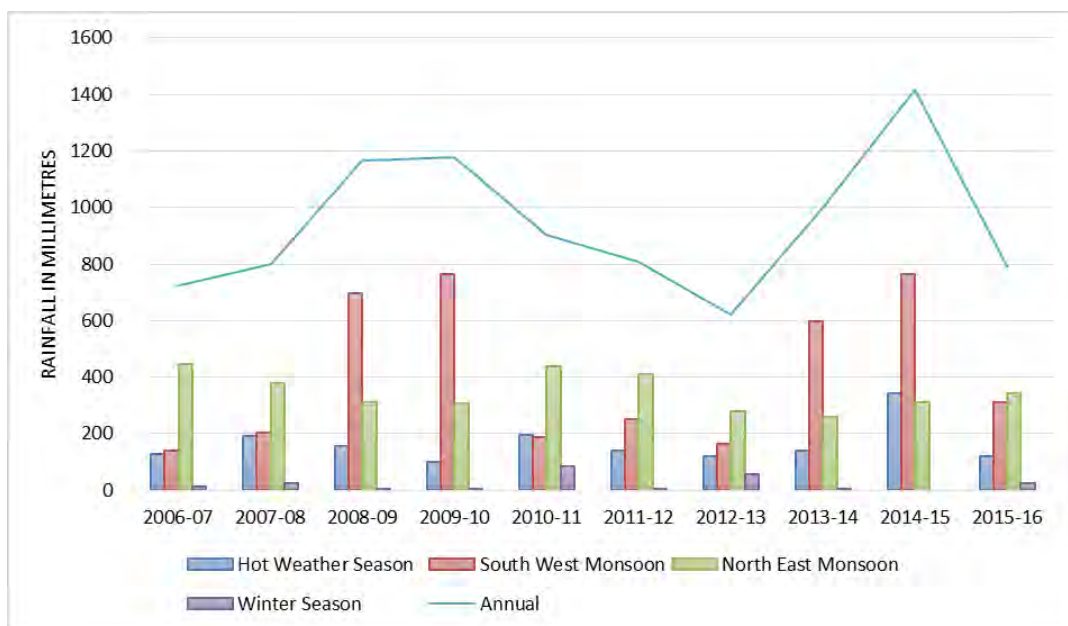
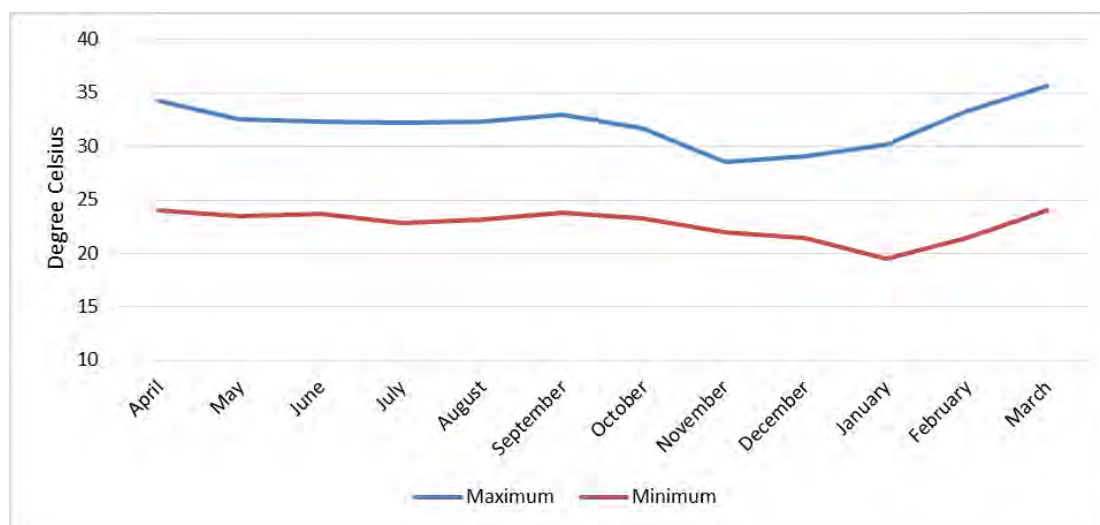


Figure 16: Monthly Max and Min Average Temperature in Project Area



5. Surface Water

49. River Noyyal, a small river and tributary of River Cauvery, passes through Coimbatore city. The flow in the river is negligible, and only consists of wastewater it collects from the surrounding areas. The maximum width of the stream is about 50 m in the city, but this is visible only at some places like river bridges in the city. In most of the course, the width is about 10-20 m, and flow within that confines to a maximum of 5 m wide, and shallow. Prior to 2011, Noyyal formed part of southern boundary of the municipal corporation limit. In 2011, Kurichi and Kuniyamuthur Municipalities, which are located south of the River are added to the municipal limit. It rises in Vellingiri hills in the Western Ghats in Tamil Nadu, close to Kerala State border. This rain fed River flows from west to east, and travels a distance of 180 km through five districts of Coimbatore, Tirupur, Erode, Karur, and Trichy. Cities of Coimbatore and Tirupur are two main cities along its course, about 50 km apart. It finally joins River Cauvery at Noyyal, a village in Karur district. The river's basin is 180 km long and 25 km wide and covers a total area of 3,500 km². Project area lies within the watershed expanse of the Noyyal River Basin and consists of a network of tanks and canals apart from lakes. Urban flooding (surface flooding of impermeable urban surfaces and overflow of saturated urban drainage systems and channels, resulting from sustained or intense rainfall events) is experienced in part of Coimbatore city during the heavy rains. Riverine flooding along Noyyal rivers and canals occurs during heavy flows.

50. There are several lakes and tanks in Coimbatore. Nine notable lakes are Ammankulam, Narasampathi, Krishnampathi, Selvampathy, Kumaraswamy, Muthannakulam, Selvachinthamani, Periya Kulam, Ukkadam Big Tank, Valankulam and Singanallur. There are 24 tanks in the city, however, none of these are located in the subproject area. Krishnampathi is located surrounding of Veerakeralam, in the subproject area. Water quality data presented in the following Table shows contamination, probably due to entry of wastewater from the catchment areas, with biochemical oxygen demand (BOD) value of 6.10 milligram per liter (mg/l) and Chemical Oxygen Demand (COD) valued from 242 mg/l to 470 mg/l.

Table 12: Water Quality Data of Lakes, 2016

S. No.	Parameters	Units	Selvachinthamani	Periyakulam
1	DO	Mg/l	5.40	5.10
2	FC	MPN/ 100ml	110	140
3	PH	PH	7.85	8.72
4	EC	MS/cm	413	1456
5	BOD	Mg/l	3.82	4.20
6	COD	Mg/l	260	470
7	PO ₄	Mg/l	2.00	2.20
8	NO ₃	Mg/l	3.70	4.90
9	SO ₄	Mg/l	24	122
10	Cl ⁻	Mg/l	320	872
11	Alkalinity	Mg/l	160	562
12	TDS	Mg/l	246	952

S. No.	Parameters	Units	Selvachinthamani	Periyakulam
13	Turbidity	NTU	7.20	12.50

[Source: Jeyaraj.M et.al (2016)]

51. **Current use and Water Quality of the Selvachinthamani Lake and Periyakulam Lake**
 . There are 8 major water bodies within the corporation limits. The total area of about 423 Ha with a storage capacity of about 16.07 Mcum. Most of the tanks are used for irrigation. These tanks could be used as potential recharge centres. Most of the tanks are located in southern part of the city and finally drain into Noyyal River.

Figure 17: Location of 8 Lakes in Coimbatore Corporation



Figure 18: Tanks and Anaicuts Connecting Noyyal River

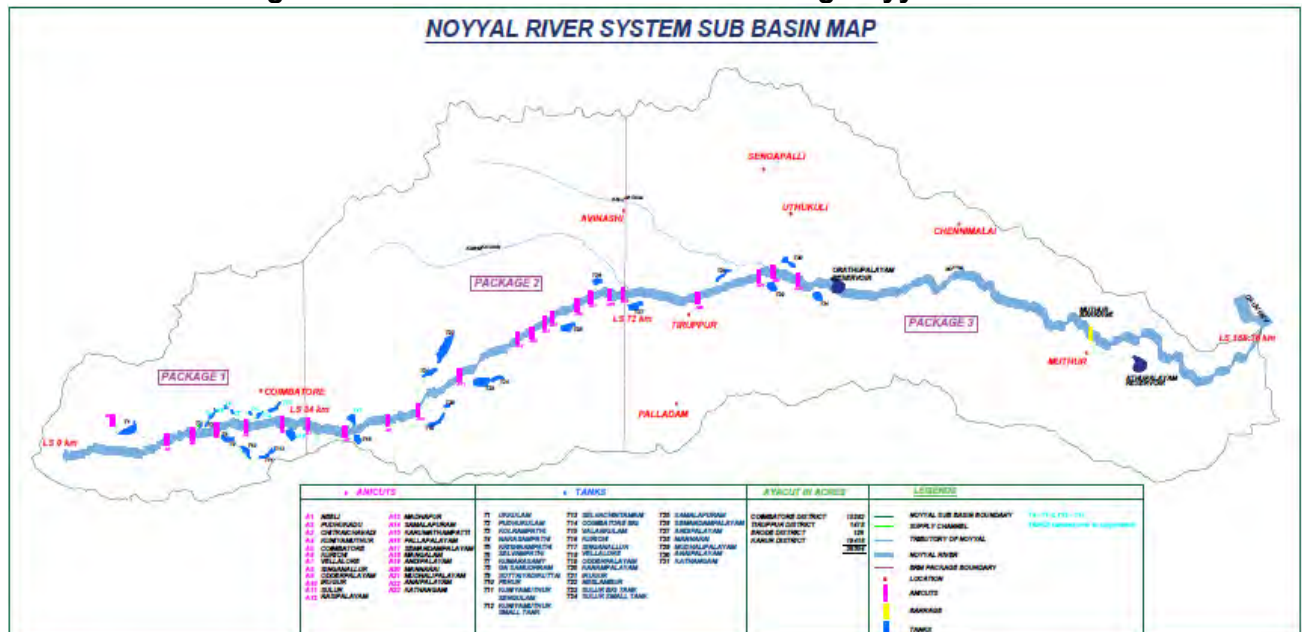


Figure 19: Connectivity of Lakes and Joining into River Noyyal



52. The Noyyal River forms the southern boundary of the Coimbatore Corporation and acts as a major drainage course carrying the storm water discharge.

53. **Selvachinthamani Lake** is the smallest water body and is located under core corporation limits of Coimbatore City. The lake is spread over an area of 33 Acres 21.12 Guntas (1,33,518 sqm). It is a rain fed lake and is connected with Narasampathy, Krishnampathy, Kumaraswamy and Selvampathy Lakes in the upstream; in the downstream it is connected to Periyakulam Lake and eventually joins River Noyyal on the south of the city.

Figure 20: Details of Selvachinthamani Lake**8. Selva chinthamani kulam**

Location Taluk: Coimbatore (South), Village: Konmarapalayam Latitude: 10° 59'29" N and Longitude: 76° 56'50" E		
Size of wetland Catchment area: 1.69 Sq.km (0.653 Sq.miles) Water Spread area: 37 Acres (0.149 Sq.km) Capacity: 85600 Cubic Metres (3.02 M.cft) Full Tank Level: 1.83 M Max Water Level: 2.28 M Top Bund Level: 3.91 M Depth: 1.829 Metres (6 Feet) Length of the Bund: 1500.00 M Length of Shoreline: 1500.00 M Ayacut: 72.00 Acres		
Inlet and outlets It receives excess water from the Kumaraswamy tank. The outlet of the tank is in the form of regulator with three shutters. The shutters are located along the Perur road. The excess water from the tank will reach Coimbatore big tank in the down stream. No of Inlets: 1 (1 canal and many sewage inlets) No of Outlets: 1 (1 sluice) Surplus escape: Regulator with 3 vents		
Threats Encroachments: Hutments located in the land filled areas and agriculture Waste dumping: Building debris and domestic solid waste along the bund Roads: Siruvani main road is the Southern side of this lake. The vehicle traffic is heavy in this road.		
Violation (According to Wetland (Conservation and management) Rules, 2010) i. Encroachment and road construction: Under section 4 (1)(vi) ii. Solid Waste dumping: Under section 4 (1)(iv) iii. Agriculture: Under section 4 (2)(x)		

Table 13 : Salient Features of Selvachinthamani Lake

Latitude	N 10° 59' 24.29"
Longitude	E 76° 56' 48.91"
Area of the Lake (as per Topographical survey drawing)	33 Acres 21.12 Guntas (133518 sqm)
Catchment area of the lake (Watershed delineation using Topo Sheet)	1.23 sq.km
Current analysis catchment area of the lake (independent)	0.89 sq.km
Existing Full Tank Level as per survey drawing	411.00 m
Total length of the existing main bund	550 m
Surplus Arrangement / Surplus Weir	3 vent regulator
Existing surface area of Lake at FTL as per survey drawing	1,16,757 sq. m
Storage volume of the Lake as per survey drawing up to FTL	1,85,215 cu. m.
Storage volume of the Lake (as per survey Tank Register)	85,517 cu.m
Existing Maximum depth (Z max) (Considering from FTL)	2.82 m
Estimated flood discharge	51.6 Cumecs
Spillage Depth	0.45 m (Historical) 0.90 m (Proposed)

54. A Dry Weather Flow of 1200 cum/day was measured at inlet 1 of Selvachinthamani lake, that is mostly generated from households in the catchment.

Table 14 : Water Quantity / Quality of Selvachinthamani Lake

Quantity	1200 cum/day as measured in June 2017 (Dry Weather Flow)
Quality	Sample Type : Composite
Parameter	Value
BOD (mg/L)	164
COD (mg/L)	714
pH @ 25° C	11.36
Nitrates (mg/L)	20.2

55. **Periyakulam Lake** is the largest water body which falls under core corporation limits of Coimbatore city, having a completely built-up catchment area with a spread of over 337 acres, and is connected with Narasampathy, Krishnampathy, Selvampathy, Kumaraswamy and Selvachinthamani lakes and the river Noyyal in the upstream. In the downstream it is connected to Valankulam and Singanallur lakes eventually joining into the Noyyal River.

Figure 21: Details of Periyakulam Lake

14. Periyakulam (also known as Ukkadam big tank)		
Location Taluk: Coimbatore (South), Village: Coimbatore Latitude: 10° 59'06" N and Longitude: 76° 56'58" E		
Size of wetland Catchment area: 27.83 Sq.km (10.752 Sq.miles) Water Spread area: 320 Acres (1.295 Sq.km) Capacity: 1980800 Cubic Metres (69.95 M.cft) Full Tank Level: 5.82 M Max Water Level: 6.51 M Top Bund Level: 7.88 M Depth: 5.822 Metres (19.10 Feet) Length of the Bund: 2880.00 M Length of Shoreline: 5200.00 M Aysent: 1425.00 Acres		
Inlet and outlets The lake is being fed by Coimbatore amsut channel from the Coimbatore amsut on Noyyal River. The lake also receives surplus water from the Selvachinthamani lake located in the upstream (north-west). The lake is provided with the outlet connection to feed the Valankulam lake, which is located east side of the lake. It has surplus weir arrangement of about 25.8 m situated south side of the lake, which is a masonry weir with side walls and solid apron. No of Inlets: 7 (1 from River Noyyal, 1 from Selvachinthamani and 5 sewage inlets) No of Outlets: 5 (1 Weir and 4 sluices) Length of Surplus escape: 15.40 M		
Threats Encroachment: The tank has huge encroachment on the boundary area. One big taxi stand is being operated on the tank bund in north-eastern corner. Farmers cultivate green leafy vegetables with the drainage water inside the water spread area. All kinds of solid wastes are dumped on the tank bund and near the tanks. There are 300 pucca/datched houses located at the toe of the bund on southern side of the tank. The approximate area under the encroachment is around 10 acres. (Source: PWD/WHO, Bhavanisagar dam division, Irrigation sub division, Coimbatore) Waste dumping: Building debris and domestic solid waste along the bund Roads: Sururani byepass road is the Northern side of this lake. Pollachi/Palghat road is on the eastern side of this lake. The vehicle traffic is heavy in this road.		
Violation (According to Wetland (Conservation and management) Rules, 2010) i. Encroachment and road construction. Under section 4 (1)(vi) ii. Solid Waste dumping: Under section 4 (1)(iv)		

Table 15: Salient Features of Periyakulam Lake

Geographic Location of the Lake	N 10° 58' 44" E 76° 56' 43.56"
Catchment Area of the Lake as per toposheet	8.53 sq km
Catchment area of the Lake as per Storm water network and diverted catchment	11.31 sq km
Existing FTL as per Survey drawing	405.86
Proposed New Full Tank Level	405.50
Existing surface area of the lake at FTL as per topo survey	12,49,739 sqm (333 acres)

Storage volume of the lake (as per survey tank memoir	19,80,763 cum (1980 ML)
Storage volume of the lake as per topo survey drawing upto FTL	24,40,059 cum (2440 ML)
Estimated Flood Discharge (combined catchment)	162.2 cumecs
Surplus arrangements	Surplus weir length – 27m
Sluice arrangements	2 (N-E & S-E Corners)
Spillage depth at the weir	0.6 m Historical 0.9 m Proposed
Total wastewater inflow	12.8 MLD

56. A Dry Weather Flow of 80 cum/day was measured at inlet 3 of Periyakulam lake that is mostly generated from households along Sukrawarapetai area located upstream of the lake. This flow contains less load of pollutants.

Table 16: Water Quantity / Quality of Periyakulam Lake

Particulars	Inlet-3	Inlet-4	Inlet-5
Quantity	80 cum/day as measured in June 2017 (Dry Weather Flow)	6000 cum/day as measured in June 2017	2.95 mld as measured in June 2017 (Dry Weather Flow)
Quality	Sample Type : Composite	Sample Type : Composite	Sample Type : Composite
Parameter	Value	Value	Value
BOD (mg/L)	135	102	452
COD (mg/L)	576	472	1190
pH @ 25° C	7.36	7.26	7.38
Nitrates	18.6	17.3	2.3

57. **Sanganoor Stream:** Sanganoor Stream which was a natural stream carrying rainwater from the Thadagam valley into the Singanallur Lake and finally drains into the River Noyyal. Thus, this stream has the adequacy to carry the treated water from the STP. Also, the Corporation has submitted a proposal to the finance committee for the rejuvenation and restoration of the stream.

58. **Lake Level Recommendation and Interventions :** Under the SMART City Mission programme - Eco-Restoration for Lakes in Coimbatore Corporation Area, following interventions have been recommended such as FTL Revision; Desilting; Inlet Drain Refurbishment; Dismantling/decommissioning of inlet weir; Construction of Surplus Arrangement; Refurbishment of Outlet Nallah Surplus Arrangement; Improvements to existing bund; Wastewater Treatment System at all the inlets of both the lakes and the Project Implementation is in progress in Selavachinthamani and Periyakulam Lakes. In the Periyakulam lake mobility corridor has been provided to avail recreational facility and remaining works are in progress.

59. **Disposal of Treated Effluent from two STPs :** In the Sub-project Zone V & VII, the sewage will be treated to the current standards stipulated by the NGT (ie., BOD – 10 mg/l) and let into the nearby stream post chlorination.

- In Zone V, Disposal of treated effluent from STP into outlet odai of Kumaraswamy Lakewhich flows to Selva Chintha-mani Kulam & thereon to Periyakulam having its final outfall into the River Noyyal. Under the 'Eco-Restoration of Lakes' already taken up for implementation by Coimbatore Corporation, the inlet channels are proposed to be refurbished and the carrying capacity will be improved. The treated effluent after disposal travels for a distance of about 3 km in the open channel, before reaching the subsequent

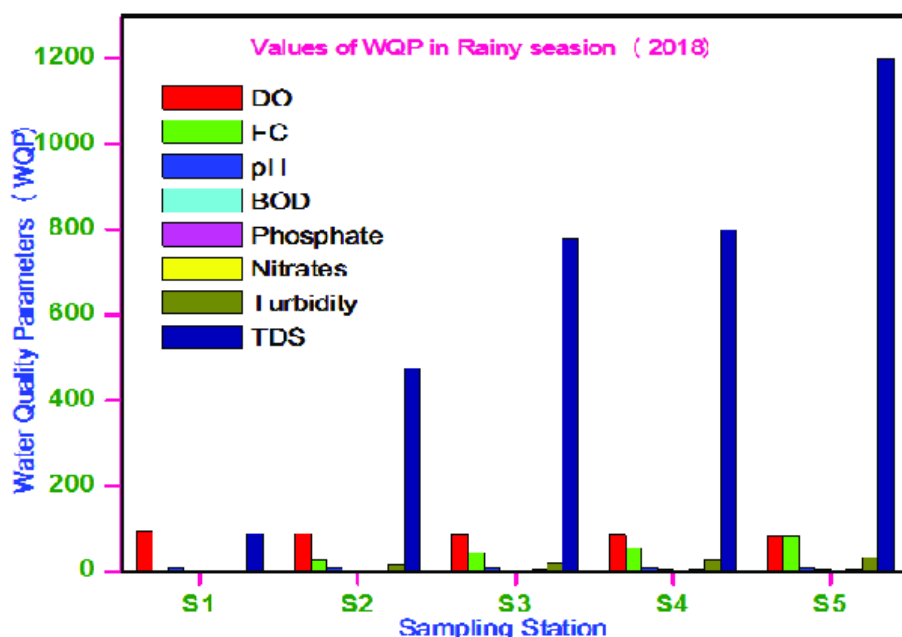
waterbody, Selvachinthamani Kulam, during which, the level of BOD gets reduced further due to aeration in the atmospheric contact. Hence, letting the treated effluent from the above Sub-project is not envisaged to affect the receiving water bodies in respect of its usage, such as agriculture, fishing, recreational purpose, etc. Since the pivotal objective of the above programme are ecological restoration of lakes while ensuring maximum storage of water in the lakes thereby ensuring continuous flow of water. This would facilitate the management of treated effluent without harming the eco system.

- In Zone VII, Disposal of treated effluent let into Sangnur stream adjacent to the site, leading to River Noyyal. The stream is proposed for rejuvenation and restoration to increase the depth, by Corporation.

6. Ground Water

60. Investigation of Water Quality Index of River Noyyal and Its Connected Ponds Coimbatore Tamil Nadu India. This investigation deals with the determination of various physico-chemical and biological parameters of surface water quality of river Noyyal and its connected ponds at Coimbatore, India. Based on their significance, the sampling locations were selected. There are five sampling locations were selected like river Noyyal at source (S1), Perur Lake, (S2), Ukkadam Pond (S3), Singanallur Lake (S4) and Sular Pond (S5), and samples were collected from each locations at river Noyyal basin in and around Coimbatore district. The surface water quality index determination is prerequisite and essential. In this present work, from different methods of water quality determination, the most commonly used index of National Sanitation Foundation water quality index (NSF-WQI) has been followed. The physico-chemical and biological parameters such as dissolved oxygen, faecal coliforms counts, pH, biochemical oxygen demand, phosphate, nitrates, turbidity, and total dissolved solids were investigated. Except in Noyyal river at source (S1) all the measured parameters are showed to be very high compared to limits suggested by WHO particularly during summer season and thereby it is not suitable for public use.

Figure 22: Graphical Representation of WQP of River Noyyal Connected Ponds during Summer and Rainy Seasons – 2018



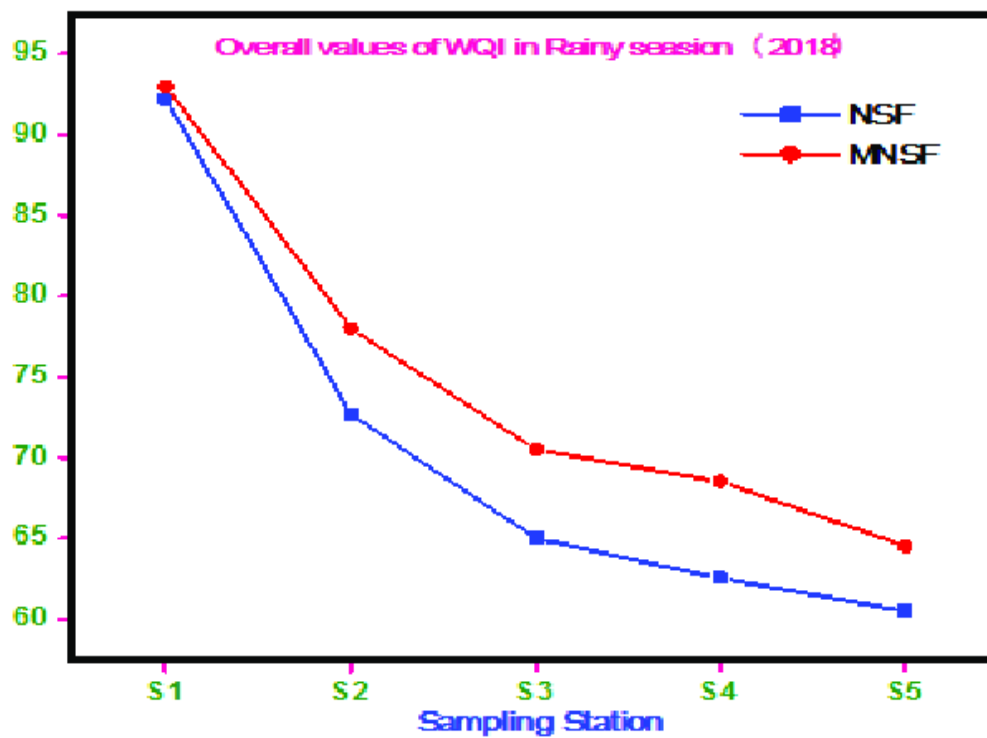
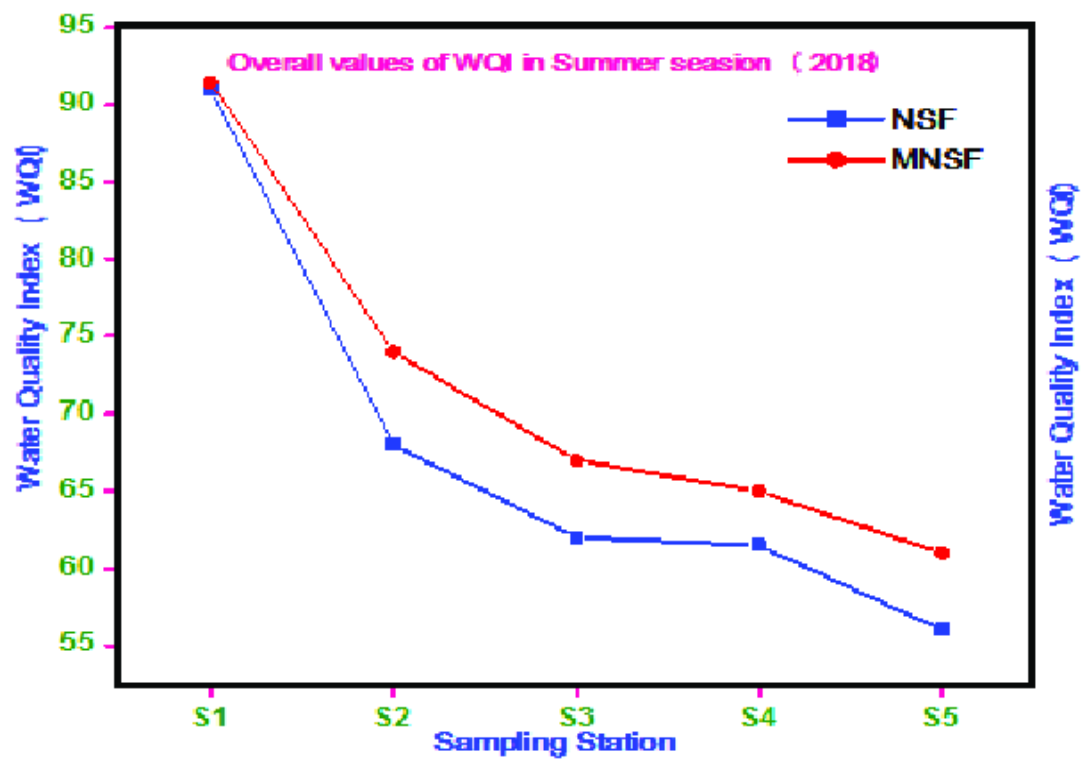


Table 17: Values of Water Quality Parameter and Water Quality Index of River Noyyal Connected Ponds during Summer Season (2018)

S.No.	Test Parameters	Unit	S1	S2	S3	S4	S5
1.	DO	% Saturation	94.00	87.00	86.00	84.00	81.00
2.	Faecal Coliforms	MPN/100 ml	4.00	24.00	85.00	119.00	128.00
3.	pH	pH units	7.80	8.00	8.14	9.20	10.90
4.	BOD	mg/L	0.90	3.50	4.20	5.50	8.60
5.	Total Phosphates	mg/L	0.30	1.40	1.65	1.80	2.10
6.	Nitrates	mg/L	0.50	4.00	4.80	5.10	7.50
7.	Turbidity	NTU	2.00	18.00	22.00	32.00	43.00
8.	TDS	mg/L	97.00	437	680	1250	1800
Overall WQI		NSF	91.00	68.00	62.00	61.50	56.00
		MNSF	91.50	74.00	67.00	65.00	61.00

Table 18: Values of Water Quality Parameter and Water Quality Index of River Noyyal Connected Ponds during Rainy Season (2018)

S.No.	Test Parameters	Unit	S1	S2	S3	S4	S5
1.	DO	% Saturation	95.00	87.50	86.00	84.50	83.00
2.	Faecal Coliforms	MPN/100 ml	2.50	28.00	45.00	54.00	82.00
3.	pH	pH units	7.50	7.70	7.80	9.10	9.50
4.	BOD	mg/L	0.60	2.40	3.55	4.50	6.50
5.	Total Phosphates	mg/L	0.20	1.20	1.50	1.72	1.90
6.	Nitrates	mg/L	0.40	3.00	4.50	4.80	6.50
7.	Turbidity	NTU	1.50	16.00	20.00	28.50	34.00
8.	TDS	mg/L	88.00	476	780	800	1200
Overall WQI		NSF	92.20	72.70	65.00	62.50	60.50
		MNSF	93.00	78.00	70.50	68.50	64.50

[Source : JEYARAJ et al., Orient. J.Chem.,Vol. 35(3), 1125-1131 (2019)]Values shown are absolute values of one-time sampling and laboratory testing.

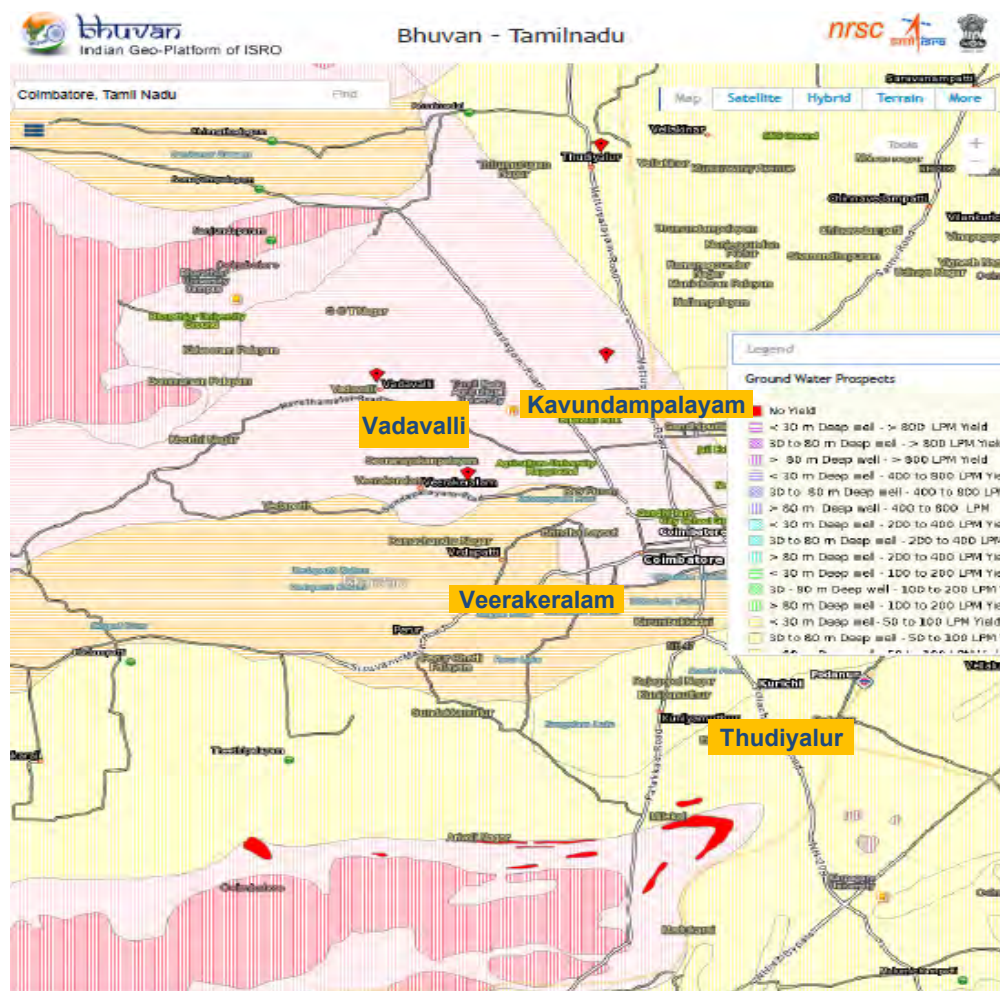
61. The district is underlain by both porous and fissured formations. The important aquifer systems in the district are constituted by i) unconsolidated formations and ii) weathered and fractured crystalline rocks. The porous formations in the district are represented by alluvium and colluviums.

62. Ground water occurs under phreatic conditions in the weathered mantle and under semi-confined conditions in the fractured zones. The shallow aquifers in the major part of the district occur within the depth of 30 m while in the western most part of Coimbatore; they are more than 30 m. The depth of the wells ranged from 7 to 45 m bgl. The yield of large diameter wells in the district, tapping the weathered mantle of crystalline rocks ranges from 50 to 300 lpm and are able to sustain pumping for 2 to 4 hours per day. The Specific capacity of large diameter wells tested in crystalline rocks from 6.28 to 200.00 lpm/m. of drawdown.

63. The yield of bore wells drilled down to a depth of 50 to 100 m, by various state agencies mainly for domestic purposes ranged from 1 to 5 lps. The yield of successful bore wells drilled down to a depth of 304 mbgl during the ground water exploration programme of Central Ground Water Board ranged from <1 to 10 lps. The aquifer and well parameters of the wells show wide variation. The depth to water level in the district varied between 1.54 and 39.03 mbgl during pre-monsoon (May 2006) and varied between 0.62 and 36.42 mbgl during post monsoon (Jan 2007). The seasonal fluctuation shows a rise in water level, which ranges from 0.34 to 10.88 mbgl. The piezometric head varied between 1.47 to 50.66 mbgl (May 2006) during pre-monsoon and 0.34 to 51.02 mbgl during post monsoon (Jan 2007).

64. The estimation of groundwater resources for the Coimbatore district has shown that out of 19 blocks, 11 blocks are over exploited and 4 blocks are under “critical” category.

Figure 23: Ground Water Prospects in Project Area



Source: Bhuvan

65. **Groundwater Quality.** Ground water in phreatic aquifers in Coimbatore district in general is colorless, odorless and slightly alkaline in nature. According to central ground water board (CGWB) report, the specific electrical conductance of ground water in phreatic zone (μS at 25°C) during May 2006 was in the range of 597 to 4810 in the district. It is between 750 and 2250 $\mu\text{S}/\text{cm}$ at 25°C in the major part of the district. Conductivity below 750 $\mu\text{S}/\text{cm}$ has been observed in Kaltanpet whereas conductance exceeding 2250 $\mu\text{S}/\text{cm}$ has been observed in parts of Avinashi, P.N.Palayam, Tiruppur, Nachipalayam, Vadavalli, Singanallur, Suler, Podanur and Chinnaripalayam. In Vadavalli, Veerakeralam & Part of Kavundampalayam areas, 800 lpm of yield is expected in deep well to a depth more than 30m and in Thudiyalur area 50 to 100 lpm of yield out of deep well more than 30 m depth. Following table shows the groundwater quality in Coimbatore along River Noyyal. Water hardness and calcium is higher than permissible limits.

Table 19:Groundwater Quality

Parameters	BIS standard	Pre-monsoon (mean)	Post-monsoon (mean)
pH	6.5 – 8.5	7.47	7.26
Total dissolved solids, mg/l	500 – 2000	1237.10	1329.72
Total hardness, mg/l	300 – 600	748.23	676.15
Calcium, mg/l	75 -200	518.26	512.69
Magnesium, mg/l	30 – 100	230.73	163.46
Sodium, mg/l	200	70.96	100.82
Potassium, mg/l	-	88.7	165.66
Chloride, mg/l	250 – 1000	218.63	200.3
Bicarbonate, mg/l	300 – 600	702.54	95.63
Sulphate, mg/l	200 – 400	17.06	19.31

Kalaivani S. and Ramesh K. (2014-15), “Groundwater Quality Assessment using WQI In South Coimbatore, Tamil Nadu, India”, International Journal of Chem Tech Research, Vol. 7(1).

7. Ambient Air Quality

66. The ambient air quality in the project area is being monitored under National Air Quality Monitoring Programme (NAMP) at following locations in Coimbatore (i) District Collector’s Office (Mixed zone), (ii) Ponniyarajapuram (Residential zone), and (iii) SIDCO Building (Industrial zone).

67. National ambient air quality monitoring (NAAQM) station at Small Industries Development Corporation (SIDCO) Industrial Estate is located within Kurichi area (southeastern corner) while rest of the two monitoring stations are about 5 kilometers away from the project area, but within Coimbatore City. The sources of pollution are windblown road dust, industries and automobile emissions. Kurichi area is traversed by NH209 and Kuniyammur area is bifurcated by Palakkad road. Both the roads are busy with high vehicular movement. This vehicular movement contribute to the air quality in the area. Maximum and average values of the PM₁₀ is higher than the prescribed standard.

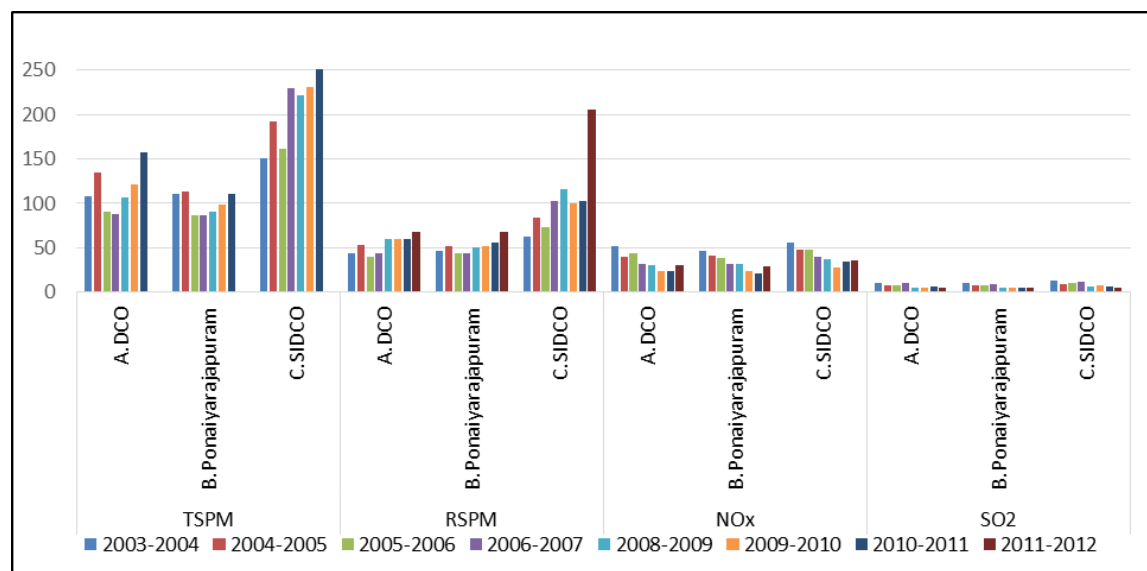
Table 20: Annual Average Concentrations of Air Pollutants, 2018 -2019

Sl. No.	Location	Category	Annual Average Concentrations of Air Pollutants in Micro Grams per Cubic Meter($\mu\text{g}/\text{m}^3$)								
			SO ₂ (Sulphur di oxide)			NO ₂ (Nitrogen di oxide)			PM ₁₀ (Particulate Matter)		
			Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
1	DCO	Mixed	6	4	5	25	19	22	80	36	57
2	Ponaiyarajapura	Residential	6	4	5	24	18	21	75	30	48
3	SIDCO	Industrial	8	6	7	29	20	23	87	40	61
NAAQ Standard											
Industrial, Residential, Rural and Other Areas – Annual Average			50			40			60		
Industrial, Residential, Rural and Other Areas 24 hours			80			80			100		
Ecologically Sensitive Area-Annual			20			30			60		

Table 21: Annual Average Concentrations of Air Pollutants, 2008 -2009

Table 22: Annual Average Concentrations of Air Pollutants, 2009 -2010

Figure 24: Annual Average Concentrations of Air Pollutants



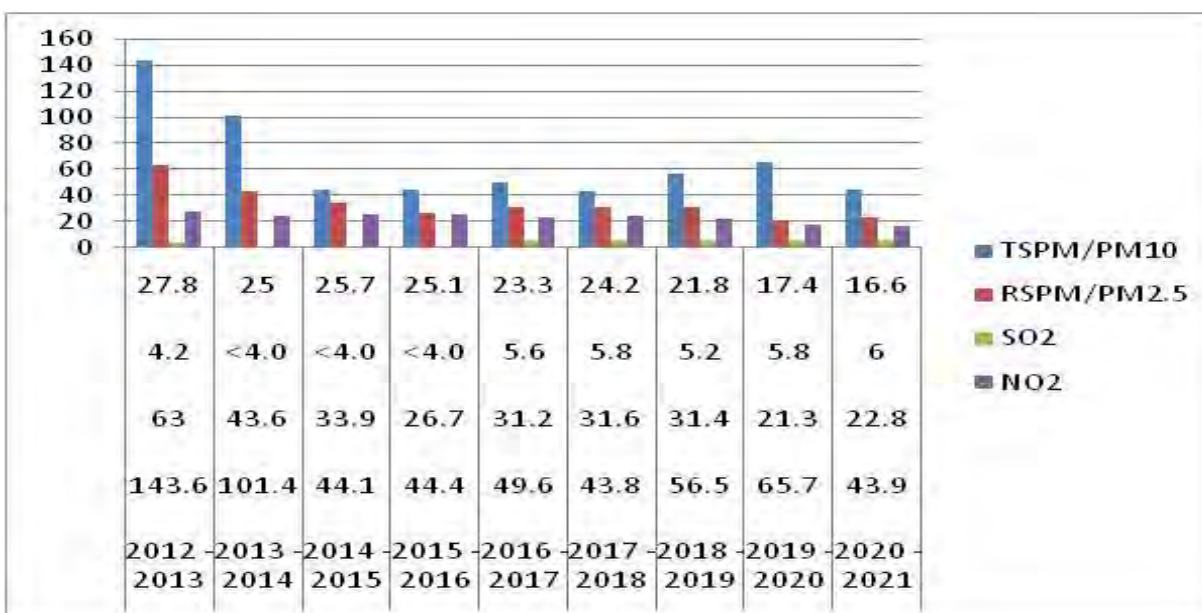
Source: Air Pollution Database in Tamil Nadu 2014 by Envis Centre.

68. Following figure shows the ambient air quality in “Mixed Area” of Coimbatore from April ‘2012 to October ‘2020. Particulate matter is higher than the prescribed standard. Oxides of Nitrogen and Sulphur are well within the limits.

Table 23: Ambient Air Quality Monitoring Results of Coimbatore between 2012& 2020
A. Location : Collectorate Office Building / GD Matric School, Coimbatore
Category – Mixed Area

Year (April to March)	Annual Average Concentration of Air pollutants, $\mu\text{g}/\text{m}^3$			
	TSPM	RSPM	SO₂	NO₂
2012 -2013	143.6	63.0	4.2	27.8
2013 - 2014	101.4	43.6	<4.0	25.0
	PM 10	PM 2.5	SO₂	NO₂
2014 - 2015	44.1	33.9	<4.0	25.7
2015 - 2016	44.4	26.7	<4.0	25.1
2016 - 2017	49.6	31.2	5.6	23.3
2017 - 2018	43.8	31.6	5.8	24.2
2018 - 2019	56.5	31.4	5.2	21.8
2019 - 2020	65.7	21.3	5.8	17.4
April ‘2020 – October ‘2020	43.9	22.8	6.0	16.6
Prescribed Standard				
Industrial	360	120	80	80
Residential, Rural & Other Areas (Mixed)	140/PM ₁₀ -60	60/PM _{2.5} -40	60	60
NAAQS-2009	100	60	40	50

[Source: TNPCB - Advanced Environmental Laboratory, Coimbatore - Air Pollution Database]

Figure 25: Ambient Air Quality of Coimbatore 2012 to 2020 (Mixed Area)

[Source: TNPCB - Advanced Environmental Laboratory, Coimbatore - Air Pollution Database]

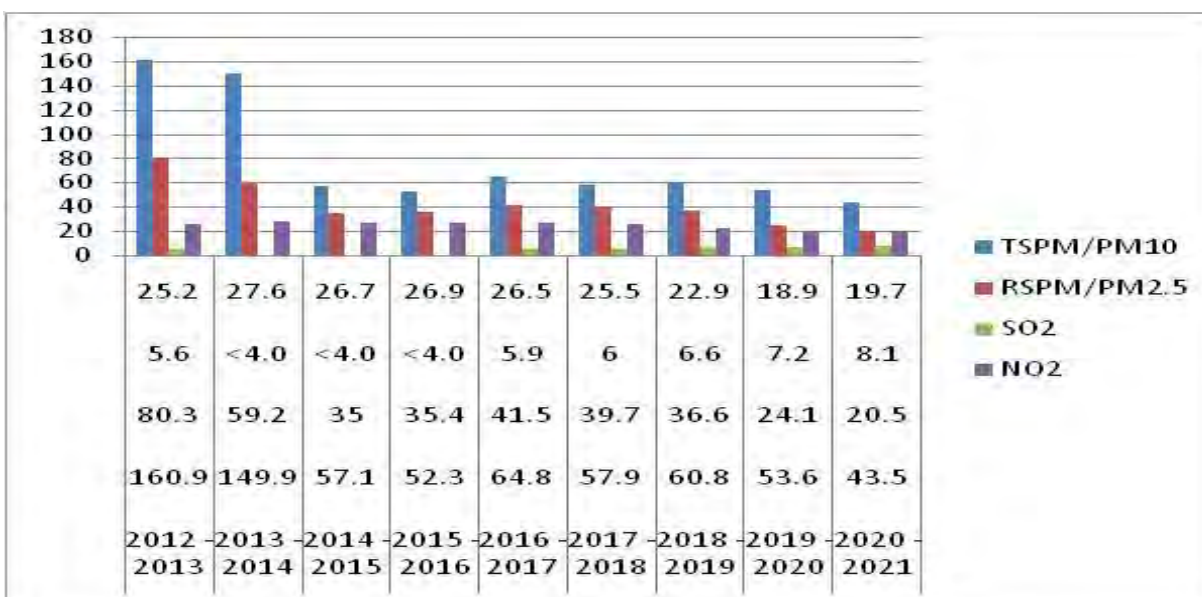
69. Following figure shows the ambient air quality in “Industrial Area” of Coimbatore from April ‘2012 to October ‘2020. Particulate matter, Oxides of Nitrogen and Sulphur are well within the limits.

Table 24: Ambient Air Quality Monitoring Results of Coimbatore between 2012& 2020

B. Location : SIDCO
Category – Industrial

Year (April to March)	Annual Average Concentration of Air pollutants, µg/m ³			
	TSPM	RSPM	SO ₂	NO ₂
2012 -2013	160.9	80.3	5.6	25.2
2013 - 2014	149.9	59.2	<4.0	27.6
	PM 10	PM 2.5	SO₂	NO₂
2014 - 2015	57.1	35.0	<4.0	26.7
2015 - 2016	52.3	35.4	<4.0	26.9
2016 - 2017	64.8	41.5	5.9	26.5
2017 - 2018	57.9	39.7	6.0	25.5
2018 - 2019	60.8	36.6	6.6	22.9
2019 - 2020	53.6	24.1	7.2	18.9
April ‘2020 – October ‘2020	43.5	20.5	8.1	19.7
Prescribed Standard				
Industrial	360/PM ₁₀ -60	120/PM _{2.5} -40	80	80
Residential, Rural & Other Areas	140/	60	60	60
NAAQS-2009	NA	60	40	50

[Source: TNPCB - Advanced Environmental Laboratory, Coimbatore - Air Pollution Database]

Figure 26: Ambient Air Quality of Coimbatore 2012 to 2020 (Industrial Area)

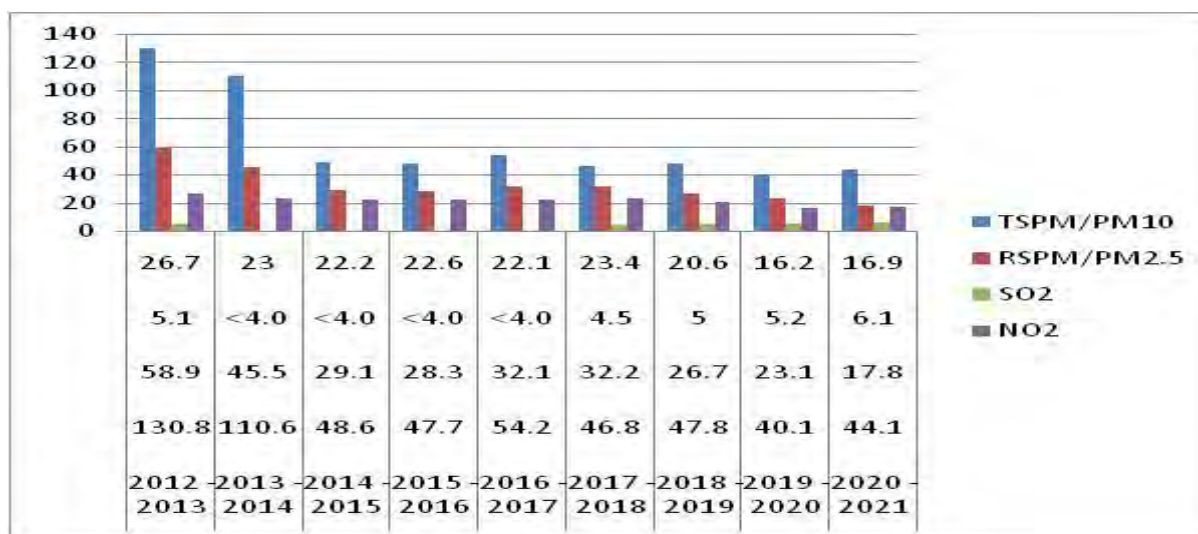
[Source: TNPCB - Advanced Environmental Laboratory, Coimbatore - Air Pollution Database]

70. Following figure shows the ambient air quality in “Residential Area” of Coimbatore from April ‘2012 to October ‘2020. Particulate matter, Oxides of Nitrogen and Sulphur are well within the limits.

Table 25: Ambient Air Quality Monitoring Results of Coimbatore between 2012& 2020
C. Location :Ponniyarajapuram, Velandipalayam, Kavundampalayam & Thudiyalur
Category – Residential Area

Year (April to March)	Annual Average Concentration of Air pollutants, $\mu\text{g}/\text{m}^3$			
	TSPM	RSPM	SO ₂	NO ₂
Ponniyarajapuram				
2012 -2013	130.8	58.9	5.1	26.7
2013 - 2014	110.6	45.5	<4.0	23.0
PM 10 PM 2.5 SO ₂ NO ₂				
2014 - 2015	48.6	29.1	<4.0	22.2
2015 - 2016	47.7	28.3	<4.0	22.6
2016 - 2017	54.2	32.1	<4.0	22.1
Ponniyarajapuram & Velandipalayam				
2017 - 2018	46.8	32.2	4.5	23.4
Velandipalayam & Kavundampalayam				
2018 - 2019	47.8	26.7	5.0	20.6
Kavundampalayam				
2019 - 2020	40.1	23.1	5.2	16.2
April ‘2020 – October ‘2020	44.1	17.8	6.1	16.9
Prescribed Standard				
Industrial	360	120	80	80
Residential, Rural & Other Areas	140/ PM ₁₀ -60	60/ PM _{2.5} -60	60	60
NAAQS-2009	NA	60	40	50

[Source: TNPCB - Advanced Environmental Laboratory, Coimbatore - Air Pollution Database]

Figure 27: Ambient Air Quality of Coimbatore 2012 to 2020 (Residential Area)

[Source: TNPCB - Advanced Environmental Laboratory, Coimbatore - Air Pollution Database]

8. Ambient Noise Levels

71. The ambient noise levels recorded in the vicinity of project area are higher than the day and night time noise standards (55 dBA and 45 dBA) for residential areas as well as for commercial areas (65 dBA and 55dBA).

Table 26: Ambient Day-time Noise Levels in Coimbatore

Area Name	Normal Day dB (A) - Max	Festival Day dB(A) - Max
Saibaba Kovil Signal	72	68
Ponniarajapuram	67	82
Standards	55	55

Source: CPCB 2014

C. Ecological Resources

72. Geographicaly

Coimbatore is situated on the banks of river Noyyal and foothills of Western Ghats and Nilgiri Biosphere Reserve (NBR). NBR is spread over vast area of 5,520 sq. km in three states of Tamil Nadu, Kerala and Karnataka; about 46% area is situated in Tamil Nadu state. NBR falls under the biogeographic region of the Malabar rain forest. Mudumalai Wildlife Sanctuary, Wyanaad Wildlife Sanctuary Bandipur National Park, Nagarhole National Park, Mukurthi National Park and Silent Valley are the protected areas present within this reserve. The reserve extends from the tropical and subtropical moist broadleaf forests, tropical moist forests of the western slopes of the Ghats to the tropical and subtropical dry broadleaf forests tropical dry forests on the east slopes. Rainfall ranges from 500mm to 7,000 mm per year. The reserve



encompasses three ecoregions, the South Western Ghats moist deciduous forests, South Western Ghats montane rain forests, and South Deccan Plateau dry deciduous forests. This encompasses Nilgiri mountains, spread in west of Coimbatore. The boundary of biosphere reserve is about 15-20 km from the project area. As the project is confined to urban area of Coimbatore municipal corporation, none of the components are located in or close to biosphere reserve. Noyyal river originates in a mountain range in the biosphere reserve.

73. Coimbatore and surrounding region receives scanty rainfall, and Noyyal River forms an important ecological aspect for water resources. There are series of tanks/lakes (32 in all) to hold overflow of Noyyal river during northwest and southwest monsoon along Noyyal river in its course of over 170 km. These are interconnected tanks, some of which are located in Coimbatore. The edible, freshwater teleost, *Mystus vittatus* (Bloch), the striped dwarf catfish, vernacularly called as 'Pown keluthi' is a fish variety cultured in major lakes in and around Coimbatore city. Twenty-one species of fish have been recorded from six of the city lakes.

74. A 2007 study by Sálim Ali Centre for Ornithology and Natural History (SACON) in 14 wetlands in the Coimbatore had recorded 12,000 birds, belonging to 54 species. Other studies, recorded around 133 species of birds representing 48 families and 16 orders around the city wetlands; most of the species were either wetland birds or wetland associated species. But the diversity and numbers in recent years has drastically reduced. According to Sivakumar T et al the following migratory birds were recorded at Kurichi Kulam (lake) in 2014: Little Crane, Water Cock,

Black tailed Godwit, Marsh Sandpiper, Wood sandpiper, Grey Wagtail, Brown Shrike, Greenish Leaf Warbler, Orphean Warbler. None of the listed birds are protected or listed under the Schedule I of Wildlife Protection Act. The migratory season in the region generally spreads between July to January.

75. Mammals that are usually encountered in the project area includes the domestic cattle, cats and dogs. A study by Athira (2012) during the months of March and April 2012 around Ukkadam Lake documented *Pipistrellus* as the wide spread and dominant genus of bat in the study area.

76. Chandrabose (1981) and Chandrabose and Nair (1988) based on their study of over a decade have made a comprehensive account of the floral diversity; 159 species belonging to 51 families across the Coimbatore city including the Noyyal River, its ponds and canals. Flora like *Ceratophyllum demersum*, *Hydrilla verticillata*, *Ipomoea aquatica*, *Nymphaea nouchali*, *Eichhornia crassipes* and *Lemna paucicostata* *Colocasia esculenta*, *Cyperus alopecuroides*, *Argemone mexicana*, *Chloris barbata*, and *Cleome chelidonii* are commonly observed in the wetlands. Predominant trees in the area are Banyan or Aala maram (*Ficus benghalensis*), Neem (*Azadirachta indica*), the golden shower tree *Cassia fistula* and Tamarind or Puliyamaram (*Tamarindus indica*).

77. Subproject components are all located in urban land parcels surrounded by developed lands which were converted to agricultural and/or urban use many years ago, and therefore there are no sensitive environmental features in or near the subproject sites. Western ghats is at 5 km away from Vadavalli area, and no way disturbed due to this project. **Sálim Ali Centre for Ornithology and Natural History** is located at Anaikatti, which is about 22 km from Vadavalli and 27 km from Veerakeralam.

Figure 28: Salim Ali Centre for Ornithology and Natural History [SACON]



D. Economic Development :

1. Land use

78. The urban agglomeration of Coimbatore expanded from 38 km² in 1973 to 79 km² in 1989 and further to 274 km² in 2011, registering over fivefold expansion, in less than four decades. In terms of spatial pattern, the city developed concentrically during the initial years and later into linear development along the major roads (Coimbatore Corporation City Development Plan 2006). A review of 2002 land use plan for the city indicated that nearly 75 per cent of land within the corporation limits had developed into urban land use, while the rest was classified as agricultural land, water bodies, vacant areas, and heritage sites. However, the network of manmade wetlands in Coimbatore that is its lifeline, contributes only 1.08% of the total area. Land-use/cover changes in Coimbatore City Corporation was studied by the German Technical Cooperation (GTZ) using

Landsat ETM+ and Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS) data for the period of 2003-2014. Two Landsat images (obtained from USGS Earth Explorer) for the years 2003 and 2014 were utilised. Maximum likelihood method was used to classify the images into five classes: urban fabric, vegetation, water bodies, agriculture lands, and barren lands. Overall kappa accuracy measure is about 87.60 and 86.15% for the years 2003 and 2014, respectively. The change detection analysis has been performed for years 2003 and 2014 postclassified images. The results of the study have indicated that Coimbatore City has experienced rapid modifications in LULC, particularly in terms of urban/built-up area. Over the past 11 years, urban/built-up areas have increased by 94.5 km², resulting in a significant drop in the area of agricultural land and vegetation cover. It is found that:

- (i) urban areas are increased 200% due to population growth cum rapid economic progress.
- (ii) Vegetation cover decreased 38.76% due to conversion into urban features.
- (iii) Water bodies in area increased to 15.78% due to eradication of encroachment
- (iv) There is loss of 1.89% of agricultural lands due to demand for construction activities.
- (v) About 85.24% of barren lands were converted into other uses, particularly 57.33% to urban areas.
- (vi) Urban growth has accelerated towards north-eastern, northern, and eastern parts, where national highways exist. The built-up areas were dropped from 85.32 to 22.28%, within 5-km distance from the city center.

Figure 29: Map Showing Proposed land use plan for CMC 2021

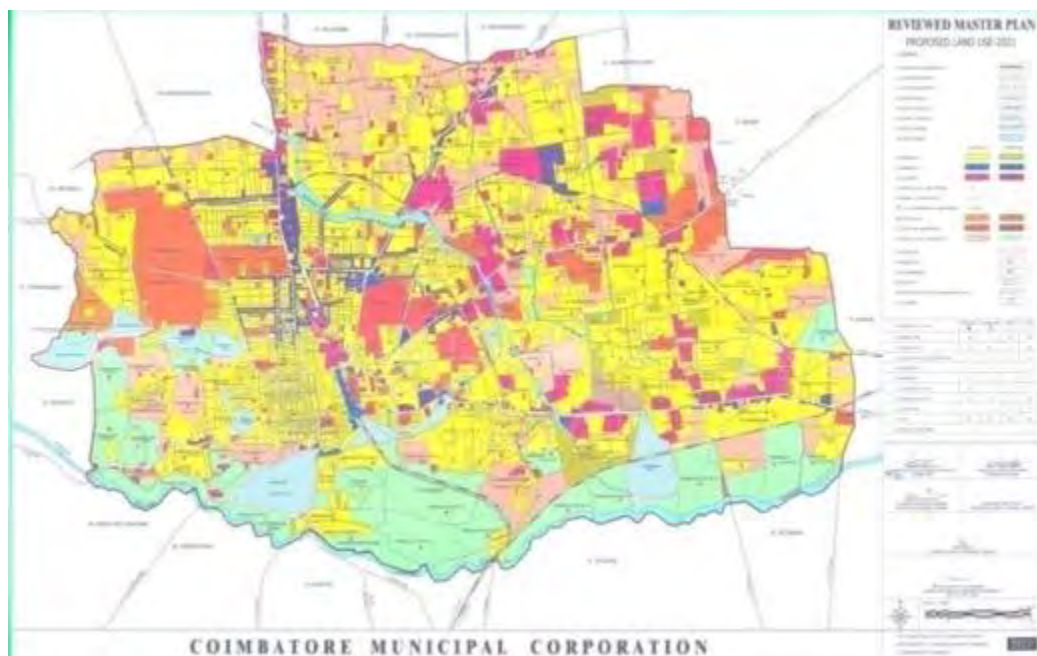


Figure 30: Proposed land use for Coimbatore LPA 2021

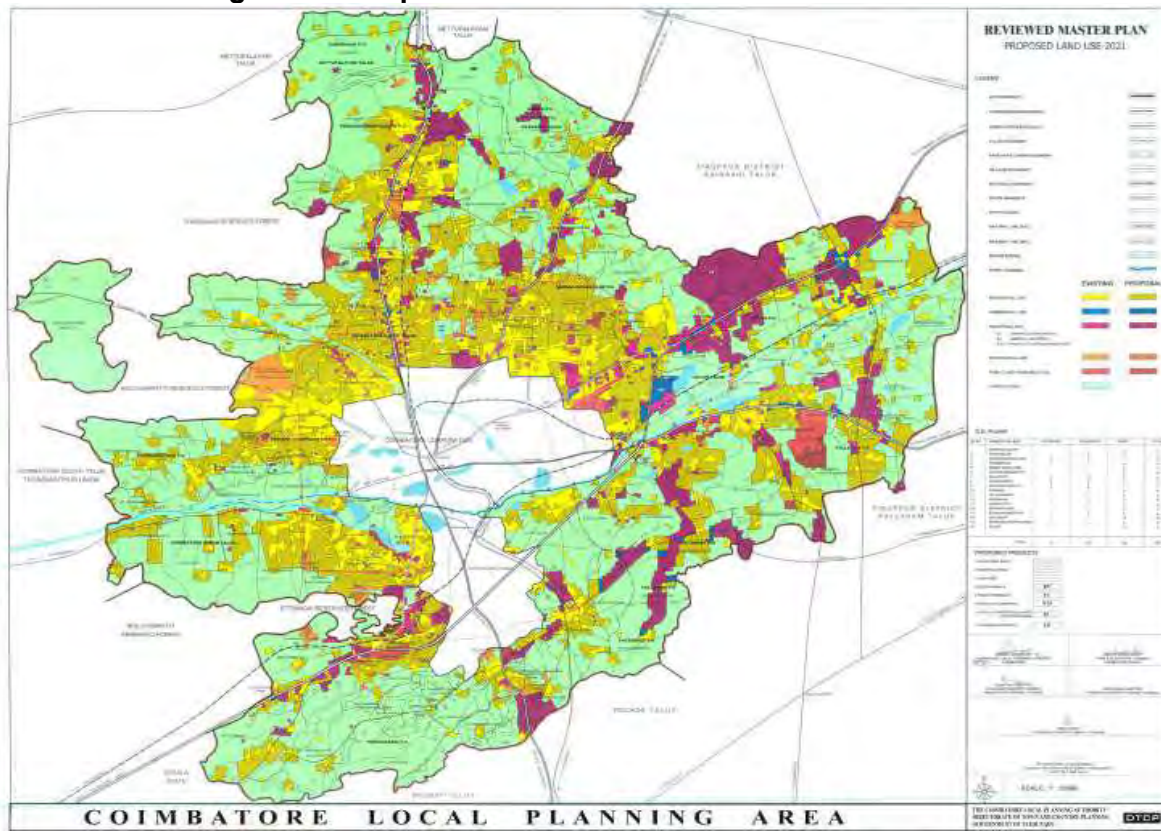
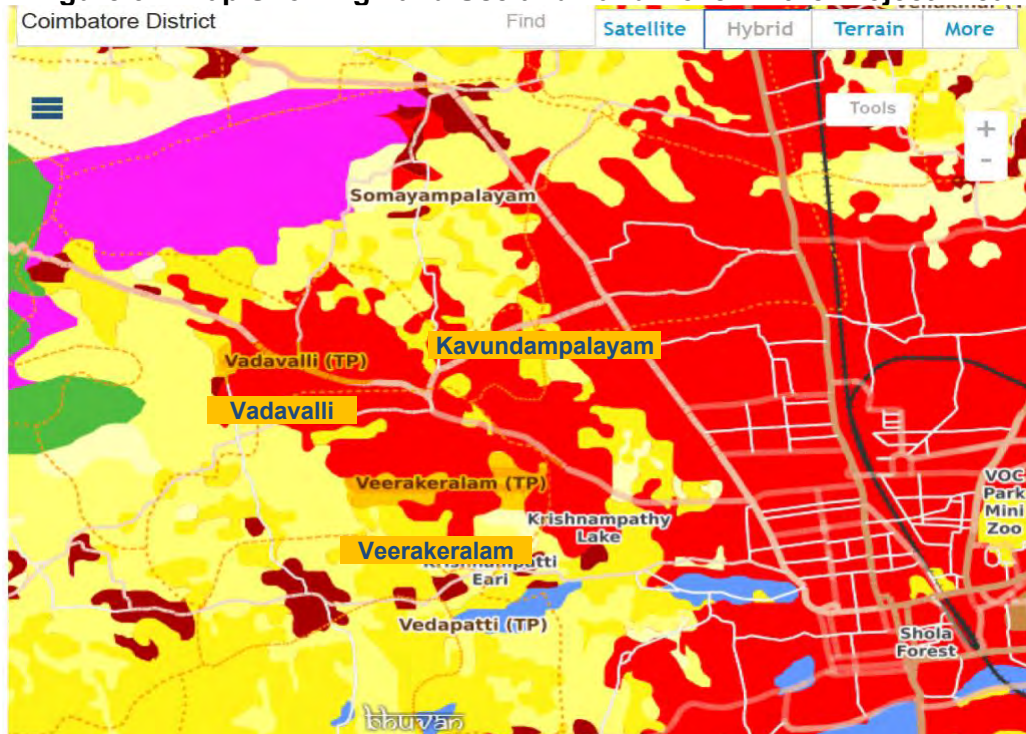


Figure 31: Map Showing Land Use and Land Cover in the Project Area



Source: Bhuvan

2. Industry and Agriculture

79. Coimbatore city is a major commercial and business hub in the state of Tamil Nadu. It is the highest revenue yielding district in the state even ahead of Chennai, it is one of the fastest-growing metro cities in India. Economy of Coimbatore is heavily influenced by industrial and service sectors: Information Technology, Engineering and Textiles. It is called the Manchester of South India due to its extensive textile industry, fed by the surrounding cotton fields. Rapid growth of textile has helped growth of associated industries like manufacture of machinery and tools. Next to textiles, manufacture of motors and pumps for domestic and agricultural uses are taking place in small and large scale in and around Coimbatore city. Wet grinder cluster and pump set cluster are the 2 industrial parks in the district. The city is the second largest software producer in Tamil Nadu, next to Chennai. Tamil Nadu Government owned SIDCO industrial unit, which is located at Kurichi in Coimbatore, and houses a large number of small scale engineering units. The city has two special economic zones (SEZ), the Coimbatore Hi-Tech Infrastructure (CHIL) SEZ and the Tidel park Coimbatore. On Maruthamalai Road via Vadavalli, renowned "Tamil Nadu Agricultural University (TNAU)" is situated. TNAU assumed full responsibilities of Agricultural Education and Research and supported the State Agricultural Department by delivering research products. As Coimbatore known as 'Manchester of South India', Central Institute for Cotton Research, Regional Station, Coimbatore is located on the Maruthamalai Road Near Tamil Nadu Agricultural University about 8 km from the Coimbatore Railway Station and about 15kms from the Coimbatore Airport. Central Institute for Cotton Research, Coimbatore is affiliated to Bharathiar University and was established in the year 1967.

80. Due to urbanization, the project area of Vadavalli and Veerakeralam has seen conversion of agriculture land for urban land use. Major Agricultural Crops cultivated in the region are Sorghum, Groundnut, Maize, Cowpea, Rice, Cotton. The most produced crop is Sorghum and the highest productivity is found in Maize.

3. Infrastructure

81. Water Supply. There are two major sources of supply of drinking water to Coimbatore City: Siruvani and Pillur schemes. These schemes are based on Siruvani and Pillur Dam, which are located about 30-40 km from Coimbatore City. The corporation is maintaining the distribution of water supply. The entire supply of water from Siruvani is by nature of gravity whereas pumping is being done in the Pillur scheme. A separate scheme to augment the Pillur water supply scheme to the Coimbatore Corporation is in progress. There is another Koundampalayam-Vadavalli CWSS, which is also catering the water supply needs to Vadavalli area.

82. The increase in population under the Corporation limits due to the territorial reorganization in July has resulted in increased demand for water. As per the norms based on the city's population set by the Government of India, Coimbatore's Corporation is required to provide 135 liters per capita per day (lpcd) to the citizens within the city limits whereas the current capacity despite the schemes in place is 110 lpcd. This deficit gets aggravated especially during summer months before arrival of Monsoon rains.

83. **Sewerage.** The existing underground sewerage system covers almost entire area of Coimbatore City Corporation limit prior to its expansion in 2011. This area is divided into 3 sewerage zones. Zone 1 forms the heart of the city and the sewage from this Zone (20.143 MLD) is pumped to the anaerobic lagoon STP at Vellalore. Zone 2 comprises original Corporation limits in North and West. Sewage collected from Zone II (16.62 MLD) is also pumped to the anaerobic lagoon at Vellalore. Zone 3 covers Tatabad, Sivananda colony, Gandhipuram, Sidhapudur,

Puliyakulam, Trichy road and Ramanathapuram areas. Sewage from Zone III (23.625 MLD) is pretreated at Nanjundapuram pumping station and pumped to anaerobic lagoon at Vellalore. In 2011, government through a notification included 3 municipalities (Kurichi, Kuniyamuthur and Kavundampalayam) and 7 Town Panchayats (Chinnavedampatty, Kalapatti, Saravanampatti, Vellakinaru, Thudiyalur, Vadavalli, and Veerakeralam) and a village panchayat (Vilankurichi) in the Coimbatore Corporation limits, increasing the corporation area from 105.60 sq. km to 257.04 sq. km. Municipal wards reorganized and increase from 72 to 100, with newly added areas constituting 40 wards. In the extended areas, in 14 wards (wards 87 to 100) of Kurichi and Kuniyamuthur underground sewerage scheme with STP of 30.53 MLD capacity and is 69,668 House Service Connections is in progress. In this subproject area, at present there is no sewerage system existing and therefore it is proposed to provide sewerage system in the extended areas under this subproject areas of Vadavalli, Veerakeralam, Kavundampalayam and Thudiyalur.

84. Solid Waste Management. The Coimbatore City Municipal Corporation (CCMC) is divided into different Zones and each Zone further divided into Sanitary Wards. Coimbatore city currently has four waste transfer stations, more than 3000 sanitary workers and about 650 acres of land being utilized for waste disposal. The waste management scenario in the city involves systematic management of waste from the households and other establishments. The waste generated in the city is transported in closed containers and is managed through semi closed transfer stations comprising of hydraulic waste compression mechanism. The city presently generates around 815 TPD of municipal solid waste (MSW) having an average generation rate of 600 gms/capita/day. The CCMC oversees the waste management in its 100 wards. CCMC collects around 775 TPD of MSW which accounts for almost 95% of collection efficiency.

85. Transportation. The Coimbatore District has got well developed road infrastructure connecting various important neighboring towns like Pollachi, Valparai and Metupalayam. Coimbatore city is internally well connected through the large network of roads maintained by the Corporation. The NH 47 and NH 209 runs through the project area. The Coimbatore Junction (Railway Station) is connected to all the major Indian cities – Chennai, Bangalore, Indore, Bhopal, Gwalior, Jabalpur, New Delhi and Mumbai. It also connects the neighboring State of Kerala. The city has an airport (Coimbatore Airport) at Peelamedu (11 km from the city) and an air-force base at Sulur (15 km). Coimbatore airport caters to domestic flights to all the major Indian cities and international flights to Sharjah and Singapore.

E. Socio-Cultural Resources

1. Demography

86. Project area consisting of eastwhile Vadavalli, Veerakeralam and Thudiyalur town panchayats and Kavundampalayam Municipality were added to Coimbatore City municipal area in the year 2011, and therefore the 2011 census population and demographic details are available separately for old Coimbatore city municipal corporation and the two town panchayats. As presented in the following Table, project area is experiencing tremendous population growth, while population core city of Coimbatore is slower than the overall state population. This shows the rapid expansion of city into outer areas from the congested core city. Literacy rate is about 90%.

Table 27: Demographic Characteristics (2011 Census)

Demographic Parameters	Tamil Nadu	Coimbatore (Old MC area)	Vadavalli Town panchayat	Veera- keralam Town panchayat	Kavundam- palayam	Thudiyalur
Population (2011)	72,147,030	1,050,721	39,873	23,841	83,908	33,924
Geographical Area(sq.km)	130,060	105.60	13.00	5.80	10.50	8.70
Total households	18,462,231	282,839	10,824	6,536	22,155	9,223
Decadal Growth rate (2001-11)	15.61%	12.9%	60.9%	19.2%	73.81%	61.51%
Sex ratio	996	997	1,000	1,012	981	983
Population Density (per sq. km)	555	9,950	3,725	4,111	7,991	3,899
Household size	3.9	3.7	3.7	3.6	3.8	3.7
literacy rate	80.09%	91.30%	89.76%	89.98%	89.88%	91.38%
literacy rate (male)	86.77%	94.46%	93.04%	93.49%	93.10%	94.71%
literacy rate (female)	73.73%	88.15%	86.49%	86.51%	86.62%	88.02%
SC Population	20.01%	10.3%	8.91%	8.62%	9.10%	11.40%
ST Population	1.1%	0.1%	0.58%	0.02%	0.13%	0.08%
Work participation ratio (among total population)	45.58%	45%	38.72%	42.41%	42.55%	41.72%
Work participation ratio – male	59.31%	68%	56.61%	60.72%	61.51%	60.27%
Work participation ratio - female	31.8%	22%	20.84%	24.33%	23.23%	22.85%
Main workers (among total workers)	85%	94.6%	91.54%	86.63%	91.36%	91.42%
Marginal workers (among total workers)	15%	5.4%	8.46%	13.37%	8.64%	8.58%
Cultivators (among main workers)	12.9%	0.4%	1.02%	0.71%	1.02%	1.76%
Agricultural Laborers (among main workers)	29.2%	0.7%	2.75%	7.38%	0.63%	3.48%
HH industry workers (among main workers)	4.1%	2.9%	2.53%	2.23%	3.06%	2.47%
Other workers (among main workers)	53.7%	96.0%	93.70%	89.68%	95.29%	92.29%

2. History, Culture and Tourism

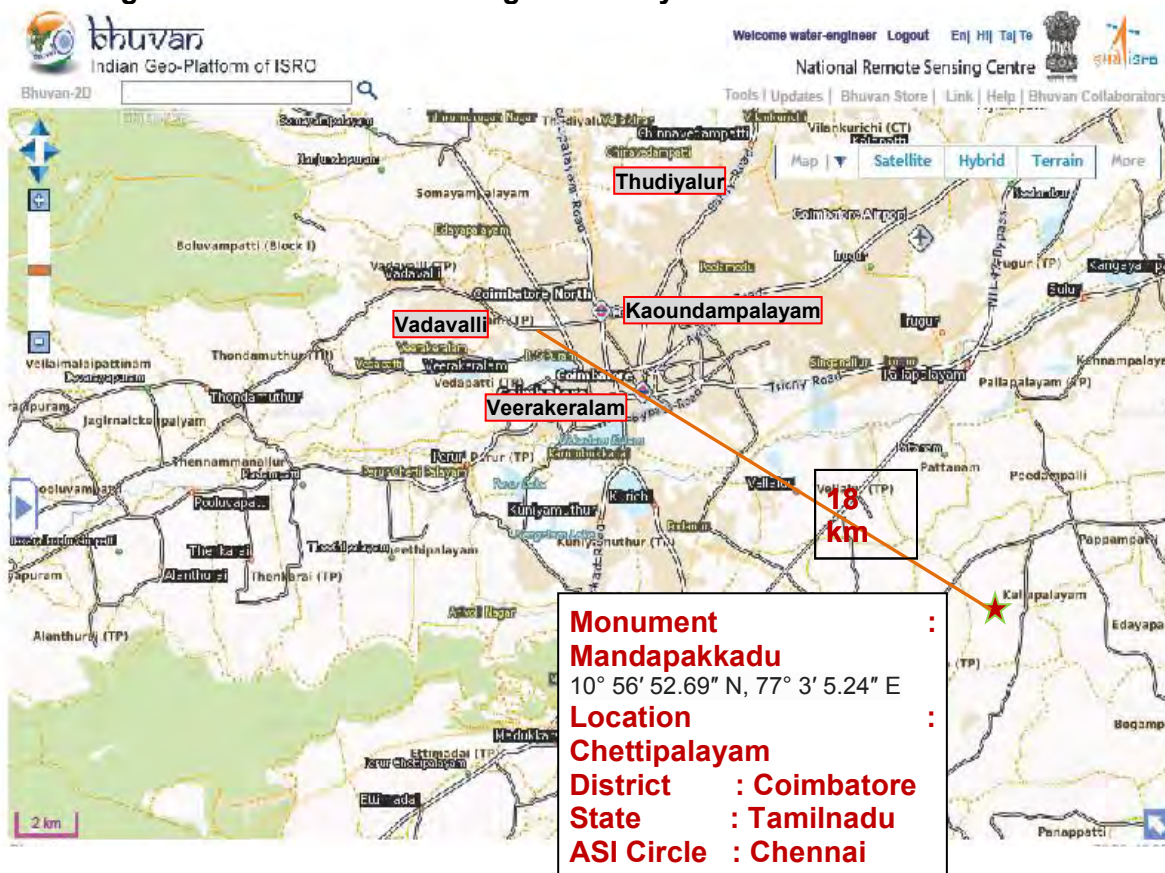
87. Though the origin of Coimbatore is shrouded in legend it has been established that Chola and Vijayanagar Kings and Tippu Sultan were associated with its history. The early name of Coimbatore city was 'Kovanpatti', meaning the hamlet of Kovan, the chieftain of Irula Tribes. The

Perur temple inscriptions (12th century) described the town as the Kovanpudur, a hamlet in Perur Nadu. Gradually the name Kovanpudur got changed and Koyampudur came to be used. During the British period, due to the difficulty in pronunciation, the officials have recorded the name as Coimbatore.

88. Coimbatore in its present form was organized by the British in the early 19th century. Though the region developed as a sound agrarian's economy, Coimbatore came to be known for its industrial enterprises and in the process, it is called the 'Manchester of South India' and the 'Detroit of India'. Industrialization of the region began in 1888 and continued into the 20th century. The city experienced a textile boom in 1920s and 1930s due to the decline of the Cotton industry in Mumbai. The region played a significant role in the Indian independence movement. In 1981, Coimbatore was constituted as a corporation.

89. Sukrawarpet and Range Gowder Street in the city is known for its old buildings, and other notable places include Tamil Nadu Agricultural University, Forest College, GASS Forest Museum, Victoria Hall, Sarvajana Higher Secondary School (where Rabindranath Tagore himself had come and sung the National Anthem in 1926). However, none of these are located in the subproject areas. There are no Archaeological Survey of India or state protected monuments in the project region. The nearest protected monument (Mandapakadu (10.94796944 N, 77.05145556 E) is located around 18 kmaerial distance from the project area.26 km from Vadavalli, 22 km from Veerakeralam and 24 km from Koundampalayam.

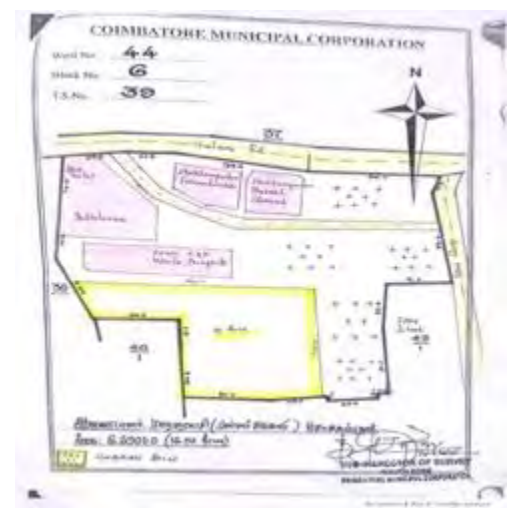
Figure 32: Nearest Archaeological Survey of India Protected Monument



F. Sub-project Site Environmental Features :

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

Table 28: Site Environmental Features – Zone V (Vadavalli & Veerakeralam areas)

Infrastructure	Location and Environment Features	Site Photograph
Sewage Treatment Plant	Sewage Treatment Plant: Site is located between Latitude 11.001795 North & Longitude 76.9388 East, near the burial ground and crematorium of the corporation at Chokkampudur, in south zone of Coimbatore corporation. Total land area is 16.52 acres, of which 4 acres allotted for construction of STP. This land is owned by Coimbatore Corporation. Allotted site is presently vacant, and covered with shrubs and bushes of local species. Site is a low lying area on southern side of Kumaraswamy Lake, outlet of which leading to Noyyal River. There are no trees present in the site. Crematorium is functional, and is provided with compound wall. The STP is proposed to be constructed in the vacant land allotted by the CCMC, after reserving the land for crematorium and other purposes. (Demarked sketch is annexed herewith). Compound wall has been proposed for a height of 2.5m for the STP. Enter upon permission has been granted by the Commissioner of CCMC. Site is surrounded with some commercial buildings and new developments, mostly residential, can be observed all around the site (about 250 m away), except in the north, wherein there is corporation road and then lake. This corporation road is the access to the STP site. At present within the CCMC site, the STP site is accessible via internal roads near crematorium/burial ground and from the Compost yard. The road near crematorium is narrow (about 3-4 m wide), abutted with graves, and used primarily by general public for crematorium purposes. Hence may not be suitable for using as access road to STP construction or operation.	  

Infrastructure	Location and Environment Features	Site Photograph
	Therefore, it is proposed to use road next to compost plant as an access with necessary clearance upto STP site. The access road alignment will be finalized by the PIU prior to start of works. The new STP will also be located 15m away from the boundary wall and 115 m and 195 m away from the Crematorium and burial ground respectively. Given the SBR based modern STP, odor nuisance will be minimal, however, at least a 100 m buffer will be maintained. Northern side of the site is fully lake area. On the South-Eastern side SBOA School is at adistance of about 300m. Odour Control measures will be taken as required. Treated water from the STP will be disposed into surplus weir outlet stream of Kumaraswamy Lakewhich flows to SelvaChinthamani Kulam and thereon to Periyakulam finally into the River Noyyal	
Sewage Pumping Stations	1. Main Pumping Station at Chokkampudur: This is the main pumping station – sewage from lift / pump stations will be collected here and conveyed to STP. Apart from green belt provision, mechanical odour control device has also been proposed. Site is selected within the STP site which lies between Latitude 11.001795 North & Longitude 76.9388 East. Land required is about 660 sqm which will be accommodated in the STP site of 5 acres. This site including STP site has been identified to involve hard rock requiring controlled blasting for excavation. The procedure proposed by TWAD Board in carrying out controlled blasting is provided in Appendix.	

Infrastructure	Location and Environment Features	Site Photograph
Sewage Pumping Stations	2. Sewage Pumping Station at Vadavalli Stream Crossing : Site is located on the Maruthamalai Road between Latitude 11.023225 North & Longitude 76.912414 East, with sparse development. In this site, burial ground with cremation facility and entirely covered with compound wall and gate. South-East corner of the site is vacant and covered with shrubs and bushes. Site is not low-lying or flood prone and is adjacent to the stream on eastern boundary and Maruthamalai Road on southern boundary. This land is owned by Coimbatore Corporation. Land required/available is about 660 sqm. However, other measures – design and operation, green buffer etc., will be required to prevent any odor issues. Apart from green belt provision, mechanical odour control device has also been proposed.	
Sewage Lift Stations	1. SLS at Kamatchi Nagar, near I.O.B.Colony : Lift station consists of a small closed underground sump to collect the sewage, fitted with submersible pumps, and an electricity panel board above the ground. A vent pipe will be fixed to the sump to release accumulated gases. The sewage will be collected in the sump and pumped to nearest sewer manhole. This LS site is located between Latitude 11.034638 North & Longitude 76.870917 East within a residential area surrounded by houses (<10 m) on one side. The other three sides are vacant land and stream. This land is owned by Coimbatore Corporation. Land required/available is about 216 sqm. Apart from green belt provision, mechanical odour control device has also been proposed.	

Infrastructure	Location and Environment Features	Site Photograph
	2. SLS at Onappalayam Burial Ground on Thondamuthur Road (Opp. To Sowdeswari College) Lift station consists of a small closed underground sump to collect the sewage, fitted with submersible pumps, and an electricity panel board above the ground. A vent pipe will be fixed to the sump to release accumulated gases. This LS site is located between Latitude 11.010645 North & Longitude 76.873703 East within the burial ground of Corporation covered with compound wall and LS site is bounded by an stream on southern / western sides; burial ground on eastern side and a commercial building on northern side 15 m away. This land is owned by Coimbatore Corporation. Land required/available is about 216 sqm. Apart from green belt provision, mechanical odour control device has also been proposed.	
Sewage Lift Stations	3. SLS at Sundapalayam near drainage crossing (SMR Nagar) This LS site is located between Latitude 10.999587 North & Longitude 76.877178 East corporation land / stream poromboke (pallavaari). It is not a waterbody anymore. On the Southern side lies a vacant open land. The Eastern side & Northern side is bounded by an stream with residential building on the Western side at a distance of 10 m. The access to this site is from the Corporation road on the Southern side. This land is owned by Coimbatore Corporation. Land required/available is about 216/242 sqm respectively. Apart from green belt provision, mechanical odour control device has also been proposed.	

Infrastructure	Location and Environment Features	Site Photograph
	4. SLS at Sri Ram Garden (Jothi Park Lands) This LS is situated in reserve site of Sri Ram Garden lies located between Latitude 11.008143 North & Longitude 76.89148 East. On the Southern side & Western side residential buildings are found at a distance of 10 m.. The Eastern side is bounded by an stream & Northern side with Road from which the PS can be accessed. This land is owned by Coimbatore Corporation. Land required/available is about 216sqm. Apart from green belt provision, mechanical odour control device has also been proposed.	
	5. SLS at Maharani Avenue Phase IV This LS is situated in reserve site of Maharani Avenue, located between Latitude 11.018109 North & Longitude 76.901429 East. On the Eastern side lies a vacant open land. The Western side & Northern side is bounded by an Road and the Southern Side, Coconut farm with residential building at a distance of 50 m. This land is owned by Coimbatore Corporation. Land required/available is about 216 sqm. Apart from green belt provision, mechanical odour control device has also been proposed.	
	6. SLS at Lawyers' Colony/ GKS Avenue This LS is situated in reserve site of GKS Avenue lies located between Latitude 11.018404 North & Longitude 76.88754 East. The provided lift station site is surrounded by large vacant land on all the four sides. This land is owned by Coimbatore Corporation. The access to this site is from the Corporation road on the Southern side. Land required/available is about 202 sqm. Apart from green	

Infrastructure	Location and Environment Features	Site Photograph
	belt provision, mechanical odour control device has also been proposed.	
Sewage Lift Stations	7. SLS at Pothigai Residency This LS is lies between Latitude 11.043311 North & Longitude 76.864473 EastThe Southern side. & Eastern side is bounded by road. On the Northern & Western side Maruthamalai Bus stand. Land required/available is about 130 sqm. This land is owned by Coimbatore Corporation. Apart from green belt provision, mechanical odour control device has also been proposed.	
Effluent Disposal	Outfall Sewer Treated effluent from the STP is disposed in the outlet stream of Kumarasamy Lake which lies between Latitude 11.000941 North & Longitude 76.564887 East. It is not sewer network, just effluent disposal pumping main from the STP site, running upto this stream. Treated Effluent disposed from STP to this stream (the other end of sluice) by means of Pumping main of 400 mm DI Pipe for 1.5 Km. The streamflows to Selva Chinthamani Kulam at a distance of 2.5 Kms and thereon to Periyakulam at Ukkadam at a distance of 5.5 kms from the point of disposal.This is a broad stream (> 3m) with lining.Stream is owned and maintained by Coimbatore Corporation. Carrying capacity of the stream: 290 cusec. Current flow in this stream: 110 cusec (during heavy rainfall). Proposed flow from STP: 3.59 cusec (6114lpm)	

Figure 33 :Site Set out Plans – Zone V (Vadavalli & Veerakeralam)

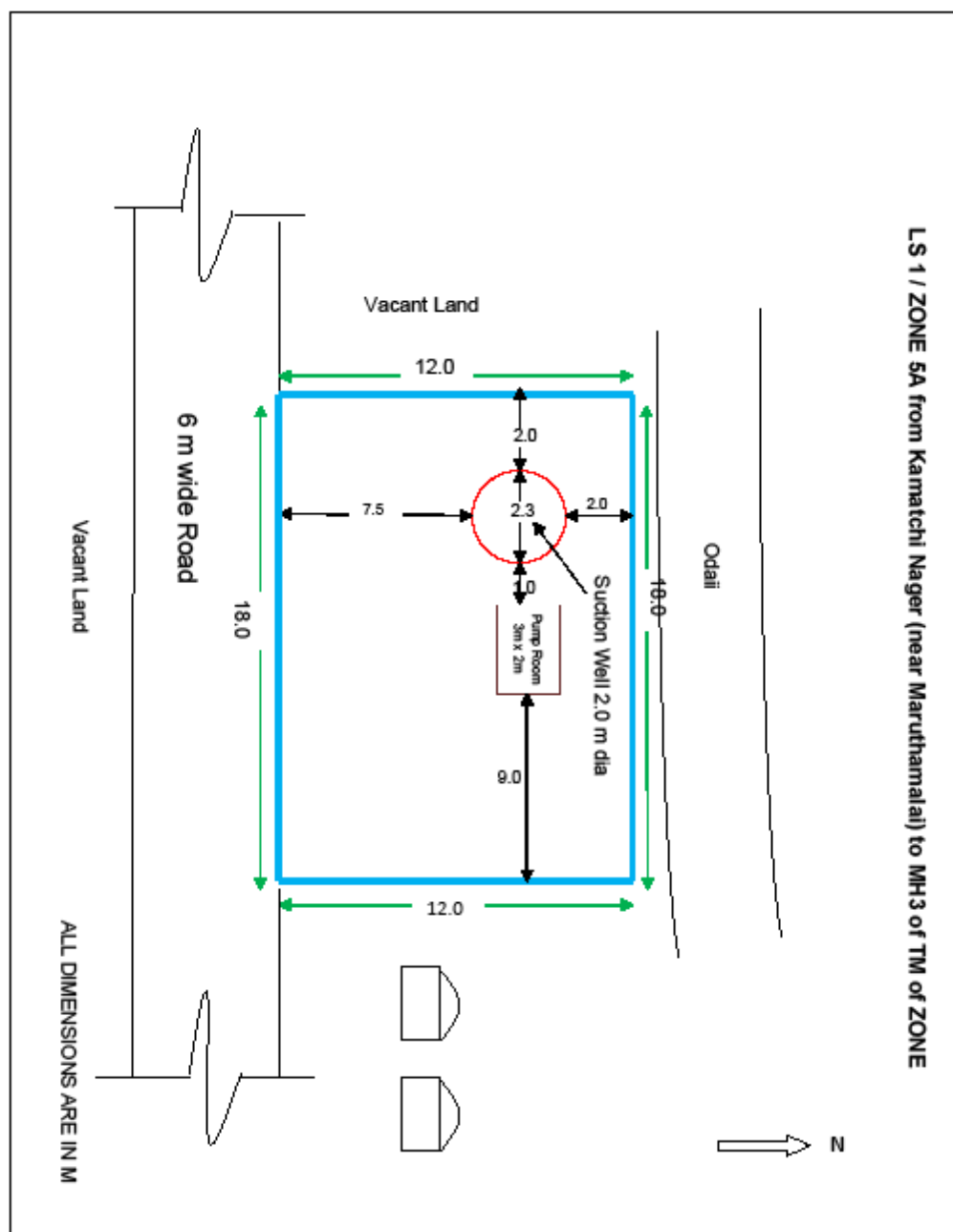


Figure 34 :Site Set out Plans – Zone V (Onnampalayam)

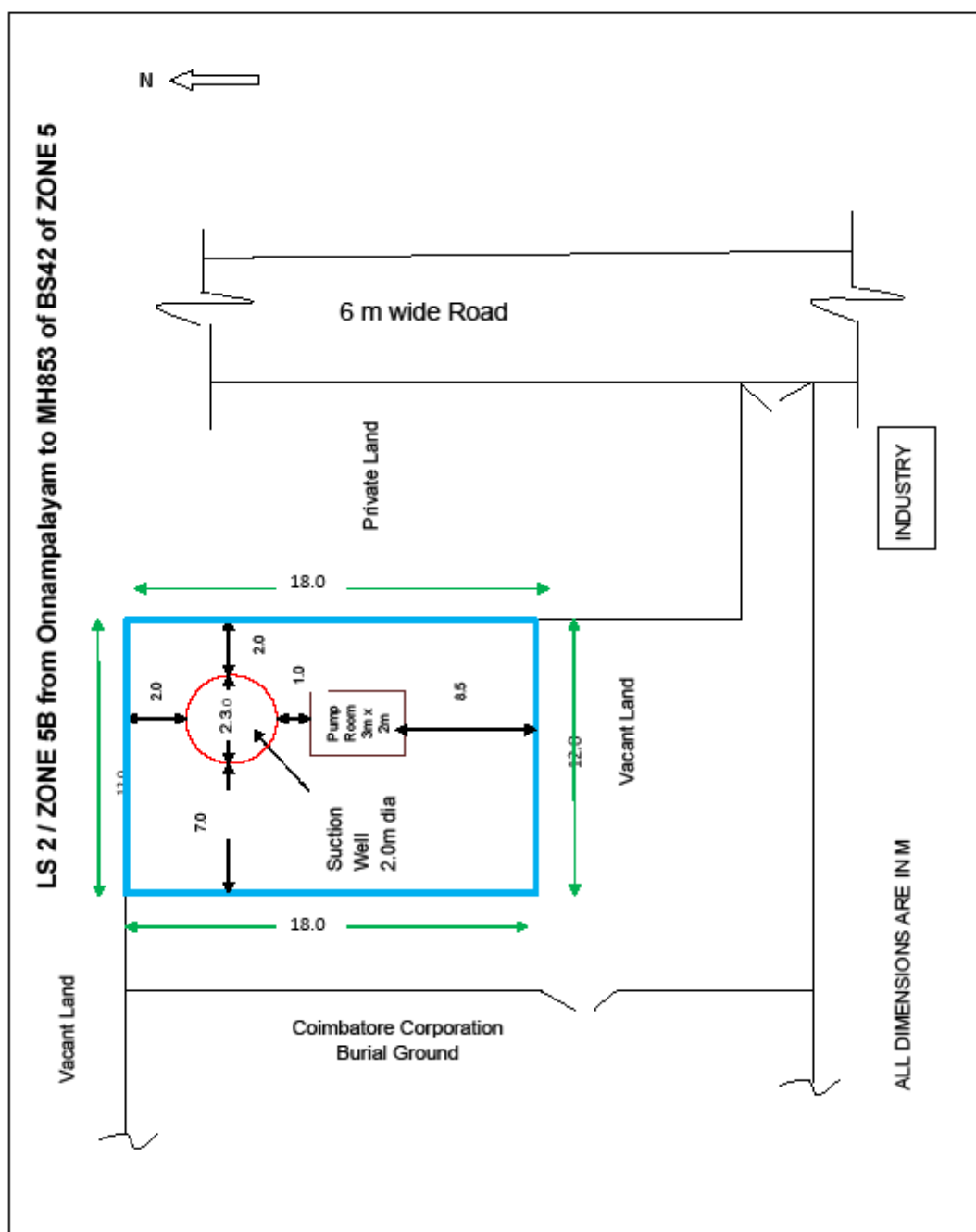


Figure 35 :Site Set out Plans – Zone V (Near Sundaram palayam drainage crossing)

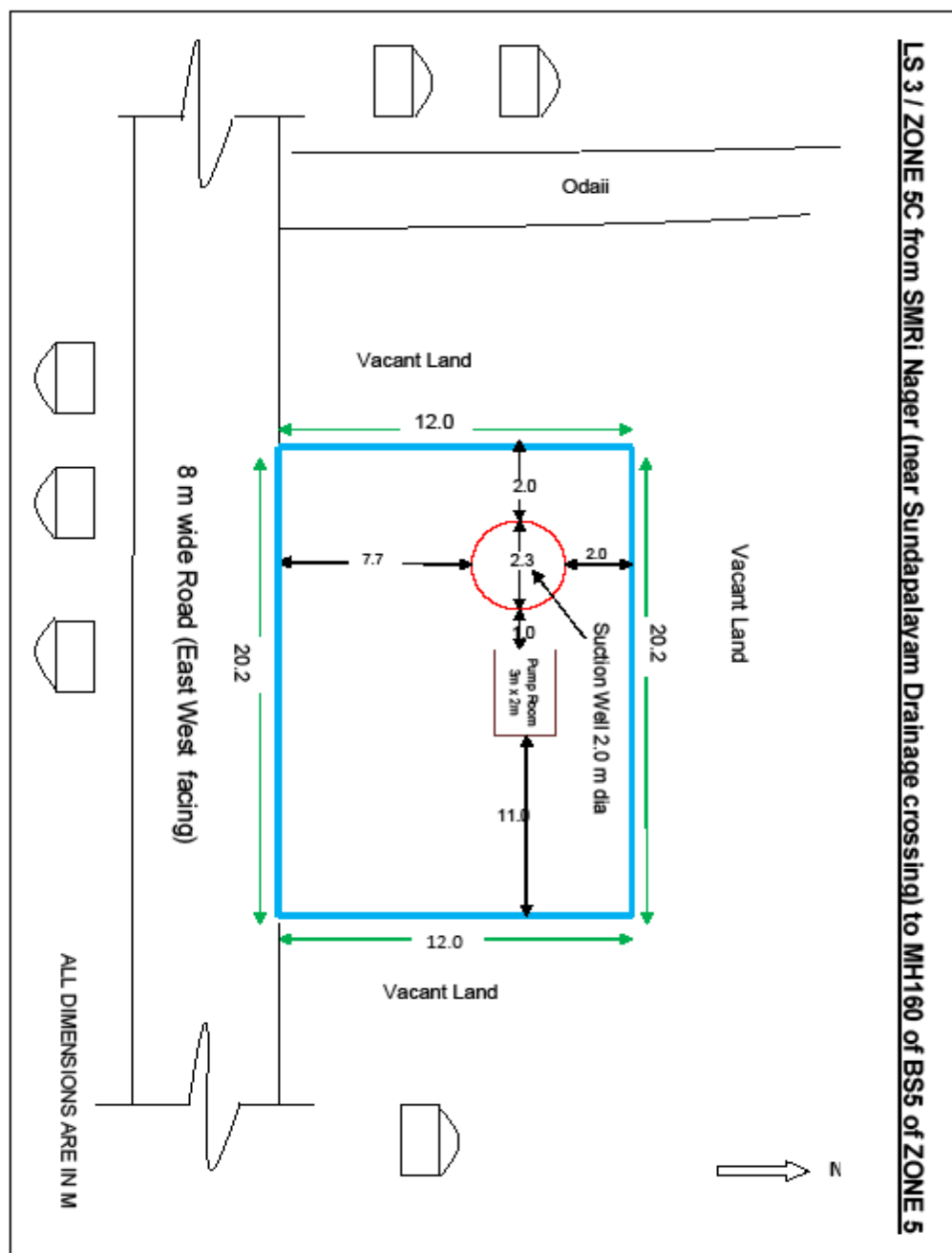


Figure 36 :Site Set out Plans – Zone V (Sri Ram Gardens)

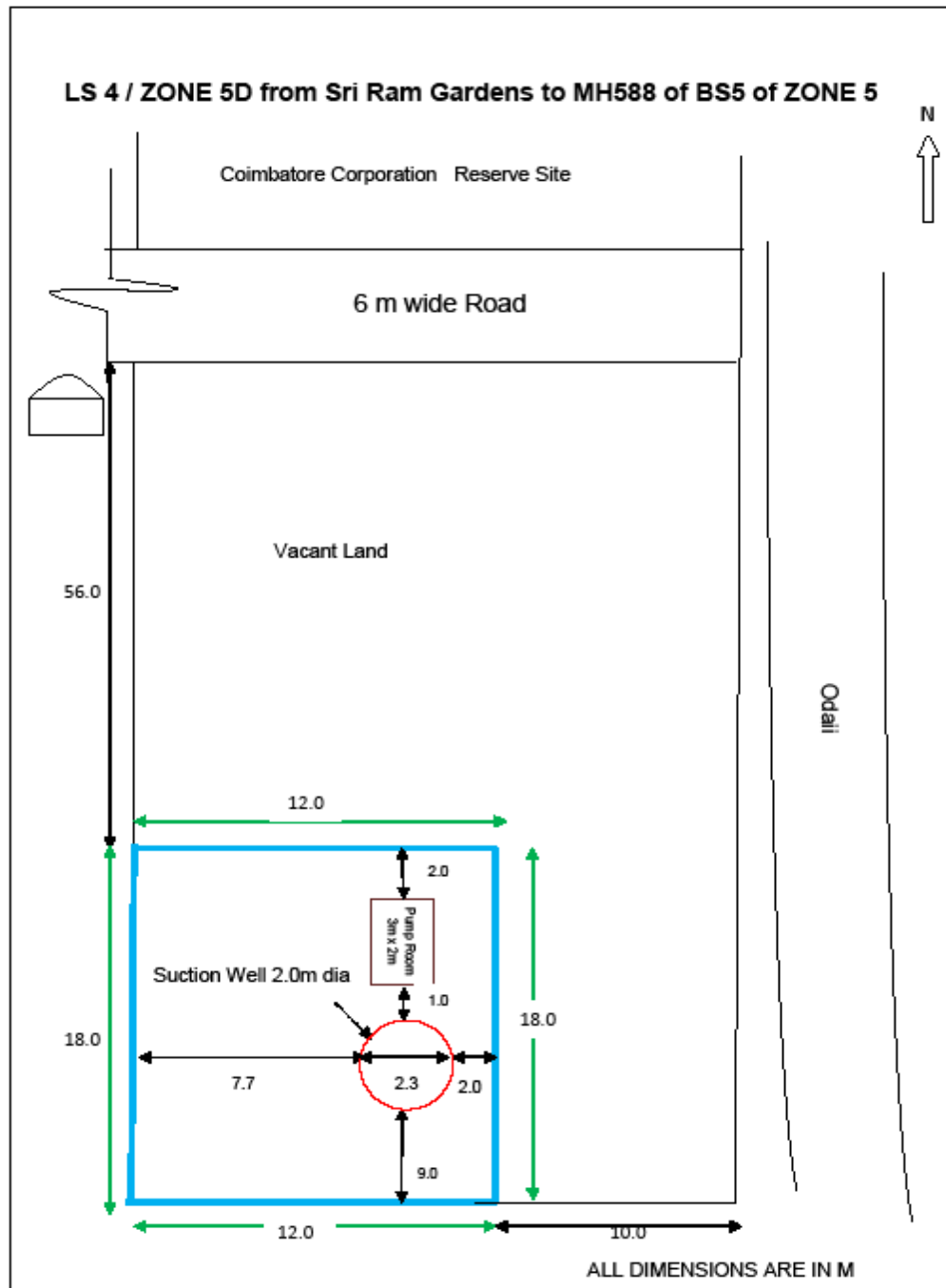


Figure 37 :Site Set out Plans – Zone V (Vadavalli Stream Crossing)

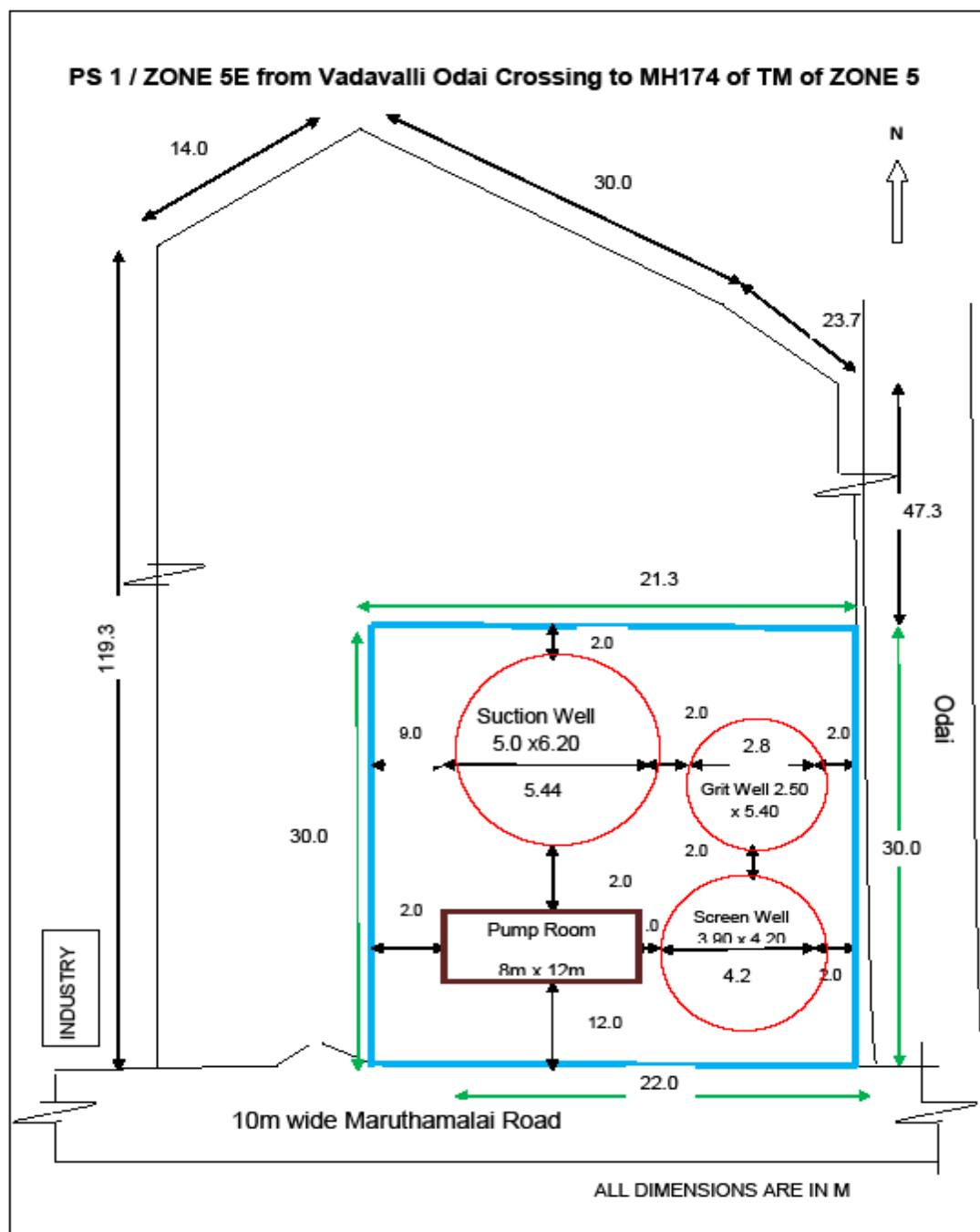


Figure 38 : Site Set out Plans – Zone V (Maharani Avenue)

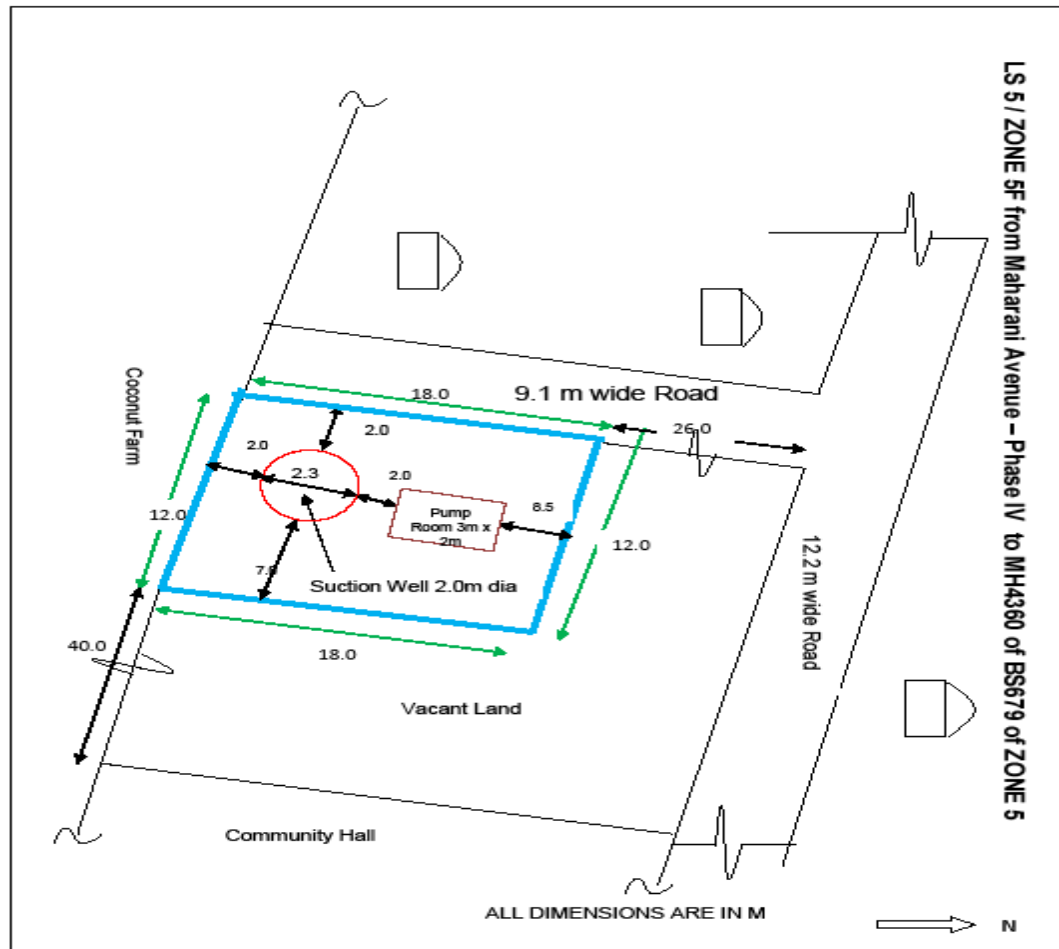


Figure 39 : Site Set out Plans – Zone V (GKS Avenue)

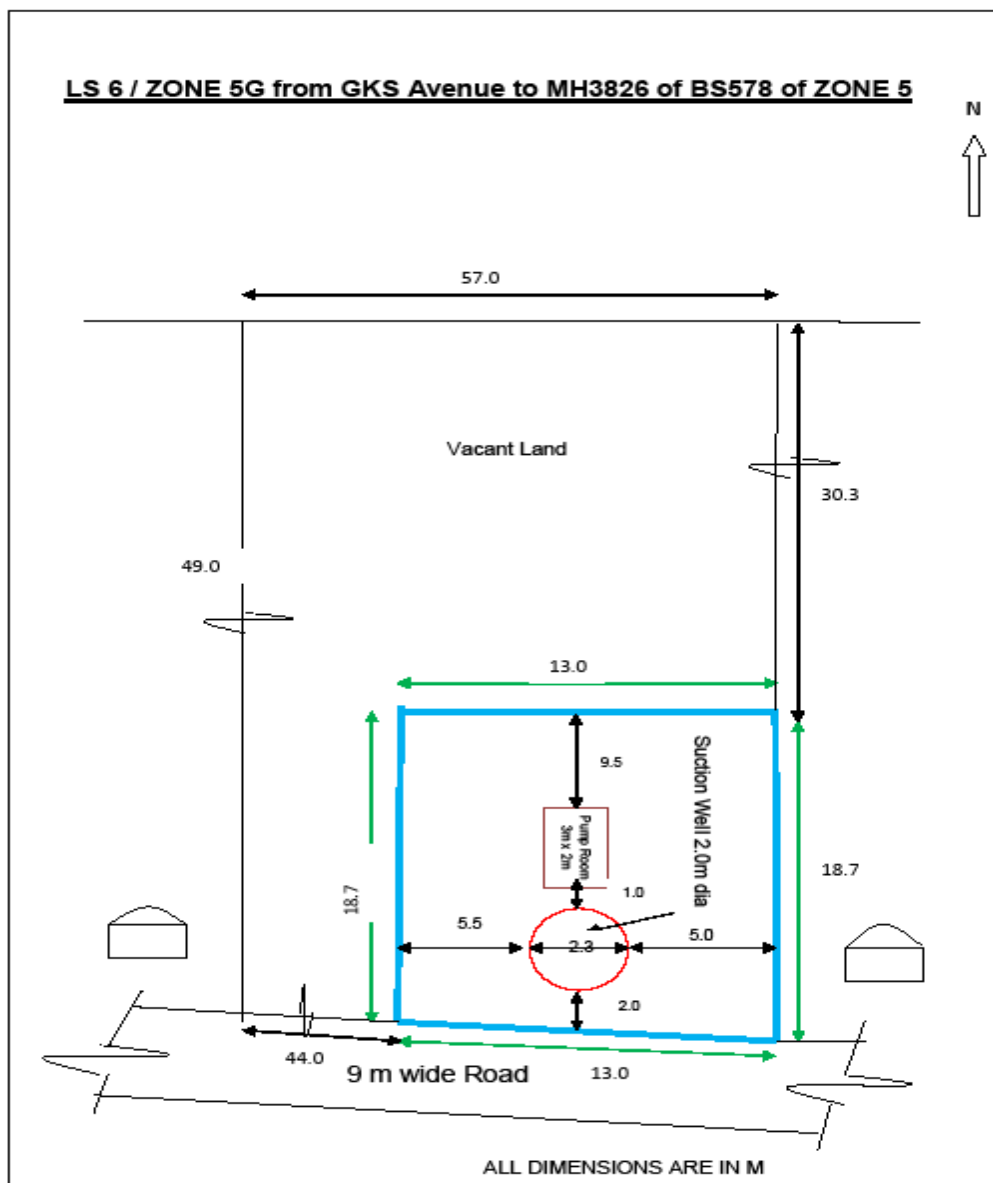


Figure 40 : Site Set out Plans – Zone V (Maharani Avenue)

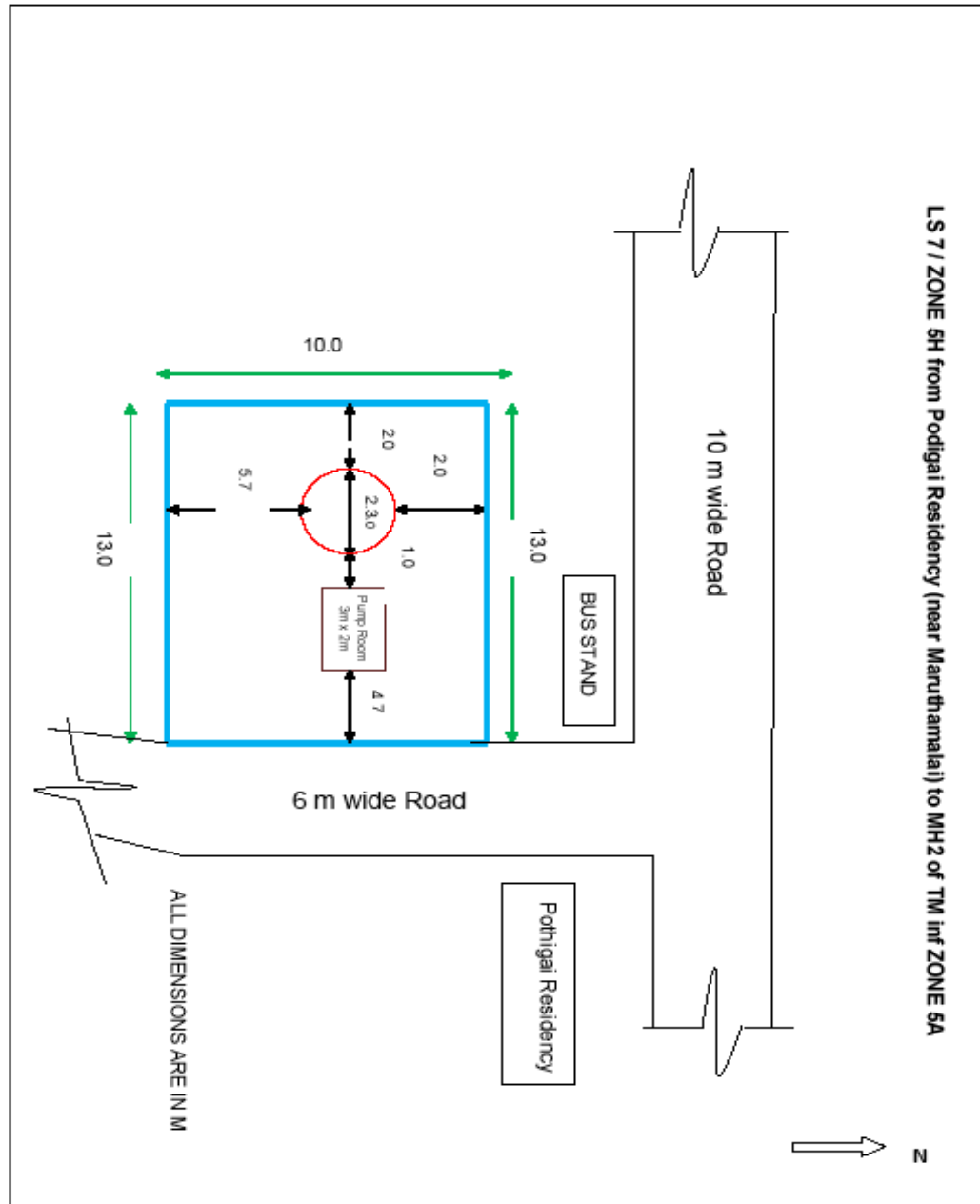


Figure 41:Site Set out Plans – Zone VII (Siva Csatile)

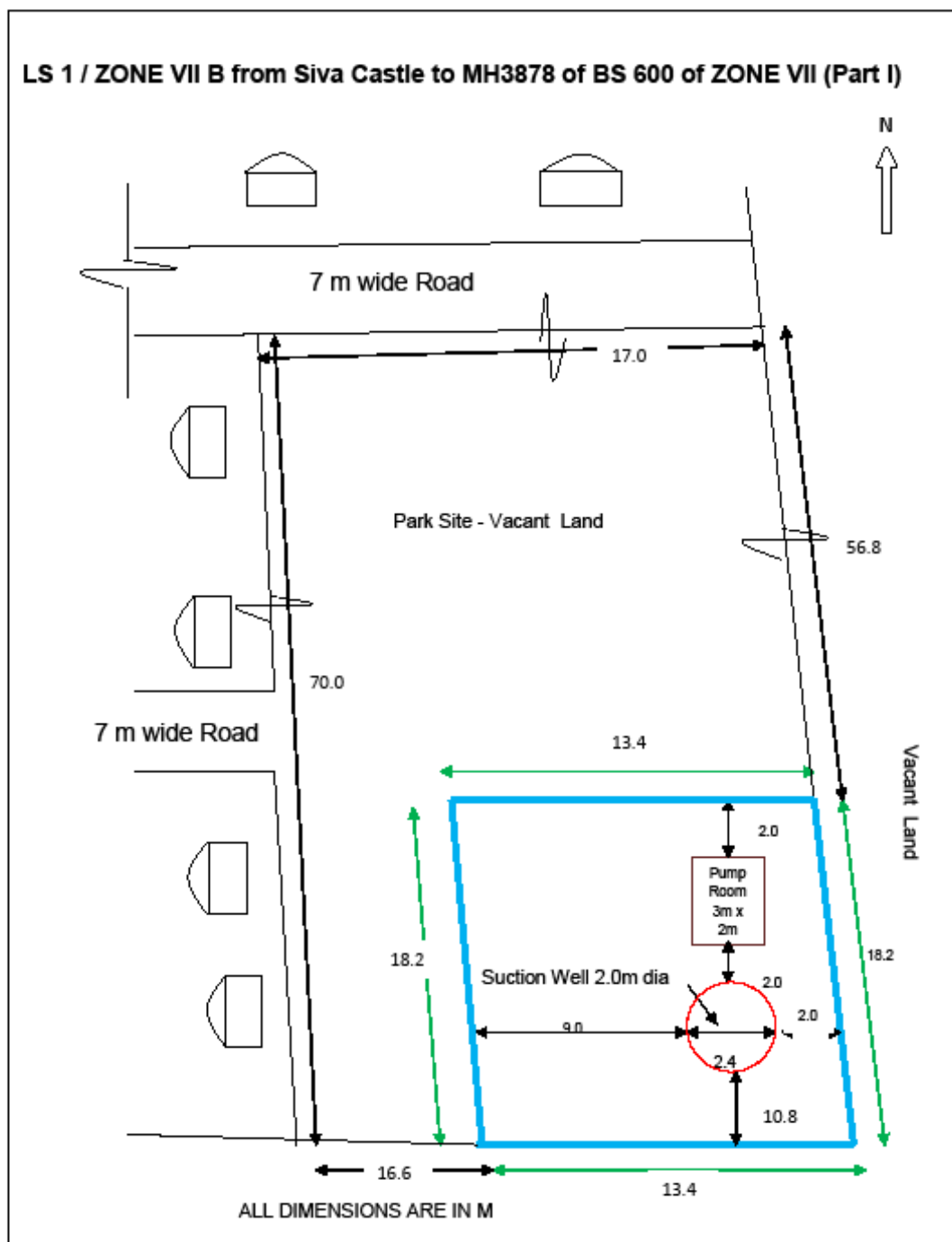


Figure 42: Site Set out Plans – Zone VII (Lakshmi Garden)

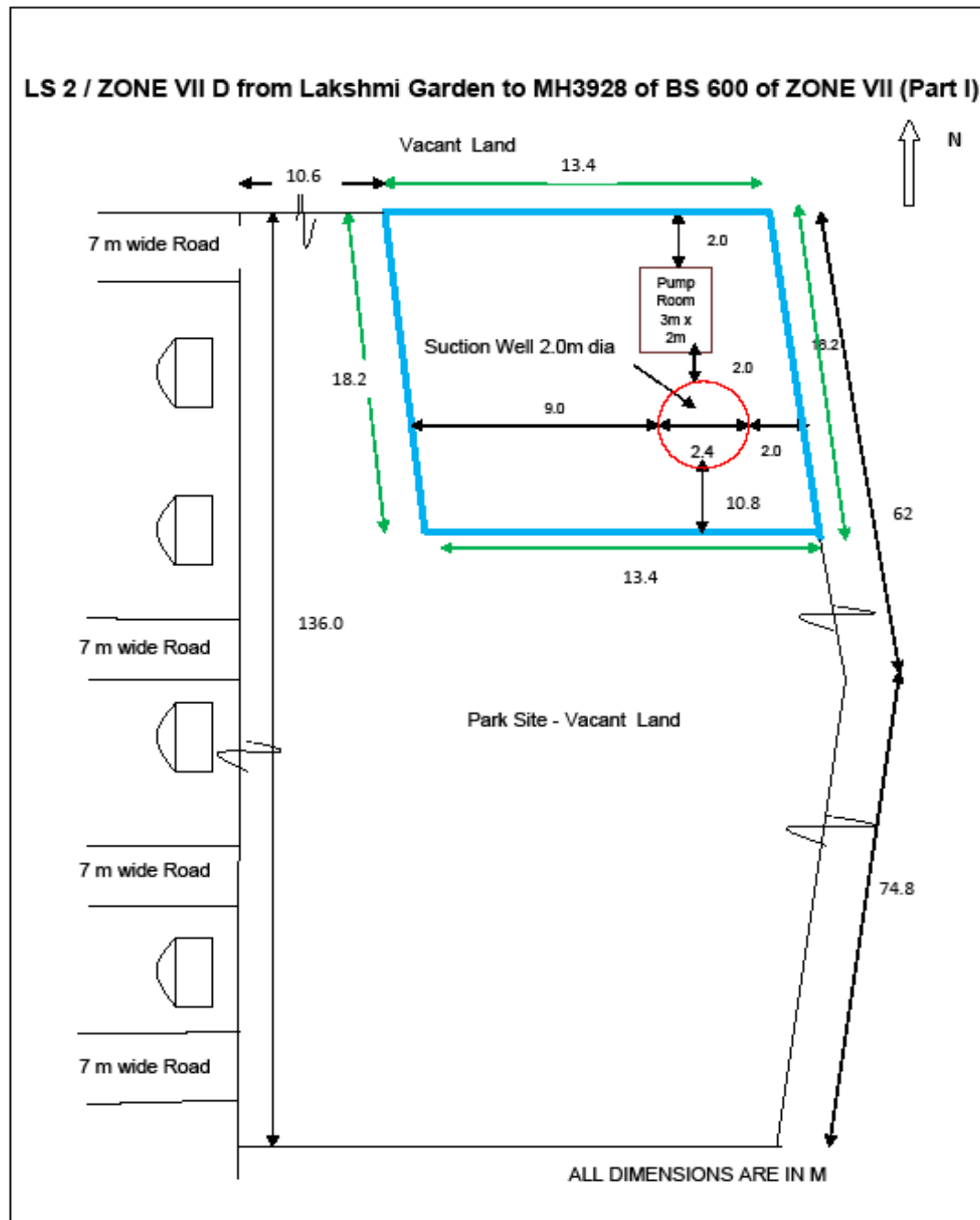


Figure 43: Site Set out Plans – Zone VII (Easwaran Nagar)

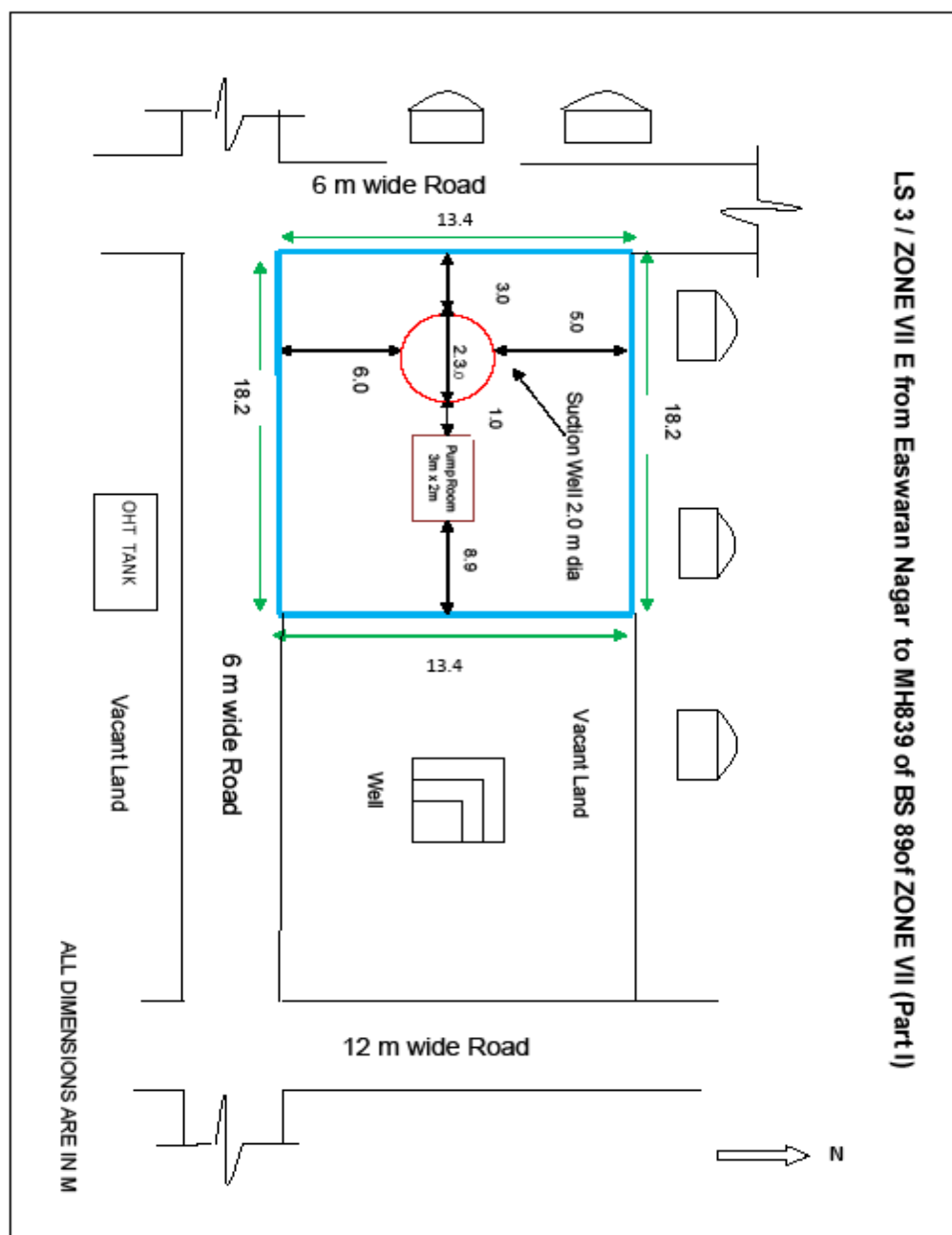


Figure 44: Site Set out Plans – Zone VII (Cheran Colony)

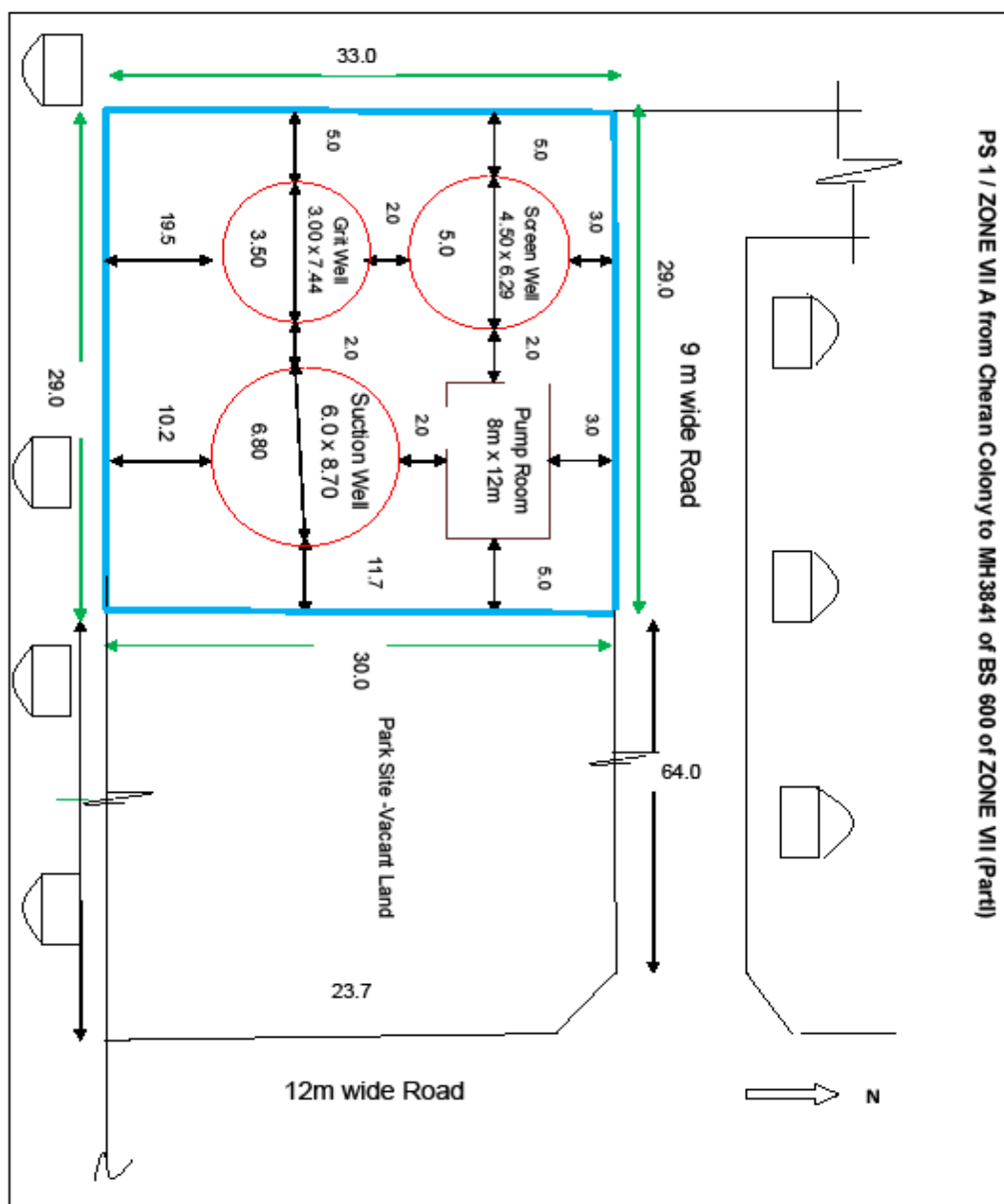


Table 29 : Details of Land in Vadavalli & Veerakeralam Areas

Sl. No.	Component		Land				Proposals			Set backs		Remarks
	Lift Station / Pumping Station	Location	Ownership	Classification	Available (m ²)	Required (m ²)	Modules (m ²)	Path ways (m ²)	Green Belts (m ²)	Within the Land	Outside Land	
1	MPS 1	Chokkampudur (near Burial Ground) (T.S.No.39)	Corporation Land	Reserved Site for public purpose	66854	2430	900	210	1320	2.0m from the lift-well on the North side 5m on the west side, 5m on the south side and 5m on the Eastern side.	Burial Ground is located on Eastern side and Coimbatore Corporation Waste Dumpsite is located on the Northern side. There is no development in the Southern side and Western side (vacant)	Sufficient space is available to provide a buffer of 5m all around the units. Three rows of trees will be planted to provide a green buffer with provision for compound wall on all the four sides.
2	SPS1	Vadavalli Stream (Drainage) Crossing (S.F.No.60)	Corporation Land	Poromboke	660	660	150	70	440	2m away from the lift-well on the north side, and East side 9m on the west, 22m on the south side.	Buildings are located on the Western side, which is 20 m away from the well. The Eastern side is bounded by an stream, Northern Side by Burial Ground Cremetorium and Southern side bounded by a road.	It is proposed to provide Trees on the open space area, leaving out the space for Lift Station.
3	Lift station 1 / Zone 5A	Kamatchi Nagar (IOB colony near Maruthamalai) (S.F.No.618)	Corporation Land	Reserved Site for public purpose	216	216	13	12	191	2.0m on the north and 13.0m on the east side, 2m on the	The Western side is covered with a vacant land. The Northern side is bounded by an	The Well is proposed on the South-West side away from the residential area.

Sl. No.	Component		Land				Proposals			Set backs		Remarks
	Lift Station / Pumping Station	Location	Ownership	Classification	Available (m ²)	Required (m ²)	Modules (m ²)	Path ways (m ²)	Green Belts (m ²)	Within the Land	Outside Land	
										western side and 7.5m on the south side from the lift-well	stream and Southern side by a Road. On the Eastern side residential Buildings are located at a distance of 10m.	Plantations will be provided on all sides.
4	LIFT STATION 2 / Zone 5B	Onappalayam (Thondamuthur Road Burial ground near Sowdeswari college) (S.F.No.734)	Corporation Land	Reserved Site for public purpose	216	216	13	12	191	7.0m on the west and 2m on the east, 12.5m on the South and 2m on the north side from the proposed lift-well.	The Southern side. & Northern side is bounded by vacant land. On the Western side lies the burial Ground and the Eastern side is private land.	A green Buffer will be provided on all sides, with two rows of Tree plantations with in the compound wall.
5	LIFT STATION 3 / Zone 5C	Sundapalayam near drainage Crossing (SMR Nagar) (S.F.No.445)	Corporation Land	Stream Poramboke	242.40	216	13	12	217.40	2m on the north and 15m on the east side, 2m on the western side and 7.7m on the south side from the proposed lift-well.	On the Northern side lies a vacant open land. The Eastern side is bounded by an stream with residential building on the Western side at a distance of 10 m and Southern side bounded by road.	It is proposed to cover the Lift Station with green plantations on all sides.

Sl. No.	Component		Land				Proposals			Set backs		Remarks
	LiftStation / Pumping Station	Location	Ownership	Classification	Available (m ²)	Required (m ²)	Modules (m ²)	Path ways (m ²)	Green Belts (m ²)	Within the Land	Outside Land	
6	LIFT STATION 4 / Zone 5D	Sri Ram Garden near Ajjanur – Jothi Park Lands (S.F.No.382, 383/1,2,4)	Corporation Land	Reserved Site for public purpose	216	216	13	12	191	6m on the South and 12.5m on the northern side, 2.0m on the western side and 7m on the Eastern side from the proposed lift-well.	On the Southern side & Western side residential buildings are located at a distance of 10 m. The Eastern side is bounded by anstream (stream)& Northern side vacant land bounded with a Road.	A green Buffer will be provided on all sides,with two rows of Tree plantations with in the compound wall
7	LIFT STATION 5 / Zone 5F	Maharani Avenue – Phase IV (S.F.No. 225pt, 231/2pt, 232pt & 233pt)	Corporation Land	Reserved Site for public purpose	216	216	13	12	191	2m on the South and 7m on the northern side, 4m on the western side and 5m on the Eastern side from the lift-well.	On the Eastern side lies a vacant open land bounded by a Community Hall at a distance of 40m. The Western side & Northern side is bounded by a Road and the Southern Side, Coconut farm with residential building at a distance of 50 m.	A green Buffer will be provided on all sides, with two rows of Tree plantations with in the compound wall

Sl. No.	Component		Land				Proposals			Set backs		Remarks
	LiftStation / Pumping Station	Location	Ownership	Classification	Available (m2)	Required (m ²)	Modules (m ²)	Path ways (m ²)	Green Belts (m ²)	Within the Land	Outside Land	
8	LIFT STATION 6 / Zone 5G	GKS Avenue (S.F.No.348/2)	Corporation Land	Reserved Site for public purpose	243	216	13	12	107	2m on the South and 12.5m on the northern side, 4m on the western side and 5m on the Eastern side from the lift-well.	The provided Lift Station site is bounded by residential buildings at a distance of 50m on Eastern and Western sides and vacant land on Northern side and road on the Southern side.	Green plantations will be provided on all sides to provide a green buffer
9	LIFT STATION 7 / Zone 5H	Pothigai Residency & CTC Depot junction @ Maruthamalai (S.F.421)	Corporation Land	Reserved Site for public purpose	130	130	11	12	107	2m on the North and 5.7m on the Southern side, 2m on the western side and 8.7m on the Eastern side from the lift-well.	The Southern side & Eastern side is bounded by road. On the Northern & Western side bounded by Maruthamalai Bus stand.	As there is only limited space, Green plantations will be provided in the available space to provide a green buffer

Sl. No.	Component		Land				Proposals			Set backs		Remarks
	Lift Station / Pumping Station	Location	Ownership	Classification	Available (m ²)	Required (m ²)	Modules (m ²)	Pathways (m ²)	Green Belts (m ²)	Within the Land	Outside Land	
10	STP	Chokkampudur (near Burial Ground) (T.S.No.39)	Coimbatore Corporation	class	16.52	4	2	1	1	The STP will be located near the Burial Ground and Waste Dumpsite.	Burial Ground is located on Eastern side and Coimbatore Corporation Waste Dumpsite is located on the Northern side. There is no development on the Southern side and Western side (vacant)	The STP will be located 50m from the Electric Crematorium. The Treated water will be let into the Outlet of Kumarasamy Lake (Muthannan Kulam) at a distance of 1.50 km through 400 mm DI pipe.

Table 30 : Details of Lift Station Land in Kavundampalayam, Thudiyalur & Vellakinar (Part) Areas

S. No.	Component		Land				Proposals			Set backs		Remarks
	(LIFT STATION/ PS)	Location	Owner ship	Classification	Available (m ²)	Required (m ²)	Modules (m ²)	Pathways (m ²)	Green Belts (m ²)	Within the Land	Outside Land	
1	MPS 1	Compost Yard at Kavundampalayam	Coimbatore Corporation		94490	2430	900	210	1320	5.0m on the North side 5m on the west side, 5m on the south side and 5m on the Eastern side.	Compost yard and Solar Plant are located on the Southern side, Residential buildings are located on the Western side at a distance of 100m, Muslim Burial Ground is located on the Northern side and Sanganoor	Sufficient space is available to provide a buffer of 4m all around the units..

S. No	Component		Land				Proposals			Set backs		Remarks
	(LIFT STATION/ PS)	Location	Owner ship	Classification	Available (m ²)	Required (m ²)	Modules (m ²)	Pathways (m ²)	Green Belts (m ²)	Within the Land	Outside Land	
											Pallam on the Eastern side	
2	PS1	Cheran Colony	Coimbatore Corporation	Reserved Site for public purpose	957	660	150	70	740	3.0m from the well on the North side 5m on the west side, 10.2m on the south side and 11.7m on the Eastern side.	Corporation Park site is located on Eastern side and Residential area is located on the Southern side and Western side, Northern side is bounded by a Road.	Sufficient space is available to provide a buffer of 4m all around the units.
3	LIFT STATION 1 / Zone VII B	Siva Castle	Coimbatore Corporation	Reserved Site for public purpose	1610	244	13	12	219	7m on the north and 2m on the east side, 9m on the western side and 10.8m on the south side from the suction well	The Eastern side is covered by a vacant land. The Northern side is bounded by a Road at a distance of 57m. On the Western side residential Buildings are located at a distance of 20m. & Southern side at a distance of 100m.	The Well is proposed on the South-East side, away from the residential area. Green plantations will be provided on all sides.

S. No	Component		Land				Proposals			Set backs		Remarks
	(LIFT STATION/ PS)	Location	Owner ship	Classification	Available (m ²)	Required (m ²)	Modules (m ²)	Pathways (m ²)	Green Belts (m ²)	Within the Land	Outside Land	
4	LIFT STATION 2 / Zone VII D	Lakshmi Garden	Coimbatore Corporation	Reserved Site for public purpose	2500	244	13	12	219	9m on the west and 2m on the east, 10.5m on the South and 7m on the north side from the well.	On the Western side residential Buildings are located at a distance of 20m. On all the other sides it is vacant land	A green Buffer of 4m will be provided on all sides, with two rows of Tree plantations within the compound wall.
5	LIFT STATION 3 / Zone VII E	Easwaran Nagar, Kanuvai Road	Coimbatore Corporation	Reserved Site for public purpose	244	244	13	12	219	5m on the north and 6m on the South side, 3m on the western side and 12.5m on the East side from the well	The Western side & Southern side are bounded by a Road and Eastern side by a Well. On the Northern side Residential Buildings were located.	As there is only limited space, it is proposed to cover the Lift Station with green plantations on all sides.
6	STP	Compost Yard at Kavundam palayam	Corporation Reserved site	Reserved site for public purpose	23.35	4.75	2	1	1.75	The STP will be located 50m from the Compost Yard	Compost yard and Solar Plant are located on the Southern side, Residential area is located on the Western side at a distance of 100m, Muslim Burial Ground is located on	The STP will be located 50m from the Compost Yard. The Treated effluent will be let into the Sanganoor Pallam

S. No	Component		Land				Proposals			Set backs		Remarks
	(LIFT STATION/ PS)	Location	Owner ship	Classification	Available (m ²)	Required (m ²)	Modules (m ²)	Pathways (m ²)	Green Belts (m ²)	Within the Land	Outside Land	
											the Northern side and Sanganoor Pallam/stream on the Eastern side	stream at a distance of 0.50 km through 700 mm DI pipe.

Table 31: Site Environmental Features–ZoneVII (Kavundampalayam & Thudiyalur)

Infrastructure	Location and Environment Features	Site Photograph
Sewage Treatment Plant	Sewage Treatment Plant: Site is located between Latitude 11.036083° North & Longitude 76.94935° East, within the Compost Yard Premises of Corporation land at Kavundampalayam, in West zone of Coimbatore Corporation. Total land area is 10 acres, of which 5 acres allotted for construction of STP. This land is owned by Coimbatore Corporation. Necessary 'Enter upon' permission has been granted by the Commissioner, CCMC. Allotted site is partly used for Solid waste management (Compost yard), Solar Plant, Muslim Burial Ground and partly covered with shrubs and bushes of local species. The site is adequately away from the surrounding residential areas. Site is a low lying area on western side of the Sanganur Stream. outlet of which leading to Noyyal River. Carrying capacity of the stream- 13485 cusec. The new STP will also be located away from the boundary wall. Given the SBR based modern STP, odor nuisance will be minimal, however, at least a 100 m buffer will be maintained. Treated water from the STP will be disposed into the Sanganur Stream which joins Noyyal River at a distance of 11.48 km from the point of disposal.	
Sewage Pumping Stations	1.Main Pumping Station at Kavundampalayam Compost Yard : This is the main pumping station – sewage from lift / pump stations will be collected here and conveyed to STP. Site is selected within the STP site which lies between Latitude 11.036083 North & Longitude 76.94935 East. Land required is about 660 sq.m which will be accommodated in the STP site of 5 acres. This site including STP site has been identified to involve hard rock requiring controlled blasting for excavation. The procedure followed by TWAD Board in carrying out controlled blasting is provided in Appendix. Apart from green belt provision, mechanical odour control device has also been proposed.	

Infrastructure	Location and Environment Features	Site Photograph
Sewage Pumping Stations	2. Sewage Pumping Station at Cheran Colony The LS site is located between Latitude 11.077364 North & Longitude 76.944613 East in Cheran Colony. The site is vacant. Residences found on the Southern side and Western side. Eastern side is covered with a vacant land and Northern side by Road. This land is owned by Coimbatore Corporation. Land required/available is about 930/2745 sqm respectively. Apart from green belt provision, mechanical odour control device has also been proposed.	
Sewage Lift Stations	1. SLS at Lakshmi Garden Lift station consists of a small closed underground sump to collect the sewage, fitted with submersible pumps, and an electricity panel board above the ground. A vent pipe will be fixed to the sump to release accumulated gases. The sewage will be collected in the sump and pumped to nearest sewer manhole. This SLS is situated in reserve site of Lakshmi Gardens, located between Latitude 11.054514 North & Longitude 76.950496 East. It is covered partly with shrubs and is located within a residential area. The Western side is bounded by a Railway Track. On the eastern side residential Buildings are found at a distance of 15m. & Northern side at a distance of 100m. On the Southern side vacant land is found. This land is owned by Coimbatore Corporation. Land required/available is about 216 sqm. Apart from green belt provision, mechanical odour control device has also been proposed.	

Infrastructure	Location and Environment Features	Site Photograph
	2. SLS at Siva Castle Public consultation has already been carried out and neither adverse comments nor objections regarding this site. Lift station consists of a small closed underground sump to collect the sewage, fitted with submersible pumps, and an electricity panel board above the ground. A vent pipe will be fixed to the sump to release accumulated gases. This SLS is situated in reserve site Siva Castle, located between Latitude 11.063409 North & Longitude 76.948645 East. This SLS site is a vacant land of Corporation covered with compound wall. LS site is bounded by Residential buildings on three sides about 15 m away and vacant land on the eastern side. Necessary Green buffer and odour control measures to be provided. Land required/available is about 216 sqm. Apart from green belt provision, mechanical odour control device has also been proposed.	
	3. SLS at Easwaran Nagar Lift station consists of a small closed underground sump to collect the sewage, fitted with submersible pumps, and an electricity panel board above the ground. A vent pipe will be fixed to the sump to release accumulated gases. This LS is situated in reserve site of Easwaran Nagar, located between Latitude 11.082806 North & Longitude 76.936478 East. This LS site is covered partly with shrubs. The Eastern side & Northern side is bounded by a Road and Western side by a Well. On the Southern side Residential Buildings were found. This land is owned by Coimbatore Corporation. Land required/available is about 216 sqm. Apart from green belt provision, mechanical odour control device has also been proposed.	
Effluent Disposal	Outfall Sewer Treated effluent from the STP is disposed in the Sanganur Pallam stream which lies between Latitude 11.036083 North & Longitude 76.94935 East, Pipe will laid underground in stream	

Infrastructure	Location and Environment Features	Site Photograph
	Porumboke. Treated Effluent disposed from STP to this stream (the other end of sluice) by means of Gravity main of 700 mm DI Pipe for 0.50 Km. The stream joins River Noyyal at a distance of 11.48.kms from the point of disposal. - Stream is owned by Revenue Department and is maintained by PWD. - Carrying capacity of the stream: 13485 cusec - Current flow in this stream: 10119 cusec (during heavy rainfall) - Proposed flow from STP: 7.76 cusec (13191 lpm) - Before commissioning the STP, necessary permission will be obtained from the PWD to let the treated effluent into the above stream	

V. ANALYSIS OF ALTERNATIVES

91. The proposed subproject shall provide underground sewerage system for added areas of Coimbatore City Municipal Corporation (CCMC), viz., Vadavalli & Veerakeralam (Zone V), Kavundampalayam & Thudiyalur (Zone VII). The subproject components included sewage collection system, lifting stations, pumping stations and pumping mains for each zone. New Sewage Treatment Plants are proposed separately for two zones, after analysing the existing sewerage system and STPs, based on zoning of the expanded Coimbatore Corporation as a whole in the subproject to treat sewage collected from the subproject areas.

92. The subproject location was carefully planned so that no significant ecological resources, no significant heritage sites and no sensitive receptors would be affected during implementation of the project. During Construction environmental impacts are expected to be very minimal and will have temporary impacts and site specific. These impacts can be minimized during proposed construction activities by proper construction methods, schedules and via implementing mitigation measures. This section analyses the project alternatives in terms of selection of Pumping station and Lifting Station sites, mode of disposal of treated sewage.

Table 32: Analysis of Alternatives

Project Locations	Sewage Pumping Station (SPS): The locations of 2 SPS sites are selected to utmost consideration to energy efficiency. Gravity flow systems have been adopted. In addition sites were selected on the basis of Government land available nearest to the required locations. The selected sites are Coimbatore corporation (CCMC) owned land. Hence alternative site is not considered in project design phase. SPS for Zone V is proposed within the premises of CCMC maintained Crematorium at Vadavalli. Another one for Zone VII is proposed in the land meant for public purpose at Thudiyalur.
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	Lifting Stations (LS): The locations of 10 LS sites were selected on the basis of Government land available nearest to the required locations. The selected sites are Coimbatore Corporation owned lands. Hence alternative site is not considered in project design phase. Collection system: Sewers will be laid underground in the roads and internal streets or within the road right of way in the proposed zones (4 added areas in Zone V & VII) of Coimbatore City Municipal Corporation Area
Treated Sewage disposal	Presently, treated sewage water from the new STP at Chokkampudur(for Zone V) is proposed to be discharged into the existing surplus stream of Kumaraswamy lake passing through Selvachinthamani & Periyakulam lakes, eventually connecting to River Noyyal. Treated effluent from another new STP at Kavundampalayam (for Zone VII) is proposed to be let into the nearby Sangapur pallam leading to River Noyyal. On considering the alternative disposal, CCMC has planned the reuse of treated sewage for non-potable uses is proposed, as already provided for in the sewerage scheme to omitted areas of CCMC.

a) Without Project Scenario :

93. At present there is no Under Ground Sewerage System in the newly added areas of Coimbatore Corporation. There is no separate system for carrying the sewage and storm water separately in the area. The road side drains are carrying both the sullage and the rain water. Only about 2/3rd of the houses have septic tanks. The houses in the slum areas do not have latrines and they depend on community toilets and open spaces. The drain overflows during rain leaving the area flooded and consequent stagnation of water in and around junction giving rise to degraded living environment with foul smell and filth. The untreated, waste water of the town badly pollutes the land, air and ground water in the village areas outside the town limits.

b) With Project Scenario :

94. As Underground Sewerage Scheme is one of the primary key indicative factors for the economic development, it was decided to take up the Underground Sewerage System to the 4 added areas. The present proposal is to provide Under Ground Sewerage System in Wards 16 to 19 covering Vadavalli and Veerakeralam areas and also in Wards 1(Pt), 2 to 9 & 43(Pt) covering Kavundampalayam and Thudiyalur areas of Coimbatore Corporation. As a result of implementation of the UGSS, the added areas as well as the surroundings will get upgraded living environment with healthy and hygienic atmosphere. Consequently, natural water bodies would also be protected from contamination, thereby utilising for irrigation and fishing etc. remaining with aesthetic and healthy recreational environment and Biodiversity.

VI. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES :

95. 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.

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

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

97. 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).

98. 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.

99. The ADB Rapid Environmental Assessment Checklist in <https://www.adb.org/sites/default/files/project-document/222541/49377-001-iee-04b.pdf> has been used to screen the project for environmental impacts and to determine the scope of the IEE.

100. In the case of this project (i) most of the individual elements involve simple construction and operation techniques, 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. In case encountered, the blasting proposed is “controlled blasting” following necessary precautionary measures including usage of appropriate quantities of explosives, hence that the nearby structures and properties are unlikely to be affected and impacts related to controlled blasting such as dust generation, increased noise levels and vibrations would be mitigated. The project will be in properties held by the CCMC 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.

D. Pre-Construction Impacts – Design and Location :

101. **Design of the Proposed Components :** Technical design of the (i) sewage treatment plants; (ii) sewage pumping and lifting stations; and (iii) 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.

102. **Design of Sewage Treatment Plant :** 15.43 MLD capacity STP is proposed to be constructed at the identified site “Chokkampudur near crematorium” to treat the sewage generated from the subproject areas of Vadavalli and Veeerakeralam. Another 19.49 MLD capacity STP is proposed to be provided at Koundamapalayam Compost yard to treat the sewage collected from the another subproject area of Koundampalayam and Thudiylaur areas. Both the treatment plants and disposal system are proposed under DBOT contract, the STP will be designed by the DBOT contractor and adopt suitable technology conversant, familiar and effective. However, the STP process will be designed to meet the stipulated disposal standards for both the STPs.

Table 33: Standards for Sewage Treatment Plants (STPs)

Parameters	Standards (Applicable to all mode of disposal)
pH	5.5 – 9.0
Bio-chemical Oxygen Demand (BOD)	10
Total Suspended Solids (TSS)	20
Chemical Oxygen Demand (COD)	50
Nitrogen – Total	10
Phosphorus – Total (For Discharge into Ponds, Lakes)	1.0
Fecal Coliform (FC) (Most Probable Number per 100 mililiter, MPN/100)	Desirable – 100 Permissible – 230

Note:

(i). Mega-Metropolitan Cities have population more than 1 crore, Metropolitan Cities-Population more than 10 Lakhs and Class-1 Population more than 1 Lakh.

(ii). All value in mg/l except for pH and Fecal Coliform.

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

(iv). These Standards shall apply to all new STPs for which construction is yet to be initiated.

(v). The existing/under construction STPs shall achieve these standards within 07 years from the date of notification.

(vi). In case 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 100m away from discharge point, then norms for deep sea marine discharge shall be applied.

(vii). Reuse/Recycling of treated effluent shall be encouraged.

(viii). State Pollution Control Boards/Pollution Control Committees may make these norms more stringent taking into account the local conditions

(Source : TNPCB, 2020)

103. One of the critical aspects in STP operation is, change in raw sewage characteristics at inlet of STP may affect the process and output quality. The system is designed for municipal wastewater, which does not include industrial effluent. Characteristics of industrial effluent widely vary depending on the type of industry, and therefore disposal of effluent into sewers may greatly

vary the inlet quality at STP, and will upset process and affect the efficiency. Although legally the disposal of effluent meeting certain standards is allowed into municipal sewers the monitoring of the same is not-practical. Although there are no significant presence of industries with problematic water discharges in the subproject areas, following measures are suggested to safeguard sewerage system efficiency:

- (i) No industrial wastewater shall be allowed to dispose into municipal sewers
- (ii) No domestic wastewater from industrial units shall be allowed into municipal sewers
- (iii) Ensure that there is no illegal discharge through manholes or inspection chambers
- (iv) Conduct public awareness programs.
- (v) Conduct regular wastewater quality monitoring (at inlet and at outlet of STP) to ensure that the treated effluent quality complies with the standards

104. The site for STP selected for the subproject areas of Vadavalli and Veeerakeralam areas is within large land parcel to an extent of 16.50 acres, presently burial ground and crematorium are functioning, remaining vacant land. An area of 4 acres is allocated for the proposed STP. This land is located in the south zone of Coimbatore corporation, eastern side bounded by burial ground; northern side by road and lake and other sides are vacant land. Further the site for STP selected for the subproject areas of Koundampalayam and Thudiylaur areas is within large land parcel to an extent of 10.0 acres, with Compost yard, Solar Power plant and Muslim Burial Ground and remaining vacant land. An area of 5 acres is allocated for the proposed STP. This land is located in the West zone of Coimbatore corporation, Compost Yard found on Southern side and Muslim Burial Ground found on the Eastern side. Northern side and Western side are vacant. The SBR being an aerobic process and conducted in a compacted and a closed system with automated operation, odor nuisance will be very minimal. Limited bad odors may be generated from wet well, primary treatment units and sludge treatment. Besides operating the plant, to minimise the odor potential, the following measures are also included in the site planning and design:

- (i) Site layout design of STP within allocated 5 acre land, maintaining adequate buffer to the closest housing area.
- (ii) Providing a green buffer zone of 15-20 m wide all around the STP with trees in rows and land scaping. This will act as a visual screen around the facility and will improve the aesthetic appearance.
- (iii) Dewatering units shall be located in enclosed building vented to odour control unit, and health and safety precaution shall be put in place H₂S build up.
- (iv) Locate sludge drying beds maintaining maximum distance from the residential area. Sludge quantity will be about 250 to 300 kg/mld/day.

105. **Sewage sludge** generally consists of organic matter, pathogens, metals and micro pollutants. The concentration of parameters such as metals can be influenced by input to the sewers system from industry. Since no industrial wastewater is allowed into sewers, it is unlikely that sludge contains heavy metals. The sludge from reactors will be collected in sludge sump and conveyed to centrifuge for dewatering. Dewatering units will be in enclosed building vented to odour control unit, and health and safety precaution shall be put in place H₂S build up. The sludge in the form of a wet cake will be further air-dried in the sludge drying beds. The treatment and drying processes kill enteric bacteria and pathogens, and because of its high content of nitrates, phosphates and other plant nutrients the sludge is an excellent organic fertilizer for application to the land. Adequate drying is however necessary to ensure maximum kill of enteric bacteria. To achieve adequate drying minimum drying period (15 days) shall be ensured. The drying period, which will be varying depending on the season will be determined during operation and be

followed..Depending upon the quantity and quality of the sludge produced, a sludge management plan upon various avenues may be examined and will be developed by the STP facility designer by means of 'DBOT'. Demand for sludge as manure/soil conditioner will be considered during the plan preparation duly taking into consideration cumulative manure/soil conditioner generated by all STPs in Coimbatore. Sludge shall be periodically tested for presence of heavy metals. The DBOT contractor will be insisted to employ proper sludge handling methods. Personal Protection Equipment should be provided to the workers.

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

Table 34: 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
Total Phosphate (as P2O5) percent by weight, minimum	percent by weight	0.4	10.4
Total Potassium (as K2O), percent by weight, minimum	percent by weight	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)
Colour			
Odour		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.

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

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

- (i) Limit the sewer depth where possible
- (ii) Sewers shall be laid away from water supply lines and drains (at least 1 m), if not possible, sewer lines shall be laid below the water lines;
- (iii) In all cases, the sewer line should be laid deeper than the water pipeline (the difference between top of the sewer and bottom of water pipeline should be at least 300 mm)
- (iv) In unavoidable cases, where sewers are to be laid close to storm water drains, appropriate pipe material (that has no or least infiltration risk) shall be selected (stoneware pipes shall be avoided)
- (v) For shallower sewers and especially in narrow roads, use small inspection chambers in lieu of manholes;
- (vi) Controlled blasting would be undertaken in STP sites including MPS where hard rock is encountered based on the site conditions. For the safety of humans and the structures within the area influenced by the blasting, the vibrations related impacts would be addressed by designing the blast charge by complying with the provisions elaborated in the applicable Indian regulations and standards. All records shall be maintained by the Contractors and PIU. Training related to controlled blasting activity will be included in the overall safeguards training programme meant for PIUs and Contractors.
- (vii) Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize silt/garbage entry

- (viii) Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulfide generation.

109. **Sewage Pumping stations and lift stations.** It is proposed to construct 10 (7+3) sewage lift stations, and 2 (1+1) sewage pumping stations, which will receive sewage from the catchment area via the sewer network and pump to higher level manholes or pumping stations or to STP as per the design. Lift stations are necessitated where in the design the depth of sewer exceeds the downstream interlinking manhole invert levels. Attempts to eliminate lift stations by examining the feasibility of providing rider mains are assessed to be uneconomical. Therefore, in such situations, the feasible and practical solution was to opt for a low capacity lift station with submersible pumps to lift and convey the collected sewage from peripheral areas to the downstream system through a bell-mouth chamber.

110. Lift stations will cater to small area, and will be located at lowest point where the sewage from catchment area will be collected, and then pumped to a higher level manhole for further gravity flow or to a pumping station, from where it is ultimately pumped to the STP. Lift station consists of a sewage sump or suction well of dia 1.5 m to 2 m and 1.9 m to 5.0 m deep, below the ground, to receive sewage, submersible pumps in the sump to pump out, and an electrical panel board for operation of pumps above the ground. A generator set will also be provided at each lift station of required size. Controlled blasting related activities may have to be undertaken at some locations for the presence of hard rock anticipated.

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

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

112. 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.

113. **Odor from pump and lift stations.** In the suction wells, the sewage emits gases, which accumulated in the air above water surface. The gas may include odorous compounds like hydrogen 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 the both as much as possible. Pumping stations cater to large area and will have high capacity of suction wells and pump sets, while lift stations are small with lower capacity of suction wells and pumps sets. The retention time is kept to its lowest

possible so that there is no stagnation of sewage for long time which could create anaerobic conditions.

114. Given that lifting stations and pumping stations are to be located at technically feasible locations (e.g., lowest point to where sewage can be conveyed from households by gravity) within or close to the residential areas which are being served by respective pumping/lifting station. Given the very limited land availability in urban areas like the project area, that too of government owned lands, locating the pumping stations ideally about 50-100 m away from the houses is not practical. In Coimbatore, sites for pumping stations were identified based on the technical suitability and availability of government owned land parcels to avoid land acquisition. Given the comparatively higher potential of odor generation, priority has been given to accommodate pumping stations at more suitable locations away from houses and mostly in sparsely populated areas. Sites which are located close have been selected only in cases where there are no other alternative lands available.

115. Following design related measures are included in the sewage pumping and lifting station design. As presented in the baseline profile, few lifting stations are located along the roads within the road right of way. In such cases there is no buffer space between the houses and the lifting station, and also no layout planning related measures as given below including creating buffer area around the facility may not be feasible. Odor potential of lifting stations is very minimal given small scale operation, however, given close location to houses, design related measures as given below are included.

1. Layout planning related measures

- (i) Siting of wells within the identified site at an internal location as far as possible from adjoining residential buildings;
- (ii) Develop green buffer zone around the facilities with a combination of tall and densely growing trees in multi rows as per the land availability to control odor and also act as visual shield, and improve aesthetical appearance; Almost all locations can be accommodated with green buffer, except one at pothigai residency, with minimal greenery, that too the site is in outskirts.
- (iii) Provision of high compound wall.

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

- (i) Proposed wells to be closed using RCC slabs. Design of RCC slab to consider both superimposed loads (human and equipment loads) and severe corrosion risk from sewer gas from within wells.
- (ii) RCC Slab to be designed and fixed in a modular manner such that access to pumps / appurtenances and other equipment can be provided for maintenance/replacement/renewal purposes;
- (iii) Since human intervention is involved and safety shall be primary and critical consideration, additional protection by way of a metallised grating / grill work shall be provided over the sections (or full cross section if required) where workers will stand / work for inspection and repair/O&M purposes;
- (iv) Provision of passive gas ventilation arrangement by providing a take-off vent from top of well by positioning vent in such a way that cover slab fitment/movement/drawl if required for maintenance purposes is not compromised.
- (v) Height of vent to be provided appropriately and a minimum 2 m above the lintel level (top level) of window(s)/passageways/doors in the nearby adjoining buildings.

- (vi) 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;
- (vii) Submersible sewage pumps of suitable rating, minimum submergence requirements, open impeller with cutting-tearing arrangement and high strength-corrosion resistant heavy duty construction shall be proposed;
- (viii) In locations / cases where sewage flow in the present to intermediate design stage is envisaged to be low, position of the submersible pumps and design of the collection well floor by providing necessary side benching / sloped flooring to allow for higher submergence during low flow shall be made to ensure regular pump operation and avoid sewage stagnation beyond the permissible limit;
- (ix) Diesel Generators shall be provided for all pump stations and in cases of lift stations with space for control room. In cases of lift manholes (road-side or road-center type structures with only provision of kerb-side kiosk), an 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) Periodic monitoring of H₂S levels at sewage pumping and lifting stations using handheld H₂S meters.⁴

116. **Provision of odor treatment system.** Besides the above measures, following odor control and mitigation measures are considered at all sewage pumping and lifting stations, for facilities located very close to the houses/properties.

- (i) Provide closed wells fitted with necessary ventilation wherever required;
- (ii) Except Pothigai Residency (where the area is less and also located outskirts from the city), all other locations proposed for LS and PS shall be provided with greenbelt to control the odor issues
- (iii) a suitable arrangement such to capture the gaseous emissions from the wells and treat via scrubber/activated carbon filter before letting out into the ambient air; such system should be designed appropriately to meet the likely emissions/flow rate of respective pumping / lifting stations. This system shall be provided for all pumping/lifting stations located close (<50 m) to houses

⁴ There are no any standards notified by Government of India or Government of Tamil Nadu. However, Central Pollution Control Board (CPCB) has stipulated Guidelines on Odor Pollution and its Control. These guidelines deal only with the basics of odor pollution, its sources and measurement, technologies for its control etc. but do not specify any threshold limits for odor-causing pollutants. Therefore, as part of mitigation, provision for odor control measures has been made in the sewage pumping stations for all UGSS subprojects. However, in case of STPs, the odor-causing processing units will be located far off to the extent possible within the premises so as to mitigate the odor nuisance. Further, the technology for treating sewage plays a vital role since release of gases like H₂S cannot be avoided in the process involving anaerobic decomposition whereas release of H₂S will almost be nil in case of aerobic treatment. PIU and design engineers have not specified any odor standards adopted elsewhere in the preliminary designs not to limit the technology that can be considered by the bidders in the treatment of domestic sewage. Sufficient mitigation measures have been taken for all sewage pumping stations and will be taken for all STPs when finalizing/revising the IEEs based on the detailed engineering design.

117. **Mechanical odor control system:** The odor control unit is becoming primary design consideration of the sewage pumping and treatment facilities. Areas in which most odor problems are collection, primary treatment facilities and solid handling facilities. Generally, odours are produced by biological reaction at anaerobic/septic conditions. This condition occurs when oxygen transfer to the wastewater is limited, in the anaerobic state, the microbes present in the wastewater have no dissolved oxygen for respiration, in the absence of dissolved oxygen. The odor causing agents in the PS/ STP are Hydrogen Sulfide, Ethyl mercaptan, Methyl mercaptan, Dimethyl sulfide, Sulfur dioxide, Benzyl mercaptan. The conventional and engineered odour control unit that are commercially available are bio filter, scrubber, carbon filter, biotrickling filter/bio scrubber. The details of odour control system is provided in the Appendix 11. The suitable type of mechanical odor control system will be installed depending on the site conditions.

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

- (i) Procure good quality latest technology high pressure pumps that guarantee controlled noise at a level of around 80dB(A) at a distance of 1 m⁵
- (ii) Use appropriate building materials and construction techniques for pump houses which can absorb sound rather than reflect noise
- (iii) Use acoustic enclosures – manufacturer specified, for all pumps, motors
- (iv) Procure only CPCB approved generators to meet air emission and noise level requirements
- (v) Provide sound mufflers for ventilators in the plant rooms; and sound proof doors
- (vi) Provide ear plugs designated for noise reduction to workers

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

120. 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

⁵Indian 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.

savings, at minimum, of 25% to 40% is possible with appropriate measures. The following measures shall be considered and incorporated into the subproject designs:

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

121. 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 including the STP sites. Sewers are proposed within the roads, and therefore no tree cutting envisaged. Following measures need to be implemented to minimize and/or compensate for the loss of tree cover.

- (i) Minimize removal of trees by adopting to site condition and with appropriate layout design of STP and pumping stations
- (ii) Obtain prior permission for tree cutting
- (iii) Plant and maintain 10 trees for each tree that is removed. Planting trees will be carried out in the bank of ponds now under decoration& adorning–(bringing aesthetic view with walking / cycling provisions etc. for the public) under smart city scheme by the CCMC. Trees will be planted in the Schools, Parks and other public places belonging to the CCMC, and in the Lit/Pump stations & STP sites of this subproject and also in the pumping stations & water treatment plants under water supply schemes maintained by TWAD Board, in order to compensate the occurrence of tree cutting, while execution of the scheme.

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

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

123. 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 sensitive areas.

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

125. Social and Cultural Resources – Chance Finds. Any work involving ground disturbance can uncover and damage archaeological and historical remains. For this project, excavation will occur in project sites for foundations, laying pipelines, and for construction of underground structures at pumping/lifting stations and at STP. There are no archeologically or historically recognized sites or places close to project sites or within the project area. Therefore it is not likely that the project sites contains any archaeological or historical remains, and risk of uncovering them is very low. Nevertheless, CCMC 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;
- (iv) Inform State Archaeological Department if a find is suspected, and taking any action they require to ensure its removal or protection in situ.

E. Construction Impacts

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

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

128. 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.

129. Subproject also include linear works (laying of 542 kms sewers along the roads). This covers almost entire project area of Zone 5 (Vadavalli & Veerakeralam) and Zone 7 (Koundampalayam & Thudiyalur), and sewers will be laid along almost all the roads. Small sewers (tertiary sewers) that collect sewage from households will be laid in all streets and roads, the larger sewers that collect sewage from tertiary sewers and convey to pumping stations and STP will be laid mostly on wider main roads. Sewers will be laid by open cut method.

130. Open cut trenching method of sewer laying involves trench excavation in the road, placing sewers in the trench, jointing and testing, and refilling with the excavated soil. Proposed pipes for tertiary sewers are double wall corrugated (DWC) pipes and conveying mains (pumping mains) are of cast iron. The diameter of sewer ranges from 150 mm to 700 mm, of which nearly 85% of the sewers are of size between 150 mm and 250 mm. According to the design the sewers will be laid at a depth of 1 to 10 m. The width of the trench excavation along the roads will vary from 0.8 m to 1.4 m, and the depth varies from a minimum of 1 m to 10 m. Nearly 90% length of sewers will be laid in trench of depth 3 m or less, and there are very few sewers that will be laid in a trench of more than 6 m deep (0.4% sewers only). The design is optimized to minimize the sewer depth to the extent possible with an optimal combination of sewer depth and pumping requirements. Details of sewer construction are provided in the following Table.

Table 35: Sewer Construction (Zone V)

Dia of Sewer	Sewer Material	Total Length of Sewers to be laid (m)	Percentage of Length (diameter-wise)	Width of Trench(m)	Depth of Trench & Percentage of Sewer Length (%)	
200	DWC	1,91,787	83.32%	0.8	0 – 2 m	85.13%
					2 – 2.5 m	9.33%
					2.5 – 3 m	5.54%
250	DWC	2,563	1.11%	0.8	0 – 2 m	71.52%
					2 – 2.5 m	17.40%
					2.5 – 3 m	11.08%
300	DWC	1,502	0.65%	0.9	0 – 2 m	64.51%
					2 – 2.5 m	11.52%
					2.5 – 3 m	23.97%
200	CI	20,237	8.79%	0.8	2 – 2.5 m	0.14%
					3 – 3.5 m	34.89%
					3.5 – 4 m	21.77%
					4 – 6 m	41.79%
250	CI	904	0.39%	0.8	6 – 8 m	1.41%
					3 – 3.5 m	11.50%
					3.5 – 4 m	6.42%
300	CI	2,004	0.87%	0.9	4 – 6 m	82.08%
					3 – 3.5 m	13.02%
					3.5 – 4 m	10.88%
					4 – 6 m	61.88%
350	CI	1,620	0.70%	0.9	6 – 8 m	14.22%
					0 – 2 m	24.89%
					2 – 2.5 m	21.23%
					2.5 – 3 m	15.86%
					3 – 3.5 m	4.38%
					3.5 – 4 m	3.58%
400	CI	1,262	0.55%	0.9	4 – 6 m	21.23%
					6 – 8 m	8.83%
					0 – 2 m	27.43%
					2 – 2.5 m	20.52%
					2.5 – 3 m	11.33%
					3 – 3.5 m	6.81%
					3.5 – 4 m	9.03%
					4 – 6 m	24.88%
					0 – 2 m	43.05%

Dia of Sewer	Sewer Material	Total Length of Sewers to be laid (m)	Percentage of Length (diameter-wise)	Width of Trench(m)	Depth of Trench & Percentage of Sewer Length (%)	
450	CI	1,338	0.58%	0.9	2 – 2.5 m	10.76%
					2.5 – 3 m	4.26%
					3 – 3.5 m	7.77%
					3.5 – 4 m	2.17%
					4 – 6 m	25.56%
500	CI	1,503	0.65%	1.0	6 – 8 m	6.43%
					0 – 2 m	17.83%
					2 – 2.5 m	24.82%
					2.5 – 3 m	7.58%
					3 – 3.5 m	6.92%
700	CI	5,513	2.39%	1.2	3.5 – 4 m	13.84%
					4 – 6 m	29.01%
					0 – 2 m	6.69%
					2 – 2.5 m	11.26%
					2.5 – 3 m	4.14%
					3 – 3.5 m	10.96%
					3.5 – 4 m	12.59%
					4 – 6 m	54.36%

Table 36: Sewer Construction (Zone VII)

Dia of Sewer	Sewer Material	Total Length of Sewers to be laid (m)	Percentage of Length (diameter-wise)	Width of Trench(m)	Depth of Trench & Percentage of Sewer Length (%)	
200	DWC	2,39,524	80.11%	0.8	0 – 2 m	83.47%
					2 – 2.5 m	9.98%
					2.5 – 3 m	6.46%
					4 – 6 m	0.08%
					6 – 8 m	0.01%
250	DWC	2,243	0.75%	0.8	0 – 2 m	61.70%
					2 – 2.5 m	14.27%
					2.5 – 3 m	18.99%
					3 – 3.5 m	4.10%
					3.5 – 4 m	0.94%
300	DWC	2,000	0.67%	0.9	0 – 2 m	49.85%
					2 – 2.5 m	33.45%
					2.5 – 3 m	16.70%
200	CI	29,674	9.92%	0.8	0 – 2 m	0.68%
					2 – 2.5 m	0.29%
					2.5 – 3 m	0.67%
					3 – 3.5 m	31.07%
					3.5 – 4 m	26.52%
					4 – 6 m	38.97%
250	CI	3,803	1.27%	0.8	6 – 8 m	1.80%
					0 – 2 m	1.50%
					2.5 – 3 m	3.00%
					3 – 3.5 m	12.25%
					3.5 – 4 m	18.01%

Dia of Sewer	Sewer Material	Total Length of Sewers to be laid (m)	Percentage of Length (diameter-wise)	Width of Trench(m)	Depth of Trench & Percentage of Sewer Length (%)	
					4 – 6 m	57.82%
					6 – 8 m	7.42%
300	CI	1,192	0.40%	0.9	3 – 3.5 m	19.46%
					3.5 – 4 m	5.54%
					4 – 6 m	67.11%
					6 – 8 m	7.89%
350	CI	2,340	0.78%	0.9	0 – 2 m	28.25%
					2 – 2.5 m	2.05%
					2.5 – 3 m	14.66%
					3 – 3.5 m	6.37%
					3.5 – 4 m	19.49%
					4 – 6 m	29.18%
400	CI	3,042	1.02%	0.9	0 – 2 m	16.54%
					2 – 2.5 m	9.43%
					2.5 – 3 m	1.91%
					3 – 3.5 m	4.80%
					3.5 – 4 m	2.83%
					4 – 6 m	62.62%
					6 – 8 m	1.87%
450	CI	2,238	0.75%	0.9	0 – 2 m	2.59%
					2 – 2.5 m	10.28%
					2.5 – 3 m	11.04%
					3 – 3.5 m	5.09%
					3.5 – 4 m	8.94%
					4 – 6 m	56.56%
					6 – 8 m	5.50%
500	CI	4,970	1.66%	1.0	0 – 2 m	29.56%
					2 – 2.5 m	8.69%
					2.5 – 3 m	19.50%
					3 – 3.5 m	10.91%
					3.5 – 4 m	5.17%
					4 – 6 m	22.35%
					6 – 8 m	3.82%
600	CI	2,626	0.88%	1.1	0 – 2 m	36.18%
					2 – 2.5 m	3.27%
					2.5 – 3 m	8.57%
					3 – 3.5 m	2.17%
					3.5 – 4 m	2.21%
					4 – 6 m	42.16%
					6 – 8 m	5.44%
700	CI	5,350	1.79%	1.2	0 – 2 m	12.00%
					2 – 2.5 m	19.35%
					2.5 – 3 m	20.26%
					3 – 3.5 m	16.52%
					3.5 – 4 m	4.62%
					4 – 6 m	26.71%
					6 – 8 m	0.54%

131. 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 backhoe excavators. As trenches are deep (up to 6-8 m), there is risk of collapse of trenches and damage to surrounding buildings, safety risk to pedestrians and traffic. Necessary precautions such as bracing / shoring in the trench will be provided for trenches of more than 1.2 m deep. The normal working hours will be 8 hours daily, the total duration of each stage depends on the soil condition and other local features. Excavated soil will be used for refilling the trench after placing the sewer and therefore residual soil after pipe laying and refilling is not significant. Total earthwork excavation will be over 724,450 m³, of which nearly 95% will be reused, and the remaining 36,000 m³ of excess soil needs to be disposed safely, to the places indicated by the CCMC, by conveying in lorries, covered with dust screen in order to avoid dusting and spoiling roads, etc. The excavation in hard rock if any encountered during implementation will be carried out by controlled blasting technique after obtaining statutory permits and following all mitigation and safety measures.

132. Although sewer laying work involves quite simple techniques of civil work, except the stretches where the controlled blasting is needed, 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.

133. Sewers will extend to all residential and developed areas, while large diameter sewers will be laid mostly along the main roads. These main roads include a State highways (Coimbatore-Maruthamalai Road (SH-167) and Corporation Roads. The next level roads are internal main roads providing connectivity within the city. These include: Edayarpalayam road, Thondamuthur road, Vedapatty road, Onapalayam road, Ajjanur road, Sundapalayam road, etc., Main road carry considerable flow of traffic and are centres of commercial activities, institutions, etc.,

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

135. **Sources of Materials.** Significant amount of sand and coarse aggregate will be required for this project, which will be sourced from quarries. Quarries inevitably cause extensive physical changes; as construction materials are excavated from the ground, leaving large cavities, or levelling hillsides, etc. The physical damage caused by quarries is controlled by allowing them to operate within specific limited areas only, so the damage is restricted in extent and not allowed to spread indiscriminately. New quarries are subject to a rigorous process of environmental assessment to ensure appropriate siting and adequate environmental controls on the operation. It will therefore be important to ensure that construction materials for this project are obtained from existing government approved licensed quarries only, to ensure these controls are in place. In Coimbatore, gravel and aggregate is available locally in Coimbatore district, which is known for stone quarries. Contractor should procure sand from the government approved quarries having valid clearance. Contractor should not create / use any new borrow pits / quarries. The contractor should also make a concerted effort to re-use as much excavated material from this project as possible. The construction contractor will be required to:

- (i) Obtain construction materials only from government approved quarries with prior approval of PIU
- (ii) PIU to review, and ensure that proposed quarry sources have all necessary consents/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

136. **Air Quality.** Construction work, especially from earthwork activities, including controlled blasting works, coupled with dry and windy working conditions, material and debris transport, and works along the public roads carrying significant traffic, have high potential to generate dust. Significant quantities of earthwork will be conducted in the subproject, spread all over the project area. Over 724,450 m³ of earthwork is anticipated from the subproject, and 95% of which will be reused for filling the trenches. Also emissions from construction vehicles, equipment, and machinery used for excavation and construction will induce impacts on the air quality. Anticipated impacts include dust and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons. Dust generation from construction work in individual and confined work sites like STP, pumping stations etc., will be mainly during the initial construction phase of earth work, as the site is confined, dust can be effectively controlled with common measures. STP is located outside the city, away from habitation area. Dust generation will be significant during sewer laying along the roads. Increase in dust/ particulate matter in ambient air is detrimental, and may have adverse impacts on people and environment. To mitigate the impacts, construction contractors will be required to:

1. For all construction works

- (i) Provide a dust screen (6 m high) around the construction sites of pumping and lifting stations and STP; provide 2 m high barricades for the sewer works
- (ii) Damp down the soil and any stockpiled material on site (will be covered in general conditions of the contract) by water sprinkling; (3-4 times a day - before the start of work, 1-2 times in between, and at the end of the day); when working in the roads there should permanently be one person responsible for directing when water sprinkling needs to take place to stop the dust moving;
- (iii) Reduce the need to sprinkle water by stabilizing surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition;
- (iv) Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process;
- (v) Cover the soil stocked at the sites with tarpaulins and surround by dust screens.
- (vi) Control access to work area, prevent unnecessary movement of vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation;
- (vii) Use tarpaulins to cover the loose material (soil, sand, aggregate etc.,) when transported by open trucks;
- (viii) Control dust generation while unloading the loose material (particularly aggregate, sand, soil) at the site by sprinkling water and unloading inside the barricaded area; minimize the drop height when moving the excavated soil
- (ix) Clean wheels and undercarriage of haul trucks prior to leaving construction site

- (x) Ensure that all the construction equipment, machinery are fitted with pollution control devices, which are operating correctly, and have a valid pollution under control (PUC) certificate.
- (xi) no vehicles or plant to be left idling at site generators to be at placed maximum distance from properties.

2. **For sewerworks**

- (i) Inform the residents likely to be affected by the works in the locality about the upcoming sewer laying works well in advance so that necessary arrangements are planned by the residents with reduced inconvenience.
- (ii) For sections where the controlled blasting is needed, the residents are provided with the schedule of blasting at least three days in advance and the residents will be explained about the preventive, precautionary, mitigation and emergency response measures being taken to address their concerns.
- (iii) Barricade the construction area using hard barricades (of 2 m height) on both sides
- (iv) Initiate site clearance and excavation work only after barricading of the site is done
- (v) Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes etc.), to the barricaded area;
- (vi) Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area;
- (vii) 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;
- (viii) For sections involving controlled blasting, ensure that dust curtains of adequate height are provided to the trenches to prevent emission of dust during drilling for charge holes and controlled blasting.
- (ix) Ensure that the excavated soil and debris along the section identified for blasting is sprinkled with adequate water prior to blasting to reduce dust emissions upon explosion of charge placed for breaking the hard rock;
- (x) 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;
- (xi) 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;
- (xii) 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.

137. **Immediate road restoration after refilling the trench.** Excavation and refilling activities disturb the top soil, and under the influence of wind, traffic, pedestrians, and other activities etc., produces dust. There is large potential to generate significant quantities of dust after refilling the trench, and prior to road relaying. It is a common practice not to restore the road immediately after refilling the trench so as to allow sufficient time for the refilled material to stabilize naturally. Given the dry and windy conditions, and heavy traffic and other activities along the roads, the refilled trenches with loose top soil along the roads will generate maximum dust, and create very unhealthy conditions. Moreover, as the barricades/dust screens will be removed after the trench is

refilled, there will be absolutely nothing to control the dust generation. Dust control activities like wetting of top soil will not be effective given the site conditions. It is therefore necessary to restore/relay the road surface immediately or take suitable steps to arrest the dust. Soil consolidation technique shall be used so that road can be restored immediately.

- (i) Immediately consolidate the backfilled soil and restore the road surface; if immediate road restoration is not possible, provide a layer of plain cement concrete (PCC) of suitable mix on the backfilled trench so that dust generation, erosion is arrested and it will also provide a smooth riding surface for the traffic until the road is properly restored. Backfilled trench without any road restoration is a major source of dust.

138. Surface Water Quality. Run-off from stockpiled materials and chemicals from fuels and lubricants during construction works can contaminate water quality of the receiving water bodies and streams/rivers. Project area receives rainfall in southwest and northeast monsoon seasons, between June/July to November/December. Krishnampathy Kulam, Narasampathy Kulam are located neighbouring areas near the project area, Selvampathy lake & Kumarasamy lake and Sanganurpallam Stream are situated near the STP site of the project area and Noyyal River flows about 11.48 km away in the southern side. Noyyal River flows only during monsoon, rest of the time it carries mostly wastewater from the surrounding areas. Project area mostly drains into Noyyal river. It is important that runoff from the construction areas, which may contain silt and chemical traces do not enter these water bodies. Impact will be temporary, and but needs to be mitigated. Construction contractor will be required to:

- (i) All earthworks be conducted during the dry season to prevent the problem of soil/silt run-off during rains
- (ii) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; do not stock earth/material close to water bodies (at least 100 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 water quality inspection according to the Environmental Management Plan (EMP).

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

- (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.

140. **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 over 724,450 m³, of which nearly 95% will be reused, and the remaining 36,000 m³ of excess soil needs to be disposed safely. The following mitigation measures to minimize impacts from waste generation shall be implemented by the contractor:

- (i) Prepare and implement a Construction Waste (Spoils) Management Plan (format is given in Appendix 3);
- (ii) As far as possible utilize the debris and excess soil in construction purpose, for example for raising the ground level or construction of access roads etc.;
- (iii) Avoid stockpiling any excess spoils at the site for long time. Excess excavated soils should be disposed off to approved designated areas immediately;
- (iv) If disposal is required, the site shall be selected (in consultation with the CCMC and local communities) preferably from barren, infertile lands; sites should be located away from residential areas, forests, water bodies and any other sensitive land uses;
- (v) Domestic solid wastes should be properly segregated in biodegradable and non-biodegradable for collection and disposal to designated solid waste disposal site; create a compost pit (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; At the time of execution, the work awarded contractor will be insisted and monitored regarding the storage of fuel, etc. as per the provisions mentioned in the "Hazardous Waste (Management & Handling) Rules '1989
- (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.

141. **Noise and Vibration Levels.** While pumping and lifting station sites are located predominantly urban and suburban areas, STP is located inside the city, but with minimum residence. Sewer lines are spread over entire project area. Except STP, all these sites are located

close to habitation areas, where there are houses, schools and hospitals, religious places and businesses. The sensitive receptors are the general population in these areas. Increase in noise level may be caused by excavation, particularly breaking of cement concrete or bitumen roads and controlled blasting in hard rocks along the alignment for laying of sewers, operation of construction equipment, and the transportation of equipment, materials, and people. Vibration generated from construction activity, for instance from the use of explosives for controlled blasting and pneumatic drills, will have impact on nearby buildings. This impact is negative short-term, and reversible by mitigation measures. The construction contractor will be required to:

- (i) Plan activities in consultation with PIU so that activities with the greatest potential to generate noise and vibrations such as controlled blasting are conducted during periods of the day which will result in least disturbance, especially near schools and other sensitive receptors
- (ii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and use portable street barriers to minimise 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) Ensure to conduct a pre-blasting survey through videography and photography of residential properties and other structures falling along the sewerage alignment to ascertain the prevailing conditions of the structures likely to be impacted by the controlled blasting and take adequate measures to minimise such impacts.
- (v) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach;
- (vi) Consult local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals.
- (vii) All the controlled blasting, shall be done by an approved and licensed Explosive contractor after submitting a blasting plan to PIU.

142. Accessibility and Traffic Disruptions. Excavation along the roads for laying of sewers, (especially controlled blasting), hauling of construction materials and operation of equipment on-site will cause traffic problems. There are two types of roads/highways in the project area that provide regional connectivity: state highway (SH) and other district roads (ODR) including internal corporation roads. Sewers are proposed along:

- (i) SH167(Coimbatore-Maruthamalai Road)& (Edayarpalayam-Vadavalli Road);
- (ii) Thondamuthur road;
- (iii) Vedapatti road;
- (iv) Ajjanur road;
- (v) Siruvani road;
- (vi) Onapalayam road;
- (vii) Sundapalayam road;

At the inception of execution phase of the scheme itself, necessary permission for laying of sewers in the above roads will be sought for by the PIU from the concerned authorities.

143. State highways carry considerable traffic, followed by MDRs and ODRs. Sewers will also be laid along the internal main roads that provide connectivity within the city. These include: Thondamuthur road, Vedapatti road, Ajjanur road, Siruvani main road, Onapalayam road, Sundapalayam road, etc., These roads also carry considerable flow of traffic and are centres of commercial activities.

144. Internal roads in the project area are include: Maruthamalai adivaram, IOB Colony, Kamatchi nagar, Nalvar nagar, Sri Ram Garden, SMR Nagar, Maharani avenue, E.B.Colony etc., have moderate/wide internal roads, and moderate traffic.

145. 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.

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

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

1. Sewer works

- (i) Prepare a sewer work implementation plan in each zone separately and undertake the work accordingly; ensure that for each road where the work is being undertaken there is an alternative road for the traffic diversion; take up the work in sequential way so that public inconvenience is minimal;
- (ii) Plan the sewer work in coordination with the traffic police; provide temporary diversions, where necessary 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 start of work

- (x) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum;
- (xi) Keep the site free from all unnecessary obstructions;
- (xii) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints. Provide information to the public through media – newspapers and local cable television (TV) services;
- (xiii) At work site, public information/caution boards shall be provided including contact for public complaints.
- (xiv) For sections where the controlled blasting is proposed, the residents are provided with the schedule of blasting atleast three days in advance and the residents are explained about the preventive, precautionary, mitigation and emergency response measures being taken to address their concerns.
- (xv) The contractor in coordination with the urban local body officials would conduct pre- blasting physical surveys through videography and photography of the adjacent residential properties and other structures along the sewerage alignment and take adequate measures to minimise such impacts.

2. Hauling (material, waste/debris and equipment) activities:

- (i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites;
- (ii) Schedule transport and hauling activities during non-peak hours (peak hours 7 to 10 AM and 4 to 7 PM);
- (iii) Locate entry and exit points in areas where there is low potential for traffic congestion;
- (iv) Drive vehicles in a considerate manner;
- (v) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.
- (vi) For controlled blasting, required quantity of explosives shall be transported to the blasting site only through suitable explosive vehicle. After blasting is over, the balance explosives shall be returned to the licensed storage.

148. **Socio-Economic – Income.** Sites for all projects components are carefully selected in government owned vacant lands and therefore there is no requirement for land acquisition or any resettlement. Blocking of access to the business / livelihood activities, especially during pipeline laying along the roads, may impact the income of households. However, given the alignment of pipeline within the road carriage way, and also the measures suggested for ensuring accessibility during sewer works, 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.

149. **Socio-Economic – Employment.** Manpower will be required during the 18-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.

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

- (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 (OH and S) Plan, informed by OHS risk assessment seeking to avoid, minimise and mitigate risk, including controlled blasting activity, which shall include measures such as: (a) safe and documented construction procedures to be followed for all site activities; (b) ensuring all workers are provided with and use personal protective equipment; (c) OH and S Training⁶ for all site personnel, (d) excluding public from the work sites; and (e) documentation of work-related accidents; Follow International Standards such as the World Bank Group's Environment, Health and Safety Guidelines⁷.

⁶ 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.

⁷<http://www.ifc.org/wps/wcm/connect/a99ab8804365b27aa60fb6d3e9bda932/EHS-Guidelines+101-Webinar.pdf?MOD=AJPERES>

- (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;
- (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

151. **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
- (xiii) Maintain regularly the construction equipment and vehicles; use manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.

152. **Safety Measures for Controlled blasting** during excavation: Presence of sub-surface rock does not occur in the alignment in the Sub-project. However during excavation if identified by any chance, alternatives like drilling and chiselling, controlled blasting etc shall be examined and the suitable technology will be identified depending upon the site conditions. Wherever controlled blasting is proposed, the following measures shall be carried out for execution in a safe manner.

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

- (xiv) The contractor shall be responsible for any and all damages to property or injury to persons resulting from blasting or accidental or premature explosions that may occur in connection with use of explosives. The contractor shall do the activities after obtaining the blasting permission from District Collector, Coimbatore.
- (xv) For the diversion of traffic in the blasting area, the contractor shall prepare a traffic management plan and obtain permission from Coimbatore Corporation and traffic police.

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

- (i) Consult PIU before locating project offices, sheds, and construction plants;
- (ii) Select a camp site away from residential areas (at least 100m buffer shall be maintained) or locate the camp site within the existing facilities of CCMC.
- (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

F. Operation and Maintenance Impacts

154. After implementation of the Project, the Under Ground Sewage Scheme in the 4 added areas will be handed over by TWAD Board to the CCMC. Operation and Maintenance of the sewerage system will be carried out by CCMC. Operation will involve collection and conveyance of wastewater from houses to nearest lifting/pumping stations; operation of lifting/pumping stations to pump accumulated sewage main pumping stations; operation of main pumping stations to pump accumulated sewage to STPs; treatment of sewage at STP to meet the disposal standards; and final disposal of treated wastewater into Stream leading to Periyakulam for Vadavalli-Veerakeralam areas and into Sanganurpallam Stream leading to Noyyal river for Kavundampalayam-Thudiyalur areas. STPs are proposed under DBOT modality, and the contractor will prepare detailed designs for STPs including the outfall sewer and disposal arrangements. At present, treatment and disposal system is designed in outline only (preliminary design); and during the detailed design phase, the assessment will be updated accordingly.

155. During its operation phase, STP located at Chokkampudur will treat 15.43million liters of wastewater every day and the STP at Kavundampalayam Compost Yard will treat 19.49 million liters of waste water every day. As discussed in the preconstruction stage impacts, various measures, following measures are suggested for detailed design to avoid, mitigate any impacts on the environment due to operation of STP.

- (i) Process design to meet the stringent inland water disposal standards
- (ii) Conduct a detailed baseline water quality assessment of receiving water body for
- (iii) the entire Project – Noyyal River; monitor water quality periodically during operation phase as per the Environmental Monitoring Plan
- (iv) Develop a sludge management plan : Sludge management to collect, treat and dispose the accumulated sludge safely; sludge will be treated in a mechanical centrifuge which will thicken the sludge by separating the liquid, thicken sludge will be further dried, and dried sludge will be used as a soil conditioner in fields; Sludge will be tested periodically for heavy metal concentration.
- (v) Designing the entire system to maintain optimal flow and terminal pressure, and optimising the overall energy usage in sewer system, including STP
- (vi) Using low-noise and energy efficient pumping systems
- (vii) Installing the noise-producing pumps and motors etc., in enclosed buildings with noise reducing walls, and also maintaining adequate buffer to the nearby inhabited areas
- (viii) Provision of appropriate personal protection equipment to the workers and staff

156. **Treatment and Disposal.** Sewage treatment facility would be designed to meet the present disposal standards notified by CPCB for disposal of treated wastewater from STPs. The treated sewage effluent from the STP for Vadavalli and Verakeralam areas would be disposed in the outlet stream of nearby Kumarasamy lake, which flows to Selva Chinthamani Kulam at a distance of 2.5 Kms and thereon to Periyakulam at Ukkadam at a distance of 5.5 kms from the

point of disposal. The carrying capacity of this Stream is 290 cusec. The Stream and the receiving waterbodies are owned and maintained by Coimbatore Corporation. The treated sewage effluent from the STP for Kavundampalayam and Thudiyalur areas would be disposed in the Sanganur Pallam stream which is leading to Noyyal River at a distance of 11.48 Kms. The Carrying capacity of this Stream is 13485 cusec. This Stream is owned by Revenue Department and is maintained by PWD. Noyyal river, except in the monsoon, mostly carries wastewater from the villages and urban areas it flows through. It ultimately meets river Cauvery at Village Noyyal in Karur District, over 100 km east of Coimbatore. With the implementation of subproject, disposal of untreated wastewater from subproject areas will be prevented, and also treated wastewater will be disposed into Lake / river. This will in fact improve the water quality, and therefore no adverse impacts envisaged. At present no water quality data of the receiving waterbodies are available, and a detailed baseline will be established during the detailed design phase since the implementation modality of this subproject is design-build. This is part of scope of work of DBOT (Design Build Operate Transfer) by the contractor. Any change / lowering of treatment efficiency during operation may lead to poor quality of wastewater and may further pollute River Noyyal. It is therefore critical that STP treats the sewage as designed. Operation and maintenance of STP and change in incoming sewage quality will have impact on the treatment efficiency.

157. During the detailed design phase:

- (i) Conduct a detailed seasonal baseline water quality assessment of receiving water body – Selvachinthamani Lake, Periyakulam Lake, Sanganoor Pallam Stream & Noyyal River.
- (ii) Monitor water quality periodically during operation phase as per the Environmental Monitoring Plan

158. STP operation. It must be ensured that the facility is operated with standard operating procedures and only by trained staff. Ensuring uninterrupted power supply with back-up facility is a must. Standard operating procedures and operation manual shall be prepared by the contractor. Besides routine operation, this will cover all necessary items such as preventive maintenance, periodic maintenance and emergency maintenance, replacement of pumps, motors, and other electro-mechanical parts as per the design life to optimize energy use and system efficiency etc., Manual shall also include safety awareness and mock drills for worker safety.

159. Quality of Raw Sewage. As discussed previously, one of the critical aspects in STP operation is, change in raw sewage characteristics at inlet of STP may affect the process and output quality. The system is designed for municipal 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. There are no significant presence of industries with problematic water discharges in the subproject area, however, it is important that no wastewater from industries is allowed into the sewer network with strict monitoring and enforcement.

160. 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. STP will have proper facilities for handling, treatment and disposal of sludge safely with implementation of sludge management plan. Therefore no adverse impacts envisaged. The treatment and drying processes kill enteric bacteria and pathogens, and because of its high content of nitrates, phosphates and other plant nutrients the sludge is an excellent organic fertilizer for application to the land. The reuse of sludge should be preceded by rigorous bacteriological tests to confirm that the treatment methods render all dried sludge and effluent free from enteric bacteria and pathogens, so that it is safe to humans, animals and crops. Sludge shall also need to be periodically tested for presence of heavy metals,

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

161. Following measures are to be implemented during the operation phase:

- (i) Ensure proper knowledge transfer, hands-on training to municipal staff engaged in STP operation has been provided by contractor prior to handover of facility;
- (ii) Ensure continuous uninterrupted power supply;
- (iii) Operate and maintain the facility following standard operating procedures of operational manual;
- (iv) Undertake preventive and periodic maintenance activities as required;
- (v) Maintain the mechanical / electrical parts as per the maintenance plan to avoid any hazards;
- (vi) Conduct periodic training to workers;
- (vii) Ensure that all safety apparatus at STP including personal protection equipment are in good condition all times; and are at easily accessible and identifiable place; periodically check the equipment, and conduct mock drills to deal with emergency situations;
- (viii) Implement sludge management plan at the STP;
- (ix) No wastewater from industrial premises (including domestic wastewater) shall be allowed to dispose into municipal sewers;
- (x) Monitor regularly and ensure that there is no illegal discharge through manholes or inspection chambers; conduct public awareness programs; in coordination with TNPCB;
- (xi) Conduct regular wastewater quality monitoring (at inlet and at outlet of STP) to ensure that the treated effluent quality complies with design standards;
- (xii) Conduct periodic testing of dried sludge/compost to check presence of heavy metals and confirming to the applicable standards to use as compost.

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

- (i) Strictly follow standard operating procedures / operational manual for operation and maintenance of lifting and pump stations;
- (ii) Ensure that operating staff is properly trained, and have clear understanding of odor issues vis-à-vis its related with operational practices;
- (iii) Ensure that pumping cycles are properly followed; and there is no buildup of sewage beyond design volume in the wells;
- (iv) Conduct periodic H₂S monitoring at pumping and lifting stations using handheld H₂S meters.

163. **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.

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

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

of any works; H2S levels confirming to ILO⁸ threshold limits⁹ shall be ensured (1 ppm as TWA (time weighted average) usually 8 hours and 5 ppm as STEL (short-term exposure limit) which is usually 15 minutes.

165. **Disaster management and Emergency Response.** The Revenue Department of the State is the Nodal Department for controlling, monitoring and directing measures for organizing rescue, relief and rehabilitation. All other concerned line departments, municipal corporations, extends cooperation to the response management of the disaster whenever it occurs. Control rooms at the State level as well as district control rooms are activated as required to deal with any disaster. At state level, Tamil Nadu State Disaster Management Authority (TNSDMA) is established to plan, coordinate and monitor the disaster management at state level. District Disaster Management Authorities (DDMA), headed by respective District Collectors, established in each district to perform similar functions at the district level in coordination with TNSDMA. District disaster management plans are prepared for each district. DDMA prepares and implements the District Disaster Management Plan and plays the role of an anchor, monitors the disaster preparedness throughout the year and particularly review non-disaster activities and preparedness of the departments to handle situations. DDMA assesses the situation and gives directions to the departments for handling of any disaster situation. It can call for outside support, if necessary, and keeps the TNSDMA informed about the handling of the situation. Meetings are held periodically during the year to ensure that alertness and preparedness levels are maintained within the district. The state and district disaster management plans follows the Sendai Framework for Disaster Risk Reduction 2015-2020.

166. **Disaster Management in Municipal Corporation Area.** Coimbatore District disaster management plan includes the Coimbatore City Municipal Corporation as an integral part, and CCMC plays very important role in disaster management within its jurisdiction and works under the overall coordination of District Collector, DDMA. District disaster management plan identifies the highlights the responsibilities of urban local bodies, and CCMC is a member of district disaster management committee. The CCMC defined roles and responsibilities of all departments within its jurisdiction in disaster management.

⁸ International Labour Organization

⁹ https://www.ilo.org/dyn/icsc/showcard.display?p_card_id=0165&p_version=1&p_lang=en

VII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Overview

167. The active participation of stakeholders including local community, /,Non-Governmental Organization (NGOs)/ Community Based Organization (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.

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

B. Public Consultation

169. The public consultation and disclosure program is a continuous process throughout the project implementation, including project planning, design and construction.

a. Consultation during Project Preparation

170. The subproject proposal is formulated by Coimbatore corporation(through TWAD) in consultation with the public representatives bodies in the project area to suit their requirements.

171. Focus-group discussions with other stakeholders were conducted during project preparation, and information on likely issues and the proposed mitigation and monitoring measures provided, to learn their views and concerns. A socio economic household survey has been conducted in the project area, covering sample households, to understand the household characteristics, health status, and the infrastructure service levels, and also the demand for infrastructure services. General public and the people residing along the project activity areas were also consulted.

172. A project area level consultation workshop it was conducted in Coimbatore in the Sub-project areas (Vadavalli & Thudiyalur) on 15thDecember 2020, with the public representatives, prominent citizens, NGOs, etc. Considering the COVID-19 pandemic situation, the necessary precautions such as thermal screening, mask, sanitizer for the participants were undertaken.

173. During the meeting, the public participants are very much interested and welcomed the UGSS to their area. They assured full-cooperation while implementing the UGSS. Details of consultation is provided in Appendix 9.

174. It was observed that people are willing to extend their cooperation as the proposed project will provide sewerage system, enhance basic infrastructure service levels and overall living standard of the public. The public expressed their concern regarding the nuisance and disturbance (dust, road closure and traffic management activities) during the construction stage

which can have impact on their day to day activities. Public demanded for advance notice before construction and proper warning signs along the construction area to avoid accidents and inconvenience. Public opined that an appropriate operation and maintenance system should be in place for sewerage system for its best functioning and to have the maximum health and aesthetic benefits. Issue of bad odors from lifting and pumping stations located close to the houses is also raised. Project team explained proposed EMP to manage the negative impacts, including odor prevention and control measures included in the design and operation.

b. Consultation during construction

175. 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 as and when required. Focus group meetings will be conducted to discuss and plan construction work (mainly pipeline work) and create awareness with local communities about the construction activity including controlled blasting to reduce disturbance and other impacts and also regarding the project grievance redress mechanism. Project information and construction schedule will be provided to the public via mass media (newspapers, television, ULB websites etc.). A constant communication will be established with the affected communities to redress the environmental issues likely to surface during construction phase. Contractor will provide prior public information (in Tamil and English) about the construction work in the area once 7 days prior to the start of work and again a day before the start of work via pamphlets (a sample public information template is provided in Appendix 4). At the work sites, public information boards will also be provided to disseminate project related information.

C. Information Disclosure

176. Executive summary of the IEE will be translated in Tamil and made available at the offices of PMU, PIU (TWAD) and CCMC 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 Coimbatore Corporation after approval of the IEE by ADB. Stakeholders will also be made aware of grievance register and redress mechanism. The IEE and environment monitoring reports prepared during the implementation stage will be publicly disclosed on ADB website as required by SPS 2009 and ADB's Access to Information Policy, 2018.

177. 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.

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

VIII. GRIEVANCE REDRESS MECHANISM

179. 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 Project Management Unit(PMU) and Coimbatore Project Implementation Unit (PIU) to be established by TWADBoard will ensure that their grievances are addressed.

180. 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 CCMC or PIU offices. PIU Safeguards officer will have the responsibility for timely grievance redress on safeguards and gender issues and for registration of grievances, related disclosure, and communication with the aggrieved party.

181. 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 multi-tier grievance redress mechanism is conceived, with two phases viz., one at project level and another, beyond project level. For the project level GRM, a Grievance Redress

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

183. 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).

184. In case of grievances that are immediate and urgent in the perception of the complainant, the contractor, 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 CCMC (PIA) level. In the event that certain grievances cannot be resolved even at CCMC(PIA)level, particularly in matters related to land purchase/acquisition, payment of compensation, environmental pollution etc., they will be referred to the district level Grievance Redress Committee (GRC) headed by the District Collector. Any issue which requires higher than district level inter-departmental coordination or grievance redress, will be referred to the state level Steering Committee.

185. GRC will meet every month (if there are pending, registered grievances), determine the merit of each grievance, and resolve grievances within specified time upon receiving the

complaint-filing which the grievance will be addressed by the state-level Steering Committee. The Steering Committee will resolve escalated/unresolved grievances received.

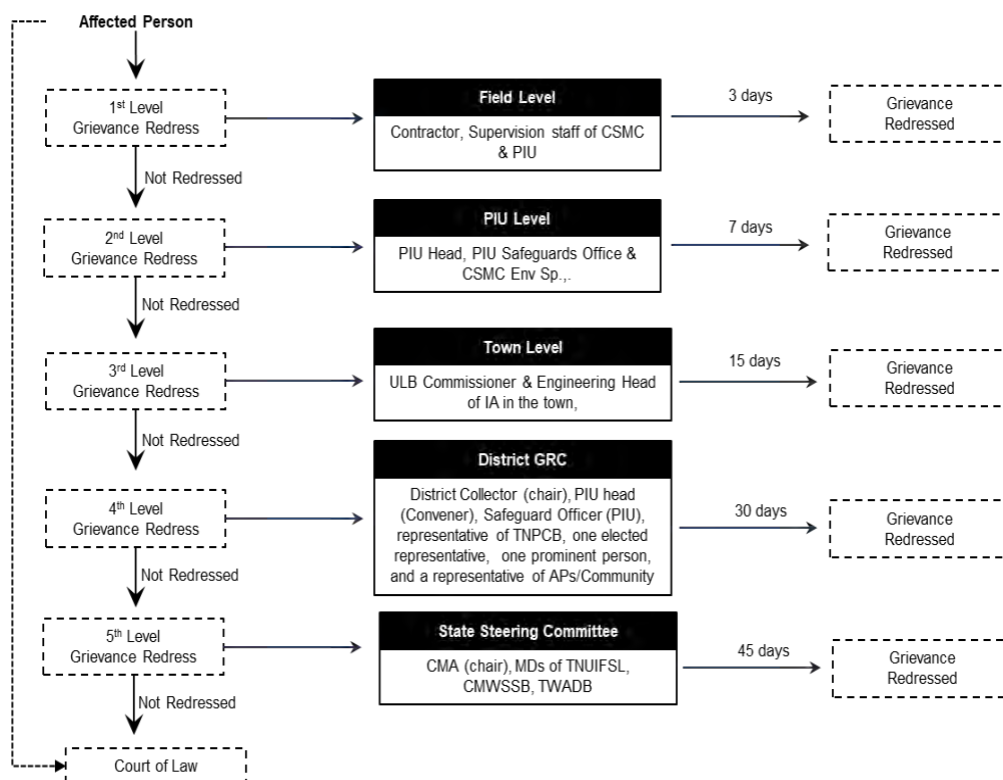
186. **Composition of Grievance Redress Committee.** GRC will be headed by the District Collector, and members include: PIU head, Safeguards Officer of PIU, representative of TNPCB(as a supporting arbitrator to explain and justify the compliance of the norms and rules of TNPCB to the affected in respect of pollution if any), one elected representative / prominent citizen from the area, and a representative of affected community. GRC must have a women member.

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

188. **Areas of Jurisdiction.** The areas of jurisdiction of the GRC, headed by the District Collector will be (i) all locations or sites within the district where subproject facilities are proposed, or (ii) their areas of influence within the District. The SC will have jurisdictional authority across the state (i.e., areas of influence of subproject facilities beyond district boundaries, if any).

189. The multi-tier GRM for the project is outlined below (Figure 31), 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 45: Proposed TNUFIP Grievance Redress Mechanism



190. **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.

191. **Information dissemination methods of the GRM.** The PIU, assisted by CMSC will be responsible for information dissemination to affected persons and general public in the project area on grievance redress mechanism. Public awareness campaign will be conducted to ensure that awareness on the project and its grievance redress procedures is generated. The campaign will ensure that the poor, vulnerable and others are made aware of grievance redress procedures and entitlements per agreed entitlement matrix including. whom to contact and when, where/ how to register grievance, various stages of grievance redress process, time likely to be taken for redress of minor and major grievances, etc. Grievances received and responses provided will be documented and reported back to the affected persons. The number of grievances recorded and resolved and the outcomes will be displayed/disclosed in the PIU, offices, CCMC 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.

192. **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.

193. **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.

194. **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.

195. **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.

IX. ENVIRONMENTAL MANAGEMENT PLAN

A. Environmental Management Plan

196. An Environmental Management Plan (EMP) has been developed to provide mitigation measures to reduce all negative impacts to acceptable levels.

197. The EMP will guide the environmentally-sound construction of the subproject and ensure efficient lines of communication between TNUIFSL (PMU), CCMC (PIA), TWAD (PIU), 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.

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

199. 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.

200. For civil works, the contractor will be required to (i) carry out all of the mitigation and monitoring measures set forth in the approved SEMP; and (ii) implement any corrective or preventative actions set out in safeguards monitoring reports that the employer will prepare from time to time to monitor implementation of this IEE and SEMP. The contractor shall allocate budget for compliance with these SEMP measures, requirements and actions.

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

Table 37: Environmental Impacts and Mitigation Measures – Sewer System

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
Design Stage				
Sewer network	Nuisance due to leaks, overflows, contamination of water supplies, occupation health and safety of workers, etc.	(i) Limit the sewer depth where possible (ii) Sewers shall be laid away from water supply 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 (stoneware pipes shall be avoided) (v) For shallower sewers and especially in narrow roads, use small inspection chambers in lieu of manholes; (vi) Design manhole covers to withstand anticipated loads and ensure that the covers can be readily replaced if broken to minimize silt/garbage entry (vii) Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent buildup of solids and hydrogen sulfide generation (viii) Ensure to conduct a pre-blasting survey through videography and photography of residential properties and other structures falling along the sewerage alignment to ascertain the prevailing conditions of the structures likely to be impacted by the controlled blasting and take adequate measures to minimize such impacts	PIU/CCMC	Project Costs
Sewage pumping stations	Odor nuisance	Measures specific (additional) to New Pumping Station near household area (i) Maintain maximum buffer distance from the nearest residences to the pumping station wells; (ii) Locate pumping station as far as away from the road (iii) Develop green buffer zone around the facility with a combination of tall and densely growing trees in multi rows as per the land availability to control odor and also act as visual shield, and improve aesthetical appearance. Apart from green belt provision, mechanical odour control device has also been proposed. Design measures	PIU /CCMC	Project Costs

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

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		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) Periodically monitor odor generation at pumping stations		
	Sewage pumping and lifting stations located close to houses	(i) For sewage pumping stations which are located adjacent to houses with a buffer distance of less than 20 m 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 pumping stations (ii) For lifting stations, the above arrangement should be provided where the buffer distance between sewage well and nearest house/property is less than 10 m.		
	Noise	(i) Procure good quality latest technology high pressure pumps that guarantee controlled noise at a level of around 80dB(A) at a distance of 1 m (ii) Use appropriate building materials and construction techniques for pump houses which can absorb sound rather than reflect noise (iii) Use acoustic enclosures – manufacturer specified, for all pumps, motors (iv) Procure only CPCB approved generators to meet air emission and noise level requirements (v) Provide sound mufflers for ventilators in the plant rooms; and sound proof doors (vi) Provide ear plugs designated for noise reduction to workers (vii) Ensure to conduct a pre-blasting survey through videography and photography of residential properties and other structures falling along the sewerage alignment to ascertain the d prevailing conditions of the structures likely to be impacted by the controlled blasting and take adequate measures to minimize such impacts.	PIU/CCMC	
Sewerage system	Energy consumption	(i) Using low-noise and energy efficient pumping systems (ii) Efficient Pumping system operation	PIU/CCMC	Project Costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(iii) Installation of Variable Frequency Drives (VFDs)		
	Tree cutting	(i) Minimize removal of trees by adopting to site condition and with appropriate layout design/alignment (ii) Obtain prior permission for tree cutting (iii) Plant and maintain 10 trees for each tree that is removed	PIU/CCMC	Project Costs
Pre-Construction Stage				
Submission of updated Environmental Management Plan (EMP) / SEP; EMP implementation and reporting	Unsatisfactory compliance to EMP	(i) Appoint Environmental Health and Safety (EHS) Supervisor to ensure EMP implementation. (ii) Submission of updated EMP/ SEMP. (iii) Submission of plans along with SEMP • Construction Waste Management Plan (covering spoils, debris, and other waste material generated from construction activity) • Traffic management plan • Occupational and Community Health and Safety Plan, including COVID-19 control and prevention plan • Controlled blasting plan (for hard rock removal/cutting, if required) • Chance find protocol • Temporary labour camp management plan (iv) 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 within proposed project area	(i) Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase; and (ii) Require construction contractors to prepare a contingency plan to include actions to be taken in case of unintentional interruption of services.	Contractor in coordination with PIU	Project cost
Construction work camps, stockpile areas, storage areas, and disposal areas.	Conflicts with local community; disruption to traffic flow and sensitive receptors	(i) Prioritize areas within or nearest possible vacant space in the project location; (ii) If it is deemed necessary to locate elsewhere, consider sites that will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems; (iii) Do not consider residential areas;	Contractor to finalize locations in consultation and approval of PIU	Project cost

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(iv) Take extreme care in selecting sites to avoid direct disposal to water body which will inconvenience the community. (v) For excess spoil disposal, ensure (a) site shall be selected preferably from barren, infertile lands. In case agricultural land needs to be selected, written consent from landowners (not lessees) will be obtained; (b) debris disposal site shall be at least 200 m away from surface water bodies; (c) no residential areas shall be located within 50 m downwind side of the site; and (d) site is minimum 250 m away from sensitive locations like settlements, ponds/lakes or other water bodies.		
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, Objection Certificates (NOCs), etc.	No Failure to obtain necessary consents, permits, NOCs, etc. can result to design revisions and/or stoppage of works	(i) Obtain all necessary consents, permits, clearance, NOCs, etc. prior to award of civil works. (ii) Ensure that all necessary approvals for construction to be obtained by contractor are in place before start of construction (iii) Acknowledge in writing and provide report on compliance all obtained consents, permits, clearance, NOCs, etc.	Contractor and PIU	Cost of obtaining all consents, permits, clearance, NOCs, etc. prior to start of civil works responsibility of PIU.

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
Chance finds	Damage to / disturbance 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
Temporary economic impacts	Disruption to vendors, hawkers on ROW during sewer laying	(i) Contractor is required to provide notice to the shop owners of the need to shift kiosk/wares displayed on ROW as soon as the work plan is ready, with minimum 7 working days. (iii) No works can be commenced unless 100% shifted in sections ready for implementation.	Contractor and PIU	Contractor / PIU
Construction Stage				
EMP Implementation Training	Irreversible impact to the environment, workers, and community	(i) Project manager and all key workers will be required to undergo training on EMP implementation including spoils/waste management, Standard operating procedures (SOP) for construction works; occupational health and safety (OH and S), core labor laws, applicable environmental laws, etc.	Contractor	Contractor cost
Air Quality	Dust, emissions from construction vehicles, equipment, and machinery used for installation of pipelines resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons.	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 works (ii) Damp down the soil and any stockpiled material on site by water sprinkling;(3-4 times a day before the start of work, 1-2 times in between, and at the end of the day); when working in the roads there should permanently be one person responsible for directing when water sprinkling needs to take place to stop the dust moving; (iii) Reduce the need to sprinkle water by stabilizing surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition (iv) Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process (v) Cover the soil stocked at the sites with tarpaulins, and surround by dust screens.	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(vi)Control access to work area, prevent unnecessary movement of vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation (vii)Use tarpaulins to cover the loose material (soil, sand, aggregate etc.,) when transported by open trucks; (viii) Control dust generation while unloading the loose material (particularly aggregate, sand, soil) at the site by sprinkling water and unloading inside the barricaded area; minimize the drop height when moving the excavated soil. (ix)Clean wheels and undercarriage of haul trucks prior to leaving construction site (x) Ensure that all the construction equipment, machinery are fitted with pollution control devises, which are operating correctly, and have a valid pollution under control (PUC) certificate. (xi) No vehicles or plant to be left idling at site generators to be at placed maximum distance from properties For sewer works (i) Barricade the construction area using hard barricades (of 2 m height) on both sides (ii) Initiate site clearance and excavation work only after barricading of the site is done (iii)Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes etc.,), to the barricaded are. (iv) Ensure the adequate cover is provided to the trenches to prevent emission of dust during controlled blasting (v) Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area (vi) Undertake the work section wise: a 500 section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones (vii)Conduct work sequentially - excavation, sewer laying, backfilling; testing section-wise (for a minimum length as possible) so that backfilling, stabilization of soil can be done. (viii)Remove the excavated soil of first section to the disposal site; as the work progresses sequentially, by the time second section is excavated, the first section will be ready for back filling, use the freshly		

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		excavated soil for back filling, this will avoid stocking of material, and minimize the dust. (ix) Backfilled trench at any completed section after removal of barricading will be the main source of dust pollution. The traffic, pedestrian movement and wind will generate dust from backfilled section. Road restoration shall be undertaken immediately. (x) Immediately consolidate the backfilled soil and restore the road surface; if immediate road restoration is not possible, provide a layer of plain cement concrete (PCC) of suitable mix on the backfilled trench so that dust generation, erosion is arrested and it will also provide a smooth riding surface for the traffic until the road is properly restored. Backfilled trench without any road restoration is a major source of dust. (xi) For sections involving controlled blasting, ensure that dust curtains of adequate height are provided to the trenches to prevent emission of dust during drilling for charge holes and controlled blasting. (xii) Ensure that the excavated soil and debris along the section identified for blasting sprinkled with adequate water prior to blasting to reduce dust emissions upon explosion of charge placed for breaking the hard rock.		
Surface water quality	Mobilization of settled silt materials, and chemical contamination from fuels and lubricants during construction can contaminate nearby surface water quality. Ponding of water in the pits/foundation excavations	(i) All earthworks be conducted during the dry season to prevent the problem of soil/silt run-off during rains (ii) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; do not stock earth/material close to water bodies (at least 100 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	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(vii) Dispose any wastes generated by construction activities in designated sites; (viii) Conduct surface quality inspection according to the Environmental Management Plan (EMP).		
	Water accumulation in trenches/pits	(i) As far as possible control the entry of runoff from upper areas into the excavated pits, and work area by creation of temporary drains or bunds around the periphery of work area (ii) Pump out the water collected in the pits / excavations to a temporary sedimentation pond; dispose off only clarified water into drainage channels/streams after sedimentation in the temporary ponds (iii) Consider safety aspects related to pit collapse due to accumulation of water	Contractor	Contractor cost
Noise Levels	Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people	(i) Plan activities in consultation with PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; especially near schools and other sensitive receptors (ii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and use portable street barriers to minimize sound impact to surrounding sensitive receptor; and (iii) Maintain maximum sound levels not exceeding 80 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s. (iv) Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity; if any building at risk, structural survey be completed prior to work, to provide baseline in case any issues from vibration, and if building is structurally unsound that measures taken to avoid any further damage (v) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach; (vi) Consult local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as night times, religious and cultural festivals.	Contractor	Contractor cost
Removal of rock during excavation for sewer works	Increase in vibration due to the controlled	(i) During excavation for sewer works, wherever removal of rock, if any, is identified, alternatives like drilling and chiseling, controlled blasting, etc., will be examined and the suitable technology shall be finalized	Construction Contractor	Cost for implementation of

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
	blasting and associated activities.	depending upon the site conditions. Following measures for ensuring safety shall be ensured during controlled blasting. (ii) Carryout controlled blasting in consultation with PIU so that blasting activities with the least potential to generate vibration are conducted during periods of the day which will result in least disturbance; especially near schools and other sensitive receptors (iii) Permission shall be obtained from The District Collector for controlled blasting for excavation. Conditions stipulated in the permission issued by the District Collector shall be complied with during implementation. (iv) The contractor shall submit a blasting plan in advance to PIU; and implement in accordance to the plan. (v) Blasting shall be done through an Licensed Explosive Contractor only (vi) For controlled blasting, explosives including blasting caps, shall be transported to the blasting site only through exclusive vehicle in safe manner in accordance with the requirements of the blasting license. After blasting is over, the balance explosives shall be returned to the licensed storage. (vii) Cost for implementation of mitigation measures and liability are the responsibility of contractor. (viii) Proper prior notice will be issued to the Residents before Commencing UGSS activity works Schedule. (ix) Proper information will be Given to Police Officials. (x) Workers (Flagman) shall be stationed on both end of roads to warn people before firing any blasts and not to permit the traffic. (xi) When blasting, ample warning shall be given to all persons within the vicinity prior to blasting. Warning signs shall be erected a minimum of 24 hours prior to the blast time. The warning signs will state the time and date of each blast. (xii) Contractor shall ensure necessary precautions / protection (like excavated earth, sand-filled bags, etc.) to reduce Ground Vibrations, Reduce noise levels, etc. Sites shall be provided with necessary shields all around. (xiii) Minimum Explosive will be used for Control Blasting for Residential areas.		mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(xiv) After a blast has been fired, the Blast Control Specialist shall make a careful inspection to determine that all charges have exploded before employees are allowed to return to the operation. (xv) The contractor shall be responsible for any and all damage to property or injury to persons resulting from blasting or accidental or premature explosions that may occur in connection with his use of explosives. (xvi) The contractor shall do the activities after obtaining the blasting permission from District Collector, Coimbatore. (xvii) For the diversion of traffic in the blasting area, the contractor shall prepare a traffic management plan and obtain permission from Coimbatore City Municipal Corporation and Traffic Police. (xviii) Ensure to conduct a pre-blasting survey through videography and photography of residential properties and other structures falling along the sewerage alignment to ascertain the d prevailing conditions of the structures likely to be impacted by the controlled blasting and take adequate measures to minimize such impacts		
Landscape aesthetics – and waste generation	Impacts due to excess excavated earth, excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items.	(i) Prepare and implement a Construction Waste Management Plan (refer Appendix 3) (ii) As far as possible utilize the debris and excess soil in construction purpose, for example for raising the ground level or construction of access roads etc., (iii) Avoid stockpiling any excess spoils at the site for long time. Excess excavated soils should be disposed 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;	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(viii) Ensure that wastes are not haphazardly thrown in and around the project site; provide proper collection bins, and create awareness to use the dust bins, recycle waste material where possible. (ix) Conduct site clearance and restoration to original condition after the completion of construction work; PIU to ensure that site is properly restored prior to issuing of construction completion certificate		
Accessibility and traffic disruptions	Traffic problems and conflicts near project locations and haul road	Sewer works (i) Prepare a sewer work implementation plan in each zone separately and undertake the work accordingly; ensure that for each road where the work is being undertaken there is an alternative road for the traffic diversion; take up the work in sequential way so that public inconvenience is minimal; prepare traffic management plans for each section (refer sample in Appendix 6) (ii) Plan the sewer work in coordination with the traffic police; provide temporary diversions, where necessary with clear signage and effectively communicate with general public (iii) Avoiding conducting work in all roads in a colony at one go; it will render all roads unusable due to excavations at the same time, creating large scale inconvenience (iv) Undertake the work section wise: a 500 section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones (v) Confine work areas in the road carriageway to the minimum possible extent; all the activities, including material and waste/surplus soil stocking should be confined to this area. Proper 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	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		not be blocked completely; alternative arrangements, at least to maintain pedestrian access at all times to be provided (viii) Provide pedestrian access in all the locations; provide wooden/metal planks with safety rails over the open trenches at each house to maintain the access. (ix) Inform the affected local population in advance about the work schedule, a week before, and a day before to start of work (x) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum. (xi) Keep the site free from all unnecessary obstructions; (xii) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints. Provide information to the public through media – newspapers and local cable television (TV) services (xiii) At work site, public information/caution boards shall be provided including contact for public complaints Controlled Blasting : (i) The contractor shall submit a blasting plan in advance to PIU; and implement in accordance to the plan. (ii) Proper prior notice will be issued to the Residents before commencing UGSS activity works schedule. (iii) Proper information will be given to Police Officials. (iv) Workers (Flagman) shall be stationed on both ends of roads to warn people before firing any blasts and not to permit the traffic. (iv) When blasting, ample warning shall be given to all persons within the vicinity prior to blasting. Warning signs shall be erected a minimum 24 hours prior to the blast time. The warning signs will state the time and date of each blast. (v) For the diversion of traffic, permission from Coimbatore City Municipal Corporation and Traffic Police. Hauling (material, waste/debris and equipment) activities (i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites (ii) Schedule transport and hauling activities during non-peak hours; (peak hours 7 to 10 AM and 4 to 7 PM);		

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(iii) Locate entry and exit points in areas where there is low potential for traffic congestion; (iv) Drive vehicles in a considerate manner (v) Notify affected public by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.		
Controlled blasting	Ground vibrations, Noise (air blast), Flying debris, Dust	(i) Carryout controlled blasting in consultation with PIU so that blasting activities are conducted during periods of the day which will result in least disturbance especially near schools and other sensitive receptors. (ii) The contractor shall submit a blasting plan in advance to PIU for approval; and implement in accordance to the plan once approved. (iii) The controlled blasting at identified locations shall be permitted only after the requisite statutory permissions from regulatory authorities are obtained. The contractor shall comply with all terms and conditions stipulated in such permissions. The controlled blasting would be monitored by following the necessary requirements to prevent safety risk to both public and nearby structures as provisioned in the prevailing Indian regulations and standards. (iv) Blasting shall be carried out through a Licensed Explosive Contractor only. (v) For controlled blasting, explosives including blasting caps, shall be transported to the blasting site only through exclusive vehicle in safe manner in accordance with the requirements of the blasting license. After blasting is over, the balance explosives shall be returned to the licensed storage. (vi) Cost for implementation of mitigation measures and liability are the responsibility of contractor. (vii) Proper prior notice will be issued to the residents before commencing blasting activity works. Inform the residents likely to be affected by the works in the locality about the upcoming blasting works well in advance so that necessary arrangements are planned by the residents with reduced inconvenience. (viii) For sections where the controlled blasting is proposed, the residents shall be provided with the schedule of blasting at least three days in advance and the residents are explained about the preventive,	Contractor	Contractor Cost

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		precautionary, mitigation and emergency response measures being taken to address their concerns. (ix) Prior information will be given to Police Officials. (x) Workers (Flagman) shall be stationed on both ends of roads to warn people before firing any blasts and not to permit the traffic. The section proposed for blasting shall be supervised by properly trained staff to ensure no movement of pedestrians, motorized or nonmotorized vehicles, and residents takes place during blasting within the area of influence. For the diversion of traffic in the blasting area, the contractor shall prepare a traffic management plan and obtain permission from CCMC and Traffic Police. (xi) When blasting, ample warning shall be given to all persons within the vicinity prior to blasting. Warning signs shall be erected a minimum of 24 hours prior to the blast time. The warning signs will state the time and date of each blast. (xii) Sites shall be provided with necessary shields all around. (xiii) Minimum explosive will be used for Controlled Blasting specifically within residential areas. (xiv) After a blast has been fired, the Blast Control Specialist shall make a careful inspection to determine that all charges have exploded before employees are allowed to return to the operation, and subsequently the movement of residents /pedestrians and vehicles is permitted. (xv) Ensure appropriate measures are taken to maintain maximum ambient noise levels within the limits as permitted by the prevailing Indian regulations and standards. The ambient noise levels would be monitored to ascertain the efficacy of acoustic measures thus implemented and compliance with associated regulatory permissions. (xvi) Ensure that adequate precautions are taken to avoid flying debris post blasting (such as covering the trench with sturdy metallic sheets with sand filled bags to absorb the blast waves); (xvii) For sections involving controlled blasting, ensure that dust curtains of adequate height are provided to the trenches to prevent emission of dust during drilling for charge holes and controlled blasting. (xix) Ensure that the excavated soil and debris along the section identified for blasting is sprinkled with adequate water prior to blasting		

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		to reduce dust emissions upon explosion of charge placed for breaking the hard rock. (xx)The project staff from the PIU, consultants and contractors would undertake a post-blasting survey of structures (including videography and/or photography) lying within the area of influence of blasting from the vibrations related impacts (preferably in the presence of the owners of the said structures) to assess and/or ascertain regarding the damages, if any, caused to the structures because of blasting activities. (xxi)The contractor shall be responsible for any and all damages to property or injury to persons resulting from blasting or accidental or premature explosions that may occur in connection with use of explosives. The log of such events would be properly maintained. The contractor shall provide immediate support and relief measures commensurate with the damages. (xxii)Training related to controlled blasting activity will be included in the overall safeguards training programme meant for PIUs and Contractors.		
Socio-Economic Loss of access to houses and business	Loss of income	(i) Inform all businesses and residents about the nature and duration of any work well in advance so that they can make necessary preparations; (ii)Do not block any access; leave spaces for access between barricades/mounds of excavated soil and other stored 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	Responsibility of 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	Contract or 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 (OH and S) Plan informed by OHS risk assessment seeking to avoid, minimise 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) OH and S Training for all site personnel, (d) excluding public from the work sites; and (e) documentation of work-related accidents;Follow International Standards such as the World Bank Group's Environment, Health and Safety Guidelines ¹⁰ .For controlled blasting activity, identify the risks involved for the labourers and public and include measures in the OHS plan. Provide necessary training and PPEs to the labourers to ensure safety during implementation. (iii) Ensure that qualified first-aid is provided at all times. Equipped first-aid stations shall be easily accessible throughout the sites; (iv) Secure all installations from unauthorized intrusion and accident risks (v) Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;	Contractor	Contractor cost

¹⁰<http://www.ifc.org/wps/wcm/connect/a99ab8804365b27aa60fb6d3e9bda932/EHS-Guidelines+101-Webinar.pdf?MOD=AJPERES>

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(vi) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; (vii) Ensure the visibility of workers through their use of high visibility vests and other PPE when working in or walking through heavy equipment operating areas; (viii) Ensure moving equipment is outfitted with audible back-up alarms; (ix) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and (x) Disallow worker exposure to noise level greater than 85 dBA for duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively. (xi) Provide supplies of potable drinking water; (xii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances		
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians during 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 100m buffer shall be maintained) or locate the camp site within the existing facilities of City Corporation (iii) Avoid tree cutting for setting up camp facilities (iv) Provide a proper fencing/compound wall for camp sites (v) Camp site shall not be located near (100 m) water bodies, flood plains flood prone/low lying areas, or any ecologically, socially, archeologically sensitive areas (vi) Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit (vii) Ensure conditions of 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	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		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) For MSW and C&D waste disposal, it will be carried out properly in consultation and coordination with the ULB (CCMC) and locations indicated by them. (xvi) Remove all wreckage, rubbish, or temporary structures which are no longer required; and (xvii) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to PIU; PIU to review and approve camp clearance and closure of work site		
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; 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	Responsibility of 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 livability at work camps are maintained at the highest standards possible at all times; (vii) Consult PIU before locating project offices, sheds, and construction plants; (viii) Minimize removal of vegetation and disallow cutting of trees (ix) Ensure conditions of livability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be allowed as accommodation for workers (x) Camp shall be provided with proper drainage, there shall not be any water accumulation (xi) Provide drinking water, water for other uses, and sanitation facilities for employees (xii) Prohibit employees from cutting of trees for firewood; contractor should be provide proper facilities including cooking fuel (oil or gas; fire wood not allowed) (xiii) Train employees in the storage and handling of materials which can potentially cause soil contamination (xiv) Recover used oil and lubricants and reuse or remove from the site (xv) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; provide a compost pit for biodegradable waste, and non-biodegradable / recyclable waste shall be collected and sold in local market (xvi) Remove all wreckage, rubbish, or temporary structures which are no longer required (xvii) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to PIU; PIU to review and approve camp clearance and closure of work site		

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
COVID 19 control measures	Health & Safety of the labourers and community	(i) Construction sites operating during the COVID-19 pandemic need to ensure they are protecting their Workforce and minimising the risk of spread of infection. (ii) Awareness shall be created among Labourer's through trainings, orientation of COVID related regulations. (iii) COVID 19 related hygiene facilities and guidance shall be made available for the labourers in the work site and accommodation. (iv) SOPs and guidelines issued by GOI and Go TN from time to time to prevent spread of Covid19 are adhered to in the work sites and camp area during sub-project implementation.	Contractor	Contractor cost
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 re-vegetation 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
Operation Stage				
Operation of sewage lifting and pumping stations	Odor nuisance	(i) Strictly follow standard operating procedures / operational manual for operation and maintenance of lifting and pump stations (ii) Ensure that operating staff is properly trained, and have clear understanding of odor issues vis-à-vis its related with operational practices (iii) Ensure that pumping cycles are properly followed; and there is no buildup of sewage beyond design volume in the wells	PIU and CCMC	Operating costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(iv) Conduct H ₂ S monitoring periodically (v) Concentration of hydrogen sulphide, which is a flammable and highly toxic gas, in or near sewage infrastructure (sewers, man holes, sewage sumps, septic tanks, STPs) etc, is highly dangerous to operation and maintenance personnel and may lead to inhalation deaths if works are conducted in such conditions. Appropriate and safe conditions shall be ensured prior to start of any works; H ₂ S levels confirming to ILO ¹¹ threshold limits ¹² shall be ensured (1 ppm as TWA (time weighted average) usually 8 hours and 5 ppm as STEL (short-term exposure limit) which is usually 15 minutes.		
Operation and maintenance of sewerage system	Blocks, overflows, system malfunction, occupational health and safety	(i) Establish regular maintenance program, including: - Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas - Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration; and - Monitoring of sewer flow to identify potential inflows and outflows - Conduct repairs on priority based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages); (ii) Maintain records; review previous sewer maintenance records to help identify “hot spots” or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed; (iii) When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open	PIU and CCMC	Operating costs

¹¹ International Labour Organization

¹² https://www.ilo.org/dyn/icsc/showcard.display?p_card_id=0165&p_version=1&p_lang=en

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		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 (ix) Concentration of hydrogen sulphide, which is a flammable and highly toxic gas, in or near sewage infrastructure (sewers, man holes, sewage sumps, septic tanks, STPs) etc, is highly dangerous to operation and maintenance personnel and may lead to inhalation deaths if works are conducted in such conditions. Appropriate and safe conditions shall be ensured prior to start of any works; H₂S levels confirming to ILO¹³ threshold limits¹⁴ shall be ensured (1 ppm as TWA (time weighted average) usually 8 hours and 5 ppm as STEL (short-term exposure limit) which is usually 15 minutes.		

¹³ International Labour Organization

¹⁴ https://www.ilo.org/dyn/icsc/showcard.display?p_card_id=0165&p_version=1&p_lang=en

Table 38: Environmental Impacts and Mitigation Measures - Sewage Treatment Plant

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
Design Stage				
Design of STP	Deficient treatment due to substandard operation / system malfunction	(i) Design process to meet the CPCB disposal standards of inland water disposal ¹ (i) Ensuring continuous uninterrupted power supply, including a back-up facility (such as generator) (ii) Providing operating manual with all standard operating procedures (SOPs) for operation and maintenance of the facility (iii) Necessary training to CCMC staff dealing with STP. (iv) Extended contractor period for O&M, proper transfer of facility to CCMC with adequate technical know-how on O&M and hands-on training to CCMC staff (v) Provision for online monitoring of crucial wastewater quality parameters at the inlet and outlet of the plant (BOD, pH, ammonia etc.,)	DBOT Contractor and PIU	Project cost – DBOT Contract.
Access Road STP (Zone V) at Chokkampudur	Narrow access road via crematorium/burial ground; risk of damage to cultural and inconvenience to public using crematorium/burial ground	(i) Form an access road in the available vacant land, such as next to compost plant with necessary clearance upto STP site prior to start of works; (ii) PIU will finalize the alignment in consultation with CCMC and road configuration to use it for both construction and operation purposes.	DBOT Contractor and PIU	Project cost – DBOT Contract.

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
Discharge of treated wastewater into Periyakulam (Vadavalli & Veerakeralam areas) and into Noyyal River (Kavundampalayam & Thudiyalur areas)	Baseline water quality and impact due to disposal	(i) Conduct detailed water quality assessment of receiving water body (Periyakulam and Noyyal River) STP discharge point including a control point on upstream (ii) Monitor water quality periodically during operation phase as per the Environmental Monitoring Plan	DBOT Contractor and PIU	Project cost – DBOT Contract
	Odor nuisance	(i) Site layout design of STP within allocated 4 acre land at both the STP sites at Chokkampudur and Kavundampalayam., maintaining adequate buffer to all boundaries. (ii) Providing a green buffer zone of 7-10m wide all around the STP with trees and landscaping. This will act as a visual screen around the facility and will improve the aesthetic appearance. Treated wastewater will be used for landscaping.	DBOT Contractor and PIU	Project cost - DBOT Contract
	Sludge disposal	(i) Prepare sludge management plan to ensure safe collection, adequate treatment prior to reuse / disposal (ii) Conduct periodic testing of sludge to check its quality according to set standards for reuse as manure/soil conditioner (iii) Provide training on safe handling of sludge, along with proper apparatus and personnel protection equipment (PPEs) to workers	DBOT Contractor and PIU	Project cost - DBOT Contract

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
	Noise	(i) Procure good quality latest technology high pressure pumps that guarantee controlled noise at a level of around 80 dB(A) at a distance of 1 m (ii) Use appropriate building materials and construction techniques for sewage pumping stations which can absorb sound rather than reflect noise (iii) Use acoustic enclosures – manufacturer specified, for all pumps, motors (iv) Procure only Central Pollution Control Board (CPCB) approved generators with low emission and low noise fitted with acoustic enclosures (v) Provide sound mufflers for ventilators in the plant rooms; and sound proof doors (vi) Provide ear plugs to workers	DBOT Contractor and PIU	Project cost – DBOT Contractor
STP operation	Energy consumption	(i) Using low-noise and energy efficient pumping systems (ii) Efficient Pumping system operation (iii) Installation of Variable Frequency Drives (VFDs)	DBOT Contractor and PIU	Project cost - DBOT Contractor
Construction subproject components of	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, if necessity arises. (iii) Plant and maintain 10 trees on the bank of ponds under smart city scheme of CCMC for each tree that is removed	DBOT Contractor and PIU	Project cost - DBOT Contractor

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
Pre-Construction Stage				
Submission of updated Environmental Management Plan (EMP) / SEP; EMP implementation and reporting	Unsatisfactory compliance to EMP	(i) Appoint Environmental Health and Safety (EHS) Supervisor to ensure EMP implementation. (ii) Submission of updated EMP/ SEMP. (iii) Submission of plans along with SEMP • Construction Waste (Spoils) Management Plan • Traffic management plan • Occupational Health and Safety Plan, including COVID-19 control and prevention plan • Controlled blasting plan (for hard rock removal/cutting) • Chance find protocol • Temporary labour camp management plan	Contractor	Contractor cost
Construction work camps, stockpile areas, storage areas, and disposal areas.	Conflicts with local community; disruption to traffic flow and sensitive receptors	(i) Prioritize areas within or nearest possible vacant space in the project location; (ii) If it is deemed necessary to locate elsewhere, consider sites that will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems; (iii) Do not consider residential areas; (iv) Take extreme care in selecting sites to avoid direct disposal to water body which will inconvenience the community. (v) For excess spoil disposal, ensure (a) site shall be selected preferably from barren, infertile lands. In case agricultural land needs to be selected, written consent from landowners (not lessees) will be obtained; (b) debris disposal site shall be at least 200 m away from surface water bodies; (c) no residential areas shall be located within 50 m downwind side of the site; and (d) site is minimum 250 m away from sensitive locations like settlements, ponds/lakes or other water bodies.	Contractor to finalize locations in consultation and approval of PIU	Project cost

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
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 and/or stoppage of works	(i) Obtain all necessary consents, permits, clearance, NOCs, etc. prior to award of civil works. (ii) Ensure that all necessary approvals for construction to be obtained by contractor are in place before start of construction (iii) Acknowledge in writing and provide report on compliance all obtained consents, permits, clearance, NOCs, etc.	Contractor and PIU	Cost of obtaining all consents, permits, clearance, NOCs, etc. prior to start of civil works responsibility of PIU.
Chance finds	Damage / disturbance to artifacts	(i) Construction contractors to follow these measures in conducting any excavation work (ii) Create awareness among the workers, supervisors and engineers about the chance finds during excavation work (iii) Stop work immediately to allow further investigation if any finds are suspected; (iv) Inform State Archaeological Department if a find is suspected, and taking any action they require to ensure its removal or protection in situ.	Contractor and PIU	Contractor cost
Construction Stage				

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
EMP Implementation Training	Irreversible impact to the environment, workers, and community	(i) Project manager and all key workers will be required to undergo training on EMP implementation including spoils/waste management, Standard operating procedures (SOP) for construction works; occupational health and safety (OH and S), core labor laws, applicable environmental laws, etc.	Contractor	Contractor cost
Air Quality	Dust, emissions from construction vehicles, equipment, and machinery used for installation of pipelines resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons.	(i) Provide a dust screen (6 m high) around the construction sites of STP's; provide 2 m high barricades for the sewer works (ii) Damp down the soil and any stockpiled material on site by water sprinkling;(3-4 times a day before the start of work, 1-2 times in between, and at the end of the day); when working in the roads there should permanently be one person responsible for directing when water sprinkling needs to take place to stop the dust moving; (iii) Reduce the need to sprinkle water by stabilizing surface soils where loaders, support equipment and vehicles will operate by using water and maintain surface soils in a stabilized condition (iv) Apply water prior to levelling or any other earth moving activity to keep the soil moist throughout the process (v) Cover the soil stocked at the sites with tarpaulins, and surround by dust screens. (vi)Control access to work area, prevent unnecessary movement of vehicle, public trespassing into work areas; limiting soil disturbance will minimize dust generation (vii)Use tarpaulins to cover the loose material (soil, sand, aggregate etc.,) when transported by open trucks; (viii) Control dust generation while unloading the loose material (particularly aggregate, sand, soil) at the site by sprinkling water and unloading inside the barricaded area; minimize the drop height when moving the excavated soil. (ix)Clean wheels and undercarriage of haul trucks prior to leaving construction site (x) Ensure that all the construction equipment, machinery are fitted with pollution control devises, which are operating correctly, and have a valid pollution under control (PUC) certificate. (xi) No vehicles or plant to be left idling at site generators to be at placed maximum distance from properties	Contractor	Contractor cost
Surface water quality	Mobilization of settled silt	(i)All earthworks be conducted during the dry season to prevent the problem of soil/silt run-off during rains	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
	materials, and chemical contamination from fuels and lubricants during construction can contaminate nearby surface water quality. Ponding of water in the pits/foundation excavations	(ii) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; do not stock earth/material close to water bodies (at least 100 m) (iii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, only designated disposal areas shall be used; (iv) Install temporary silt traps, oil traps, or sedimentation basins along the drainage leading to the water bodies; (v) Place storage areas (with impermeable surface) for fuels and lubricants away from any drainage leading to water bodies; these should be at least 100 m away from water bodies and groundwater wells) (vi) Store fuel, construction chemicals etc., on an impervious floor, also avoid spillage by careful handling; provide spill collection sets for effective spill management (vii) Dispose any wastes generated by construction activities in designated sites; (viii) Conduct surface quality inspection according to the Environmental Management Plan (EMP).		
	Water accumulation in trenches/pits	(i) As far as possible control the entry of runoff from upper areas into the excavated pits, and work area by creation of temporary drains or bunds around the periphery of work area (ii) Pump out the water collected in the pits / excavations to a temporary sedimentation pond; dispose off only clarified water into drainage channels/streams after sedimentation in the temporary ponds (iii) Consider safety aspects related to pit collapse due to accumulation of water	Contractor	Contractor cost
Noise Levels	Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people	(i) Plan activities in consultation with PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; especially near schools and other sensitive receptors (ii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and use portable street barriers to minimize sound impact to surrounding sensitive receptor; and (iii) Maintain maximum sound levels not exceeding 80 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	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		risk, structural survey be completed prior to work, to provide baseline in case any issues from vibration, and if building is structurally unsound that measures taken to avoid any further damage (v)Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach; (vi)Consult local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as night times, religious and cultural festivals.		
Traffic disruptions	Traffic problems and conflicts	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.	Contractor	Contractor cost
Landscape aesthetics – waste generation	Impacts due to excess excavated earth, excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items.	(i) Prepare and implement a Construction Waste Management Plan (refer Appendix 3) (ii) As far as possible utilize the debris and excess soil in construction purpose, for example for raising the ground level or construction of access roads etc., (iii) Avoid stockpiling any excess spoils at the site for long time. Excess excavated soils should be disposed 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	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(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		
Controlled blasting	Ground vibrations, Noise (air blast), Flying debris, Dust	(i) i) Carryout controlled blasting in consultation with PIU so that blasting activities are conducted during periods of the day which will result in least disturbance especially near schools and other sensitive receptors. (ii) The contractor shall submit a blasting plan in advance to PIU for approval; and implement in accordance to the plan once approved. (iii) The controlled blasting at identified locations shall be permitted only after the requisite statutory permissions from regulatory authorities are obtained. The contractor shall comply with all terms and conditions stipulated in such permissions. The controlled blasting would be monitored by following the necessary requirements to prevent safety risk to both public and nearby structures as provisioned in the prevailing Indian regulations and standards. (iv) Blasting shall be carried out through a Licensed Explosive Contractor only. (v) For controlled blasting, explosives including blasting caps, shall be transported to the blasting site only through exclusive vehicle in safe manner in accordance with the requirements of the blasting license. After blasting is over, the balance explosives shall be returned to the licensed storage. (vi) Cost for implementation of mitigation measures and liability are the responsibility of contractor. (vii) Proper prior notice will be issued to the residents before commencing blasting activity works. Inform the residents likely to be affected by the works in the locality about the upcoming blasting works well in advance so that necessary arrangements are planned by the residents with reduced inconvenience.	Contractor	Contractor Cost

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(viii) For sections where the controlled blasting is proposed, the residents shall be provided with the schedule of blasting at least three days in advance and the residents are explained about the preventive, precautionary, mitigation and emergency response measures being taken to address their concerns. (ix) Prior information will be given to Police Officials. (x) Workers (Flagman) shall be stationed on both ends of roads to warn people before firing any blasts and not to permit the traffic. The section proposed for blasting shall be supervised by properly trained staff to ensure no movement of pedestrians, motorized or non-motorized vehicles, and residents takes place during blasting within the area of influence. For the diversion of traffic in the blasting area, the contractor shall prepare a traffic management plan and obtain permission from CCMC and Traffic Police. (xi) When blasting, ample warning shall be given to all persons within the vicinity prior to blasting. Warning signs shall be erected a minimum of 24 hours prior to the blast time. The warning signs will state the time and date of each blast. (xii) Sites shall be provided with necessary shields all around. (xiii) Minimum explosive will be used for Controlled Blasting specifically within residential areas. (xiv) After a blast has been fired, the Blast Control Specialist shall make a careful inspection to determine that all charges have exploded before employees are allowed to return to the operation, and subsequently the movement of residents /pedestrians and vehicles is permitted. (xv) Ensure appropriate measures are taken to maintain maximum ambient noise levels within the limits as permitted by the prevailing Indian regulations and standards. The ambient noise levels would be monitored to ascertain the efficacy of acoustic measures thus implemented and compliance with associated regulatory permissions. (xvi) Ensure that adequate precautions are taken to avoid flying debris post blasting (such as covering the trench with sturdy metallic sheets with sand filled bags to absorb the blast waves); (xvii) For sections involving controlled blasting, ensure that dust curtains of adequate height are provided to the trenches to prevent emission of dust during drilling for charge holes and controlled blasting.		

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(xix) Ensure that the excavated soil and debris along the section identified for blasting is sprinkled with adequate water prior to blasting to reduce dust emissions upon explosion of charge placed for breaking the hard rock. (xx) The project staff from the PIU, consultants and contractors would undertake a post-blasting survey of structures (including videography and/or photography) lying within the area of influence of blasting from the vibrations related impacts (preferably in the presence of the owners of the said structures) to assess and/or ascertain regarding the damages, if any, caused to the structures because of blasting activities. (xxi) The contractor shall be responsible for any and all damages to property or injury to persons resulting from blasting or accidental or premature explosions that may occur in connection with use of explosives. The log of such events would be properly maintained. The contractor shall provide immediate support and relief measures commensurate with the damages. (xxii) Training related to controlled blasting activity will be included in the overall safeguards training programme meant for PIUs and Contractors.		
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 (OH and S) Plan informed by OHS risk assessment seeking to avoid, minimise 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) OH and S Training for all site personnel, (d) excluding public from the work sites; and (e) documentation of work-related accidents; Follow International Standards such as the World Bank Group's Environment, Health and Safety Guidelines¹⁵. For controlled blasting activity, identify the risks involved for the labourers and public and include measures in the OHS plan. Provide necessary training and PPEs to the labourers to ensure safety during implementation.	Contractor	Contractor cost

¹⁵<http://www.ifc.org/wps/wcm/connect/a99ab8804365b27aa60fb6d3e9bda932/EHS-Guidelines+101-Webinar.pdf?MOD=AJPERES>

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(iii) Ensure that qualified first-aid is provided at all times. Equipped first-aid stations shall be easily accessible throughout the sites; (iv) Secure all installations from unauthorized intrusion and accident risks (v) Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; (vi) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; (vii) Ensure the visibility of workers through their use of high visibility vests and other PPE when working in or walking through heavy equipment operating areas; (viii) Ensure moving equipment is outfitted with audible back-up alarms; (ix) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and (x) Disallow worker exposure to noise level greater than 85 dBA for duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively. (xi) Provide supplies of potable drinking water; (xii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances		
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians during 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 100m buffer shall be maintained) or locate the camp site within the existing facilities of City Corporation (iii) Avoid tree cutting for setting up camp facilities (iv) Provide a proper fencing/compound wall for camp sites (v) Camp site shall not be located near (100 m) water bodies, flood plains flood prone/low lying areas, or any ecologically, socially, archeologically sensitive areas (vi) Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(vii) Ensure conditions of livability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be used as accommodation for workers (viii) Camp shall be provided with proper drainage, there shall not be any water accumulation (ix) Provide drinking water, water for other uses, and sanitation facilities for employees; ; drinking water should be regularly tested to confirm that drinking water standards are met (x) Prohibit employees from cutting of trees for firewood; contractor should provide cooking fuel (cooking gas); fire wood not allowed (xi) Train employees in the storage and handling of materials which can potentially cause soil contamination (xii) Wastewater from the camps shall be disposed properly either into sewer system; if sewer system is not available, provide on-site sanitation with septic tank and soak pit arrangements(100 m away from surface water body or groundwater well) (xiii) Recover used oil and lubricants and reuse or remove from the site; (xiv) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; provide a compost pit for bio degradable waste, and non-biodegradable / recyclable waste shall be collected and sold in local market. (xv) For MSW and C&D waste disposal, it will be carried out properly in consultation and coordination with the ULB (CCMC) and locations indicated by them. (xvi) Remove all wreckage, rubbish, or temporary structures which are no longer required; and (xvii) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to PIU; PIU to review and approve camp clearance and closure of work site		
Work Camps and worksites	Temporary air and noise pollution from machine operation, water pollution from	(i) As far as possible located the camp site within the work 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	Contractor	Contractor cost

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
	storage and use of fuels, oils, solvents, and lubricants Unsanitary and poor living conditions for workers	(iii) Ensure that a proper compound wall is provided, and erect a wind/dust screen around (iv) Camp site shall not be located near (100 m) water bodies, flood plains flood prone/low lying areas, or any ecologically, socially, archeologically sensitive areas (v) Separate the workers living areas and material storage areas clearly with a fencing and separate entry and exit (vi) Provide proper temporary accommodation with proper materials, adequate lighting and ventilation, appropriate facilities for winters and summers; ensure conditions of livability at work camps are maintained at the highest standards possible at all times; (vii) Consult PIU before locating project offices, sheds, and construction plants; (viii) Minimize removal of vegetation and disallow cutting of trees (ix) Ensure conditions of livability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be allowed as accommodation for workers (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		

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(xvii) At the completion of work, camp area shall be cleaned and restored to pre-project conditions, and submit report to PIU; PIU to review and approve camp clearance and closure of work site		
COVID 19 control measures	Health & Safety of the labourers and community	(i) Construction sites operating during the COVID-19 pandemic need to ensure they are protecting their Workforce and minimising the risk of spread of infection. (ii) Awareness shall be created among Labourer's through trainings, orientation of COVID related regulations. (iii) COVID 19 related hygiene facilities and guidance shall be made available for the labourers in the work site and accommodation. (iv) SOPs and guidelines issued by GOI and Go TN from time to time to prevent spread of Covid19 are adhered to in the work sites and camp area during sub-project implementation.	Contractor	Contractor cost
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 re-vegetation 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
Operation Stage				
STP operation – malfunction and effect on efficiency	Public health, safety and environmental impacts	(i) Ensure proper knowledge transfer, hands-on training to municipal staff engaged in STP operation has been provided by contractor prior to handover of facility (ii) Ensure continuous uninterrupted power supply (iii) Operate and maintain the facility following standard operating procedures of operational manual	DBOT Contractor and PIU / CCMC	Operating costs

Field	Anticipated Impact	Mitigation Measures	Responsibility of Mitigation	Cost and Source of Funds
		(iv) Undertake preventive and periodic maintenance activities as required (v) Maintain the mechanical / electrical parts as per the maintenance plan to avoid any hazards (vi) Conduct periodic training to workers (vii) Ensure that all safety apparatus at STP including personal protection equipment are in good condition all times; and are at easily accessible and identifiable place; periodically check the equipment, and conduct mock drills to deal with emergency situations (viii) Implement sludge management plan at the STP. sludge management to collect, treat and dispose the accumulated sludge safely; sludge will be tested periodically for heavy metal concentration. (ix) No wastewater from industrial premises (including domestic wastewater) shall be allowed to dispose into municipal sewers (x) Monitor regularly and ensure that there is no illegal discharge through manholes or inspection chambers; conduct public awareness programs; in coordination with TNPCB (vii) Conduct regular wastewater quality monitoring (at inlet and at outlet of STP) to ensure that the treated effluent quality complies with the standards (viii) Conduct periodic testing of dried sludge/compost to check presence of heavy metals and confirming stipulated concentrations to use as compost (ix) Concentration of hydrogen sulphide, which is a flammable and highly toxic gas, in or near sewage infrastructure (sewers, man holes, sewage sumps, septic tanks, STPs) etc, is highly dangerous to operation and maintenance personnel and may lead to inhalation deaths if works are conducted in such conditions. Appropriate and safe conditions shall be ensured prior to start of any works; H₂S levels confirming to ILO16 threshold limits¹⁷ shall be ensured (1 ppm as TWA (time weighted average) usually 8 hours and 5 ppm as STEL (short-term exposure limit) which is usually 15 minutes.		

¹⁶ International Labour Organization

¹⁷ https://www.ilo.org/dyn/icsc/showcard.display?p_card_id=0165&p_version=1&p_lang=en

Table 39: Environmental Monitoring Plan – Sewer System

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
Pre –construction and Construction Stage					
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 during controlled blasting. Site inspection checklist to review implementation is appended at Appendix 7	Weekly during construction	Supervising staff and safeguards specialists of CMSC	Staff and consultant costs are part of incremental administration costs
Ambient air quality	4 locations (4 monitoring locations 50 m downwind direction near sewer and pumping station work sites in the city);	PM₁₀, PM_{2.5} NO₂, SO₂, CO	Once before start of construction Quarterly yearly (4-times) during construction (3 year construction period)	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (52 samples x 5000 per sample = 260,000)
Ambient noise	4 locations (4 monitoring locations near sewer and pumping station work sites in the city);	Day time and night time noise levels	Once before start of construction Quarterly yearly (4-times) during construction (3year construction period)	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (52 samples x 1500 per sample = 78,000)
Operation Stage					
Odor monitoring at pumping stations	3 points (downwind)	Hydrogen sulphide (H ₂ S)	Periodical (throughout the	CCMC	Handheld H ₂ S meters to be procured as part of

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

Table 40: Environmental Monitoring Plan – Sewage Treatment Plant

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
Pre –construction and Construction Stage					
Baseline water quality of receiving water body (Selvachinthamani Tank and downstream Periyakulam Tank, Noyyal River)	6 points (2 samples from each tank & from Noyyal River)	pH, TDS, TSS, DO, BOD, COD, E-coli, Total coliform, Nitrate, Total Phosphates, Oil & grease, Total hardness, Sulphate, Fluoride, Chloride, Ammonia, Aluminum, Manganese, Iron, Zinc, Nickel, Magnesium, Phenolic compounds, Chromium, Arsenic, Mercury, Cadmium, Lead, Pesticides	Twice during detailed design phase (Pre monsoon and post monsoon during design phase)	DBOT Contractor	Cost for implementation of monitoring measures responsibility of DB contractor (6 samples x 8000 per sample = 48,000)
Baseline sediment quality in receiving water bodies (Periyakulam Tank & Noyyal River)	2 points (Periyakulam Tank & Noyyal River)	EC, pH, calcium, magnesium, % of total organic matter, Total organic carbon, N, P, K, Aluminum, fecal coliform, As, Cu, Cd, Cr, Pb, Fe, Mn, Hg, Zn, Ni.	Twice during detailed design phase (Pre monsoon and post monsoon during design phase)	DBOT Contractor	Cost for implementation of monitoring measures responsibility of DBOT contractor (4 samples x 10000 per sample = 40,000)
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 during controlled blasting. Site inspection checklist to review implementation is appended at Appendix 7	Weekly during construction	Supervising staff and safeguards specialists of CMSC	Staff and consultant costs are part of incremental administration costs
Ambient air quality	1 locations at STP Site	PM₁₀, PM_{2.5} NO₂, SO₂, CO	Once before start of construction	Construction Contractor	Cost for implementation of monitoring measures

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
			Quarterly yearly (4-times) during construction (3 year construction period)		responsibility of contractor (13 samples x 5000 per sample = 65,000)
Ambient noise	1 locations at STP Site	Day time and night time noise levels	Once before start of construction Quarterly yearly (4-times) during construction (3year construction period)	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (13 samples x 1500 per sample = 19,500)
Surface water quality	2 locations (Periya Kulam and Noyyal River at proposed STP discharge point)	pH, Oil and grease, Cl, F, NO₃, TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalinity	Once before start of construction Half yearly during construction (3 year construction period)	Construction Contractor	Cost for implementation of monitoring measures responsibility of contractor (12 samples x 4000 per sample = 48,000)
Operation Stage					
Monitoring of treated wastewater quality from STP	Inlet and outlet of STP	Parameters as specified by TNPCB in the consent/disposal standards notified for STPs.	Monthly Once	CCMC	CCMC Operating Cost
Odor monitoring at STP	2 points (downwind direction) with	Hydrogen Sulphide (H ₂ S)	Half yearly (yearly and twice)	CCMC	O&M Costs

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost and Source of Funds
	at STP boundary and at boundary near Residential area		as and when based on public complaints (throughout the operation phase)		
Ambient noise	2 locations (downwind direction) with at STP boundary and at boundary with near Residential area	Day time and night time noise levels	Monthly once during operation	VCMC	O&M Costs
River water quality at disposal point	Noyyal River disposal point, (downstream and upstream)	pH, Cl, F, NO ₃ , TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalinity, heavy metals and pesticides	Baseline monitoring prior to start of commissioning Monthly once during operation Yearly twice during operation (pre and post monsoon)	CCMC	O and M costs (water quality will be tested at the internal laboratory part of STP)
Sludge quality and suitability as manure	STP	Analysis for concentration of heavy metals and confirm that value are within the limits for use as compost	Start of operation and Yearly once	CCMC	O and M costs (testing to be done at an accredited external laboratory)

B. Implementation Arrangements

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

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

204. **Safeguards Compliance Responsibilities.** Environmental and Social Safeguards (ESS) managers in the PMU, TNUIFSL will have overall responsibility of safeguard compliance with ADB SPS 2009. ESS Managers report to Vice President in the Projects Wing. At PIU level, a Safeguards Officers will be appointed, who will be an Assistant Engineer rank officer and will coordinate safeguard tasks at PIU. An Environmental Expert will also be appointed in PIU, specifically to implement environmental safeguards. The Contractor should appoint Environmental Health and Safety (EHS) Supervisor to ensure EMP implementation; submission of updated EMP/SEP; timely submission monthly of monitoring reports including documentary evidence on EMP implementation such as photographs.

205. **PMU Safeguard Responsibilities.** Key tasks and responsibilities of the PMU for this subproject include the following:

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

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

207. **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 environmental monitoring reports to ADB.
- (v) Oversee site closures to ensure that all work/facility sites are restored properly prior to issuing work completion certificate to the contractor.

208. **Operation stage.** Ensure that all clearances as required for operation of project are in place prior to operation, such as consent to operate (CTO) for STP from TNPCB.

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

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

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

211. **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 Management 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
- (xx) Provide any assistance in environmental safeguard related tasks as required by PMU to ensure compliance and reporting to ADB.

212. **Operation stage**

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

213. **Contractor's Responsibilities:**

a. 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.

214. **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) and also Demolition waste management plan (sample is in Appendix 3)
 - b. Traffic management (TM) plan (sample is Appendix 6).
 - c. OHS Plan, pollution control plan, dust emergency response plan
- (vi) Implement the mitigation measures as per the EMP including CWM and TM Plans;
- (vii) Follow the EMP measures/guidelines for establishment of temporary construction camps, construction waste disposal sites, and material borrow areas, etc.,
- (viii) Implement EMP and ensure compliance with all the mitigation and enhancement measures;
- (ix) Conduct environmental monitoring (air, noise, water etc.,) as per the EMP
- (x) Undertake immediate action as suggested by PIU to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation;
- (xi) Submit monthly progress reports on EMP implementation to PIU;
- (xii) Act promptly on public complaints and grievances related to construction work and redress in a timely manner in coordination with PIU and CMSC;
- (xiii) Comply with applicable government rules and regulations.

C. Training Needs

215. The following Table 41 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 41: Outline Capacity Building Program on EMP Implementation

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

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

D. Monitoring and Reporting

216. 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.

217. During construction, results from internal monitoring by the contractor will be reflected in their monthly EMP implementation reports to the PIU. Safeguards Officer from PMU and Environmental Health and Safety Supervisor (EHS) in PIU will monitor, review and advise contractors for corrective actions if necessary. Quarterly Environmental Monitoring Report summarizing compliance and corrective measures, if any, taken will be prepared by 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.

218. Based on PIU Quarterly monitoring reports and oversight visits to subproject work sites, PMU will submit Environmental Monitoring Reports (EMRs) semiannually during construction and annually during operation, until the Project Completion Report (PCR) is issued by ADB. ADB will review, approve and disclose in ADB website as per SPS 2009 and Access to Information Policy

2018, once concurrence from the ADB is received the report will be disclosed on TNUIFSL, PMU and CCMC websites.

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

E. Environmental Management Plan Implementation Cost

220. 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 42: Cost Estimates to Implement the Environmental Management Plan

	Particulars	Stages	Unit	Total Number	Rate (Rs)	Cost (Rs)	Costs Covered By
A.	Mitigation Measures						
1	Providing odor control system sewage pumping and lifting stations (gas capturing and treatment at required stations) and handheld H ₂ S meters for monitoring (Refer Appendix 11)	Design	Lump sum provision	-	-	53,934,458	Provisional sums of contract (PIU)
2	Consent for establishments and consent for operation from TNPCB	Pre construction	Lump sum			200,000	Project costs (PIU)
3	Provision for tree cutting and compensatory plantation measures (1: 10 ratio replantation) (in case any encountered in the pipe laying / no tree cutting is there in the lift / pump stations)	Construction	Per tree	100	1,000	100,000	Project costs (PIU)
4	Preparation of plans traffic management plan, waste (spoils) management plan etc.), traffic management at work sites (Pavement Markings, Channelizing Devices, Arrow Panels and Warning Lights)	Construction	Lump sum	-	-	250,000	Civil works contract
5	Safety barricading	Construction	Lump sum	Lump sum		2,000,000	Civil works contract
	Subtotal (A)					56,484,458	
B.	Monitoring Measures						
1	Air quality monitoring	Construction	per sample	48	5,000	240,000	

2	Noise levels monitoring	Construction	Per sample	48	1,500	72,000	
3	Surface water monitoring	Construction	Per sample	9	4,000	36,000	
4	Soil Quality monitoring	Construction	Per sample	20	5,000	10,000	
	Subtotal (B)					358,000	
C.	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 (C)					--	
	Total (A+B+C)				₹	5,68,42,458	

X. CONCLUSION AND RECOMMENDATIONS

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

222. The site selected for STP is located within a vast parcel of land owned by CCMC in the south zone of the city. Considering the current and future development around the facility, various measures are included in the subproject design, including: design of a compact, superior process with low-odor potential; sensitive layout design by maintaining adequate distance from the boundary, so that STP is deep inside the campus with tree cover around, etc.,. All the lifting and

pumping station sites are situated on government owned vacant land parcels, and sewers will be laid on the public roads. Therefore subproject do not involve any private land acquisition.

223. Sewage and pumping stations sites, which collect sewage from the sewer network and pump to higher level to convey to sewage to STP for safe treatment and disposal, are located within or near residential areas, which it will serve. These facilities may generate odor and may cause nuisance to nearby households. Site selection is done with utmost care to located as far as away from the houses, however, given design considerations and land constraints, some of the sites identified are close to the houses. 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. Periodical odor monitoring is proposed at pumping and lifting stations.

224. STP malfunction or decrease in treatment efficiency will have adverse impacts. This will result in release of untreated or partially treated wastewater that will pollute environment and cause public health issues. STP would be designed by the DBOT contractor to meet the disposal standards and disposal is proposed into River Noyyal. Required measures to ensure that sewage system is operated and maintained with designed efficiency are to be included in the design and operation by the contractor. Proper sludge management system to collect, treat and dispose safely will be followed. Periodic monitoring of dried sludge to check suitability as a manure is suggested.

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

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

227. 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. Mitigation and monitoring measures, along with the project agency responsible for such actions, form part of the Environmental Management Plan.

228. Stakeholders were involved in developing the IEE through face-to-face discussions, on site meetings, and a city level consultation workshop, which was conducted for larger public participation in the project. Views expressed by the stakeholders were incorporated into the IEE and the planning and development of the project. The IEE will be made available at public locations and will be disclosed to a wider audience via the PMU, CCMC and ADB websites. The consultation process will be continued during project implementation, as necessary, to ensure that stakeholders are engaged in the project and have the opportunity to participate in its development and implementation.

229. 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.

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

231. The citizens of the Zone 5 and Zone 7 of CCMC will be the major beneficiaries of this subproject. The new sewerage system will remove the human waste from those areas served by the network rapidly and treated to an acceptable standard, and treated wastewater is utilized beneficial purposes. In addition to improved environmental conditions, the subproject will improve the over-all public health in the project area. Diseases of poor sanitation, such as diarrhea and dysentery, should be reduced, so people should spend less on healthcare and lose fewer working days due to illness, so their economic status should also improve, as well as their overall health.

232. This subproject is split into three contract packages for implementation: (i) sewer system in Zone 5, (ii) sewer system in Zone 7, and (iii) two STPs. Sewer system packages are of 'Works' type contract while STP contract is of design-build-operate (DBO) modality, where in which contractor will design STP, build and operate for a duration agreed in the contract.

233. Therefore, as per ADB SPS, the project is classified as environmental category B and does not require further environmental impact assessment. However, to conform to government guidelines STPs require consent to establish (CTE) and consent to operate (CTO) from Tamil Nadu Pollution Control Board. CTE shall be obtained prior to construction. The receiving waterbodies of the treated effluent from STPs, namely Periyakulam and Noyyal River are under Coimbatore Corporation and PWD respectively and require no-objection for the disposal of treated effluent.

234. This draft IEE will be updated during the detailed design phase of STP, and if required further during the implementation to reflect any changes in sewer system or STPs. Updated IEE will be submitted to ADB for review, clearance and disclosure

Appendix 1: RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

Sewerage

Instructions:

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

Country/Project Title: India/Tamil Nadu Urban Flagship Investment Program – Underground Sewerage Subproject for Vadavalli, Veerakeralam, Koundampalayam and Thudiyalur Areas of Coimbatore City Municipal Corporation

Sector Division: Urban Development

Screening Questions	Yes/No	Remarks
A. Project Siting is the project area...		
• Densely populated?	☒ Yes ☐ No	Subproject activities are located in the outer areas of Coimbatore city, which were originally townpanchayats. Old habilitation areas within these townpanchayatshave density residential pockets, with narrow and congested roads. Newly developing residential areas have low density and well planned layouts. Agriculture is still practiced in the outer areas.
• Heavy with development activities?	☒ Yes ☐ No	It is a developing area; urban expansion is considerable
• Adjacent to or within any environmentally sensitive areas?	☐ Yes ☒ No	-
• Cultural heritage site	☐ Yes ☒ No	-
• Protected Area	☐ Yes ☒ No	-
• Wetland	☐ Yes ☒ No	-
• Mangrove	☐ Yes ☒ No	-
• Estuarine	☐ Yes ☒ No	-
• Buffer zone of protected area	☐ Yes ☒ No	-
• Special area for protecting biodiversity	☐ Yes ☒ No	-
• Bay	☐ Yes ☒ No	-
B. Potential Environmental Impacts		
Will the Project cause...		
Sewerage		
• impairment of historical/cultural monuments/areas and loss/damage	☐ Yes ☒ No	No historical or cultural sites in the subproject area

to these sites?		
interference with other utilities and blocking of access to buildings; nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.?	☒ Yes ☐ No	Few sewage lifting and pump stations are located close to the house, and odor may create nuisance. Necessary measures are included to prevent and control odor; no net negative impacts envisaged
dislocation or involuntary resettlement of people?	☐ Yes ☒ No	Do not involve land acquisition or resettlement
disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?	☐ Yes ☒ No	No such possibilities; sewerage system will cover entire population including urban poor; In fact, it will have positive health impact due to improved sanitation condition.
impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?	☐ Yes ☒ No	Adequate capacity sewage treatment facility is being development under this subproject;
overflows and flooding of neighboring properties with raw sewage?	☒ Yes ☐ No	Sewerage system has been designed considering the population growth. It has been designed to accommodate sewage until design year. Design considers standard peak factors and therefore no such impact envisaged.
environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?	☐ Yes ☒ No	Proper sludge collection, treatment and disposal process is part of STP; sewerage system caters only domestic sewage; no industrial effluent is allowed into sewers
noise and vibration due to blasting and other civil works?	☒ Yes ☐ No	Temporary nuisance/disturbance due to construction activities will be minimized with appropriate mitigation measures. In case encountered with excavation in hard rock, only controlled blasting will be adopted as construction methodology with all mitigation and safety measures. Necessary noise and vibration protection measures (e.g., covered with M.S.Sheets + Excavated earth + Sand filled gunny bags) are deployed. All necessary permissions will be obtained from District Collector, Coimbatore, prior to start of the controlled blasting work.
risks and vulnerabilities related to occupational health and safety due to physical, chemical, and biological hazards during project construction and operation?	☒ Yes ☐ No	In appropriate handling of sludge may have occupational health hazard. All necessary safety precautions will be taken to avoid any risk.
discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?	☐ Yes ☒ No	There are no sources of hazardous material that will find its way into the sewers. Wastewater other than domestic will not be discharged into the sewers.

inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?	☒ Yes ☐ No	Due to technical constraints and land availability, some pumping stations are located close to houses, however, necessary measures are included in site planning, design and operation. No net negative impacts envisaged
road blocking and temporary flooding due to land excavation during the rainy season?	☒ Yes ☐ No	Complete road 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	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. If needed, controlled blasting will be carried out with necessary precautionary measures. Dust will be controlled with proper measures.
traffic disturbances due to construction material transport and wastes?	☒ Yes ☐ No	Proper planning, such as selection of routes and scheduling to avoid peak traffic hours, will be carried out in consultation with concerned authorities
temporary silt runoff due to construction?	☒ Yes ☐ No	Earthworks will not be conducted during rains; plain topography and moderate to low rains, so no such impact envisaged
hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?	☒ Yes ☐ No	A chance of failure of sewerage system is very remote; proper design and standard operating procedures will be followed in O&M; necessary equipment and training to workers will be provided
deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?	☐ Yes ☒ No	The STP design include adequate sludge treatment facilities
contamination of surface and ground waters due to sludge disposal on land?	☐ Yes ☒ No	The STP design include adequate sludge treatment facilities and the dried sludge will be utilized as manure
Health and safety hazards to workers from toxic gases and hazardous materials which 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.
• risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?	☐ Yes ☒ No	Not applicable. Construction/operation will not involve use of explosives and chemicals.
• community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?	☒ Yes ☐ No	Operational area will be clearly demarcated and access will be controlled. Only worker and project concerned members will be allowed to visit the construction sites.

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

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

- (i) Workmen Compensation Act, 1923 - The Act provides for compensation in case of injury by accident arising out of and during the course of employment.
- (ii) Payment of Gratuity Act, 1972 - Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years' service or more or on death at the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.
- (iii) Employees' PF and Miscellaneous Provisions Act, 1952 - The Act provides for monthly contributions by the employer plus workers @10 % or 8.33 %. The benefits payable under the Act are: (a) Pension or family pension on retirement or death as the case may be; (b) deposit linked insurance on the death in harness of the worker; (c) payment of PF accumulation on retirement/death etc.
- (iv) Maternity Benefit Act, 1951 - The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.
- (v) Contract Labor (Regulation and Abolition) Act, 1970 - The Act provides for certain welfare measures to be provided by the Contractor to contract labor and in case the Contractor fails to provide, the same are required to be provided by the Principal Employer by Law. The principal employer is required to take Certificate of Registration and the Contractor is required to take a License from the designated Officer. The Act is applicable to the establishments or Contractor of principal employer if they employ 20 or more contract labor.
- (vi) Minimum Wages Act, 1948 - The employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment. Construction of Buildings, Roads, Runways are scheduled employment.
- (vii) Payment of Wages Act, 1936 - It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.
- (viii) Equal Remuneration Act, 1979 - The Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees in the matters of transfers, training and promotions etc.
- (ix) Payment of Bonus Act, 1965 - The Act is applicable to all establishments employing 20 or more workmen. The Act provides for payments of annual bonus subject to a minimum of 8.33 % of wages and maximum of 20 % of wages to employees drawing Rs. 3,500/- per month or less. The bonus to be paid to employees getting 2,500/- per month or above up to Rs.3,500/- per month shall be worked out by taking wages as Rs.2,500/- per month only. The Act does not apply to certain establishments. The newly set up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of the Act.
- (x) Industrial Disputes Act, 1947 - The Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what

are the requirements for laying off or retrenching the employees or closing down the establishment.

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

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

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

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

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

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

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

I. Spoils information

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

II. Spoils management

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

III. Documentation

The Volume of Spoil Generated (Site Specific, Date Wise), Site Disposed, Reuse / Disposal Details Should Be Documented Properly.

Appendix 4: PUBLIC INFORMATION NOTICE TEMPLATE

**Public Announcement
Providing Underground Sewerage System Coimbatore City
Coimbatore City Municipal Corporation**

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

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

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

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

Inconvenience caused is regretted.

PIU - Contact No.

Contractor – Contact no.

Appendix 5: SAMPLE GRIEVANCE REGISTRATION FORM

(To be available in Tamil and English)

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

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

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

FOR OFFICIAL USE ONLY

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

Appendix 6: SAMPLE OUTLINE TRAFFIC MANAGEMENT PLAN

A. Principles for TMP around the Water Pipes Construction Sites

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

B. Operating Policies for TMP

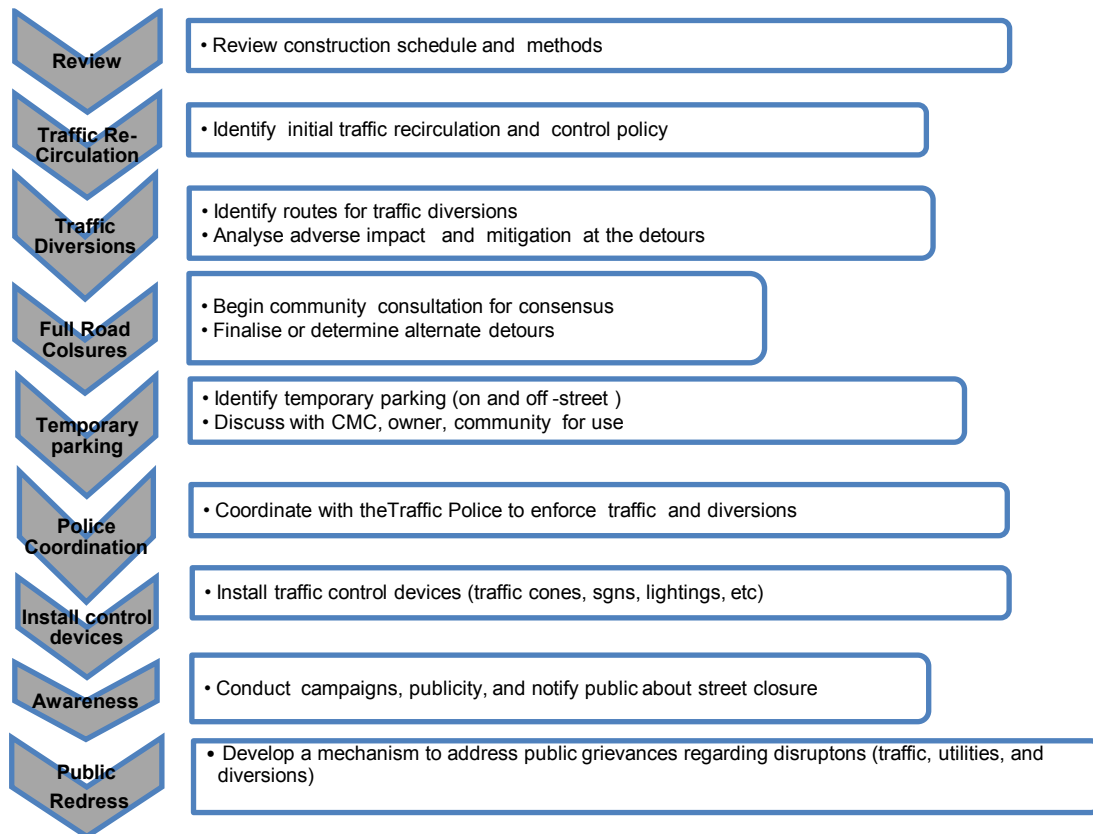
- The following principles will help promote safe and efficient movement for all road users (motorists, bicyclists, and pedestrians, including persons with disabilities) through and around work zones while reasonably protecting workers and equipment.
 - (i) Make traffic safety and temporary traffic control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

C. Analyze the impact due to street closure

- Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:
 - (i) approval from the ULB/Public Works Department (PWD) to use the local streets as detours;
 - (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.
- 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

- 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.
- 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.

- 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.
- It may be necessary to conduct the awareness programs/campaigns on road safety during construction.
- The campaign will cater to all types of target groups i.e. children, adults, and drivers. Therefore, these campaigns will be conducted in schools and community centers. In addition, the project will publish a brochure for public information. These brochures will be widely circulated around the area and will also be available at the PIU, and the contractor's site office. The text of the brochure should be concise to be effective, with a lot of graphics. It will serve the following purpose:
 - (i) explain why the brochure was prepared, along with a brief description of the project;
 - (ii) advise the public to expect the unexpected;
 - (iii) educate the public about the various traffic control devices and safety measures adopted at the work zones;
 - (iv) educate the public about the safe road user behaviour to emulate at the work zones;
 - (v) tell the public how to stay informed or where to inquire about road safety issues at the work zones (name, telephone, mobile number of the contact person; and
 - (vi) indicate the office hours of relevant offices.

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

- 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
- 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").

- **Figure A6.2 to Figure A6.6** illustrates a typical set-up for installing traffic control devices at the work zone of the area, depending on the location of work on the road way, and road geometrics:
 - ❑ Work on shoulder or parking lane
 - ❑ Shoulder or parking lane closed on divided road
 - ❑ Work in Travel lane
 - ❑ Lane closure on road with low volume
 - ❑ Street closure with detour
- 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.
- Traffic police should regulate traffic away from the work zone and enforce the traffic diversion result from full street closure in certain areas during construction. Flaggers/ personnel should be equipped with reflective jackets at all times and have traffic control batons (preferably the LED type) for regulating the traffic during night time.
- In addition to the delineation devices, all the construction workers should wear fluorescent safety vests and helmets in order to be visible to the motorists at all times. There should be provision for lighting beacons and illumination for night constructions.

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

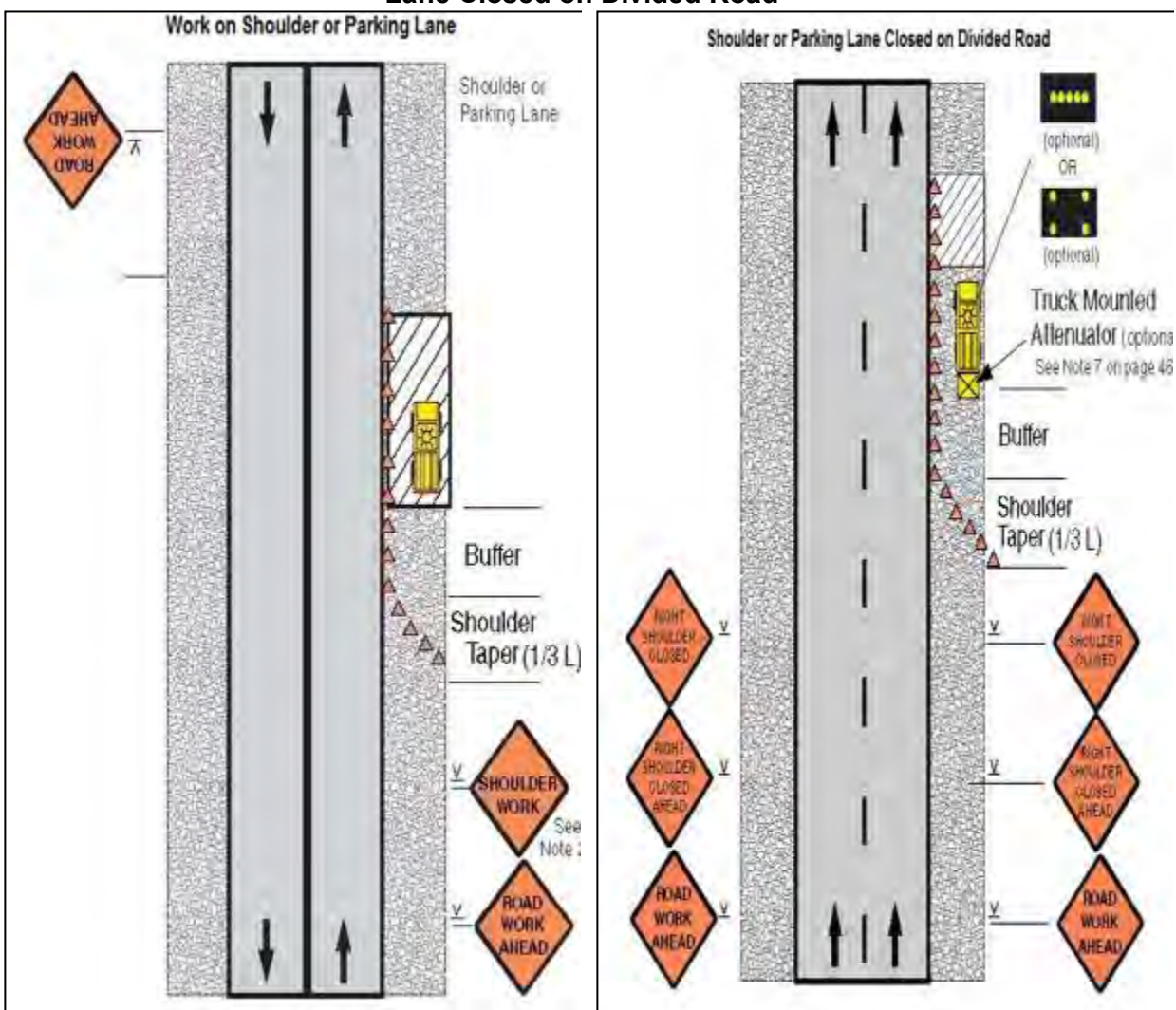


Figure A6.4 and A6.5: Work in Travel Lane and Lane Closure on Road with Low Volume

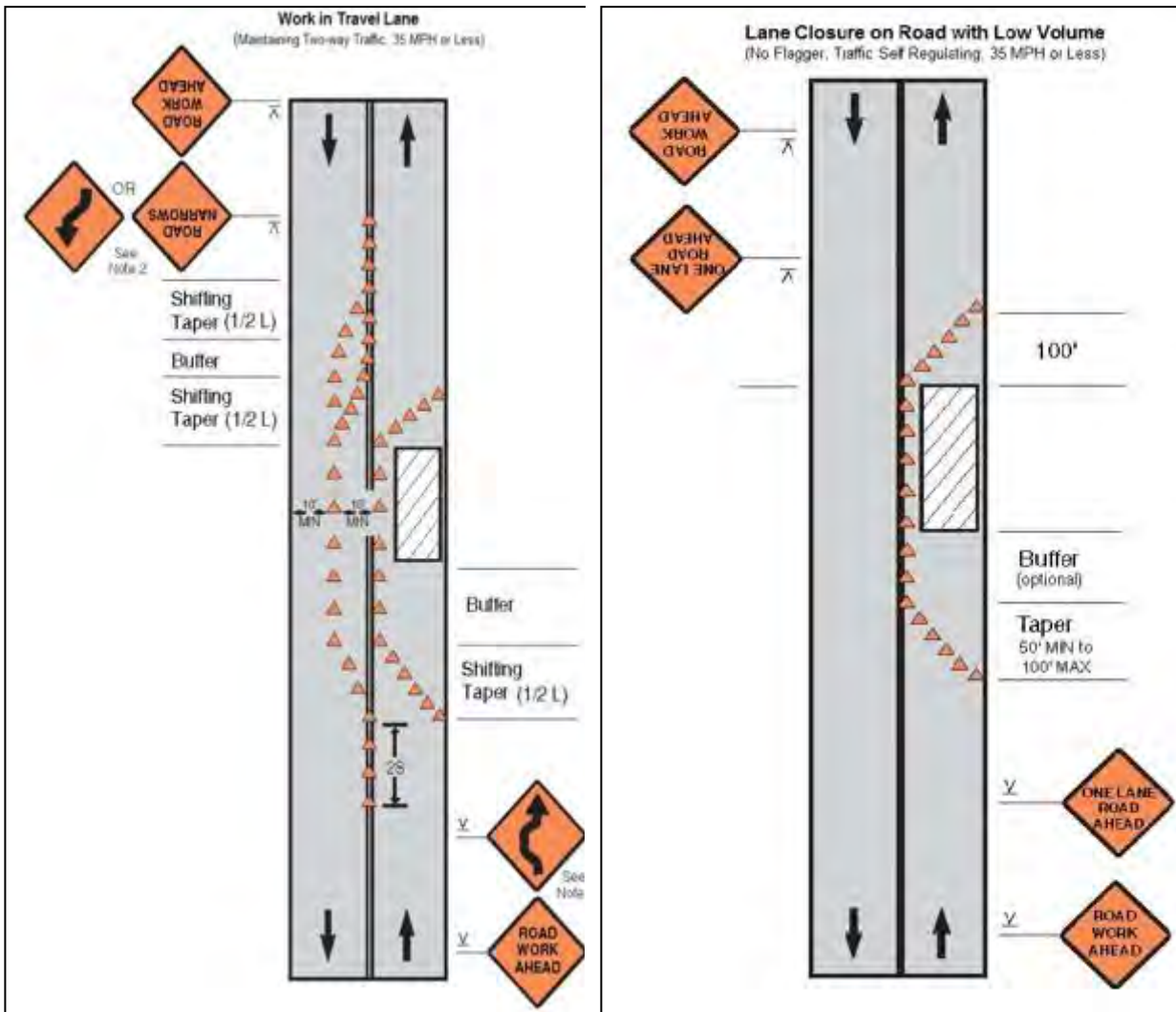
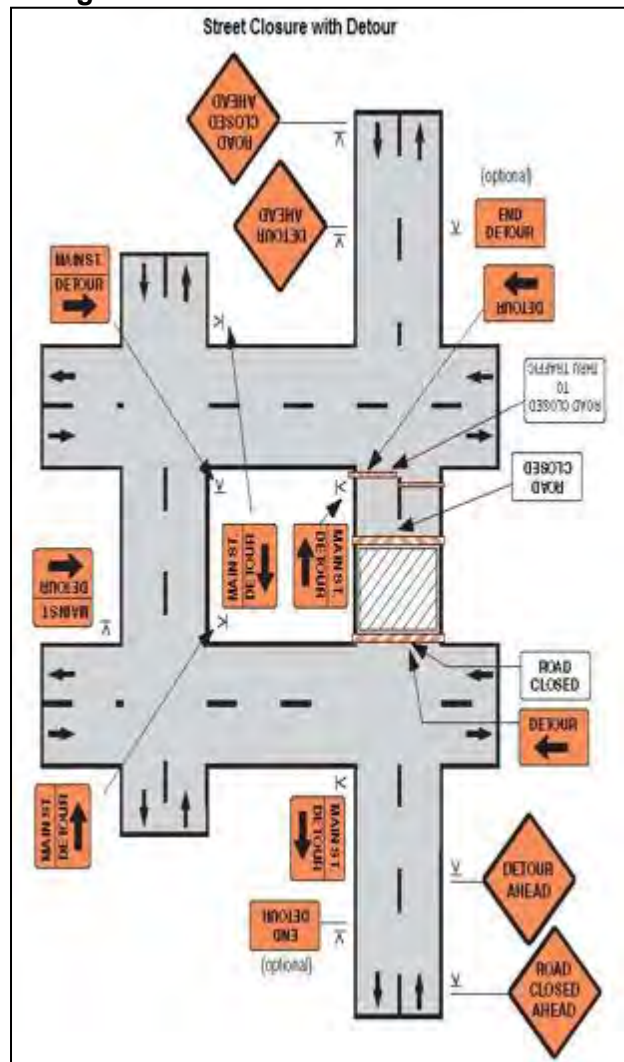


Figure A6.6: Street Closure with Detour



Appendix 7: SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name _____
 Contract Number _____

NAME: _____ DATE: _____
 TITLE: _____ 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
Position

Name
Position

Appendix 8: SEMI-ANNUAL ENVIRONMENTAL MONITORING REPORT TEMPLATE

1. Introduction

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

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

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

Package Number	Components/List of Works	Status of Implementation (Preliminary Design/Detailed Design/On-going Construction/Completed/O&M) ¹⁸	Contract Status (specify if under bidding or contract awarded)	If On-going Construction	
				%Physical Progress	Expected Completion Date

¹⁸ If on-going construction, include %physical progress and expected date of completion

2. Compliance Status With National/State/Local Statutory Environmental Requirements¹⁹

Package No.	Subproject Name	Statutory Environmental Requirements ²⁰	Status of Compliance ²¹	Validity if obtained	Action Required	Specific Conditions that will require environmental monitoring as per Environment Clearance, Consent/Permit to Establish ²²

3. Compliance Status With Environmental Loan Covenants

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

4. Compliance Status With The Environmental Management Plan (Refer To EMP Tables In Approved IEE/S)

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

Package-wise Implementation Status

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

¹⁹ All statutory clearance/s, no-objection certificates, permit/s, etc. should be obtained prior to award of contract/s. Attach as appendix all clearance obtained during the reporting period. If already reported, specify in the "remarks" column.

²⁰ Specify (environmental clearance? Permit/consent to establish? Forest clearance?Etc.)

²¹ Specify if obtained, submitted and awaiting approval, application not yet submitted

²² Example: Environmental Clearance requires ambient air quality monitoring, Forest Clearance/Tree-cutting Permit requires 2 trees for every tree, etc.

- Identify the role/s of Safeguards Team including schedule of on-site verification of reports submitted by consultants and contractors.
- For each package, provide name/s and contact details of contractor/s' nodal person/s for environmental safeguards.
- Include as appendix all supporting documents including signed monthly environmental site inspection reports prepared by consultants and/or contractors.
- With reference to approved EMP/site-specific EMP/construction EMP, complete the table below
- Provide the monitoring results as per the parameters outlined in the approved EMP (or site-specific EMP/construction EMP when applicable).
- In addition to the table on EMP implementation, the main text of the report should discuss in details the following items:
 - (i) **Grievance Redress Mechanism.** Provide information on establishment of grievance redress mechanism and capacity of grievance redress committee to address project-related issues/complaints. Include as appendix Notification of the GRM (town-wise if applicable).
 - (ii) **Complaints Received during the Reporting Period.** Provide information on number, nature, and resolution of complaints received during reporting period. Attach records as per GRM in the approved IEE. Identify safeguards team member/s involved in the GRM process. Attach minutes of meetings (ensure English translation is provided).
 - a. Confirm if any dust was noted to escape the site boundaries and identify dust suppression techniques followed for site/s.
 - b. Identify muddy water was escaping site boundaries or muddy tracks were seen on adjacent roads.
 - c. Identify type of erosion and sediment control measures installed on site/s, condition of erosion and sediment control measures including if these were intact following heavy rain;
 - d. Identify designated areas for concrete works, chemical storage, construction materials, and refueling. Attach photographs of each area.
 - e. Confirm spill kits on site and site procedure for handling emergencies.
 - f. Identify any chemical stored on site and provide information on storage condition. Attach photograph.
 - g. Describe management of stockpiles (construction materials, excavated soils, spoils, etc.). Provide photographs.
 - h. Describe management of solid and liquid wastes on-site (quantity generated, transport, storage and disposal). Provide photographs.
 - i. Provide information on barricades, signages, and on-site boards. Provide photographs.
 - j. Provide information on
 - k. Checking if there are any activities being under taken out of working hours and how that is being managed.

Summary of Environmental Monitoring Activities (for the Reporting Period)²³

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						

²³ Attach Laboratory Results and Sampling Map/Locations

Overall Compliance with CEMP/ EMP

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

5. Approach And Methodology For Environmental Monitoring Of The Project

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

6. Monitoring Of Environmental Impacts On Project Surroundings(Ambient Air, Water Quality And Noise Levels)

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

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

Air Quality Results

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

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

Water Quality Results

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

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

Noise Quality Results

Site No.	Date of Testing	Site Location	LAeq (dBA) (Government Standard)	
			Day Time	Night Time

Site No.	Date of Testing	Site Location	LAeq (dBA) (Monitoring Results)
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			Day Time	Night Time

Appendix9 :PUBLIC CONSULTATION DETAILS MINUTES OF STAKEHOLDER CONSULTATION MEETING

Sub project: Providing UGSS to 4 added areas of Coimbatore Corporation in Zone V –
Vadavalli & Veerakeralam [Wards 16 to 19]

Venue and date : KC Wedding Hall at Kalveerampalayam, Vadavalli
on 15.12.2020

A. Brief of the consultation meeting

Date : 15.12.2020
Venue : KC Wedding Hall at Kalveerampalayam, Vadavalli
Organizer : TWAD Board & Coimbatore Corporation
Participants : Public of Vadavalli & Veerakeralam areas of Coimbatore Corporation

B. Topics discussed during the meeting

The Coimbatore Corporation City Engineer welcomed the gathering and the Commissioner, Coimbatore Corporation presided over the meeting at the venue of Public consultation meeting. The Executive Engineer, TWAD Board, Project Formulation Division, Coimbatore explained about the UGSS Scheme details elaborately. About 104 persons of Vadavalli and Veerakeralam attended the meeting and raised their doubts regarding the UGSS, Lift Stations, Pumping Stations, STP site and disposal etc. and got them cleared by TWADB & Corporation officials.

C. Reports / Materials disclosed to the participants

Notices regarding the details of the UGSS scheme to be implemented were issued to the public. Maps of project areas and Sewer Network Plans were displayed to the public at the venue and were explained in detail.

D. Suggestions and feedback of participants and response of project team

The public of Vadavalli and Veerakeralam are very much interested and welcomed the UGSS to their area. They assured to offer their full Co-operation while implementing the UGSS. They insisted that the scheme should be implemented without much disturbance to the public movement. Also they insisted to close the excavated trenches then and there immediately so as to avoid accidents. The project team gave assurance to implement the suggestions promptly.

Stakeholder Consultation MeetingPhotographs

Vadavalli-Veerakeralam

தமிழ்நாடு குடிநீர் வடிகால் வாரியம் மற்றும் கோவை மாநகராட்சி வடவள்ளி மற்றும் வீரகேரளம் பகுதிக்கான பாதாள சாக்கடைத்திட்டம் பொதுமக்களின் கருத்துக்கேட்டல் கூட்டம் கூடம் : K.C.திருமண மண்டபம் [கல்வீரம்பாளையம்] நாள் : 15.12.2020 - செவ்வாய்க்கிழமை	
	
	
	

List of Participants: (insert scanned image of the attendance sheet)

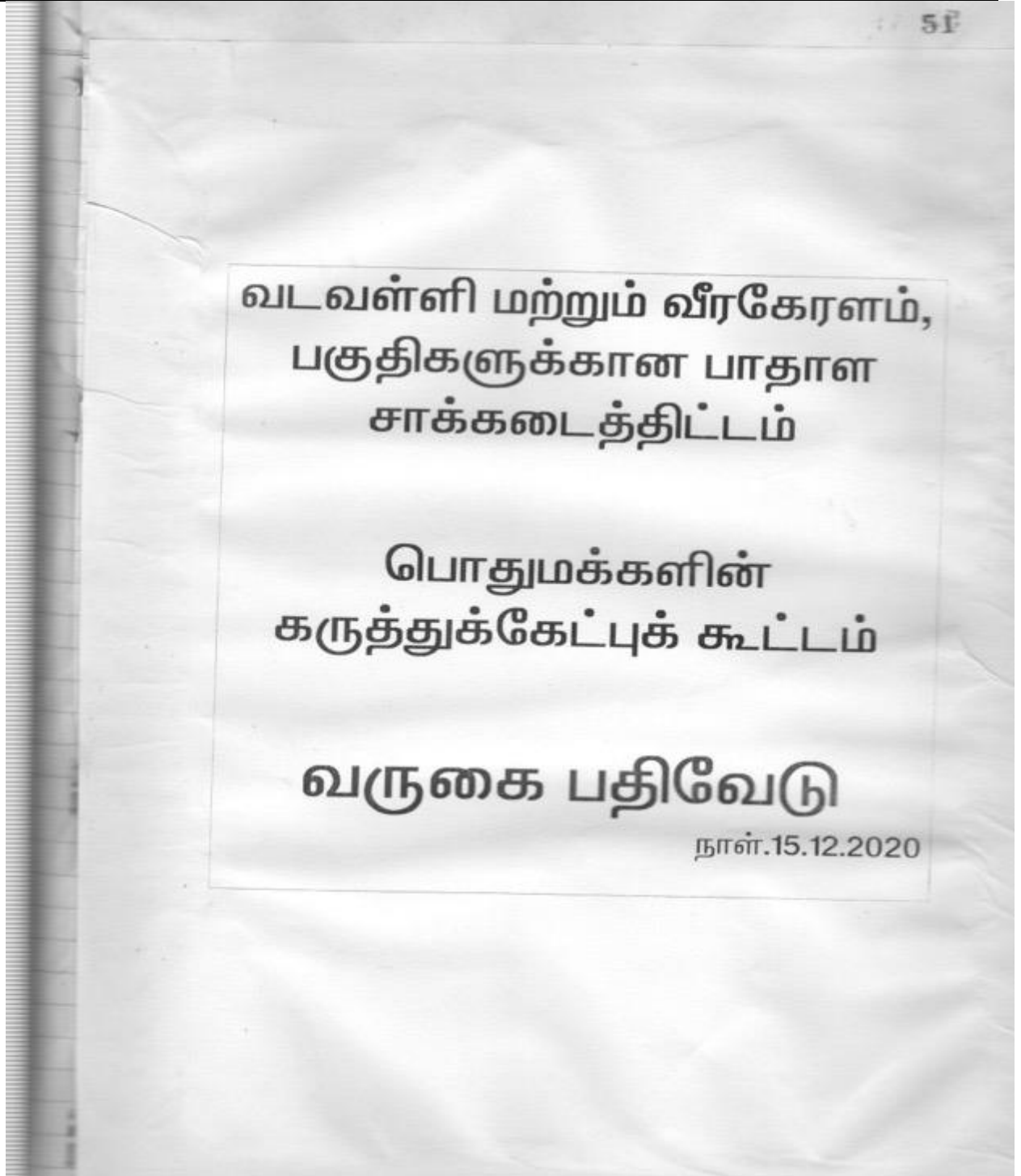
Tamil Nadu Urban Flagship Investment Program

Stakeholder Consultation Workshop

**Sub project: Providing 4 added areas of Coimbatore Corporation -
Vadavalli and Veerakeralam areas**

Date:15.12.2020 Venue:KC Wedding Hall at Kalveerampalayam, Vadavalli

Organized by TWAD Board & Coimbatore Corporation (PIU)



54

മിഷൻ	മുഖി ലിസ്റ്റി (പ്രസി)	മെമ്പർ സ്റ്റാഫ്	മെമ്പർ
19.	S. Sankaran CT, Palanyopanagar Pudukkottai, C.B.A.		S. Sankaran
20	R. Vijayakumar PAKISTAN 61, Gurusamy Nagar Aard. IT, Vadavath Coimbatore - 46		Stony
21.	M. SATHASIVAM Bharthi Nagar, E. Thoppil Nagar. Association. Kumar. Balakrishnan		M. Sathasivam
22	R. RISHA and S. S. P.F. Colony		R. Risha
33	G. Murali New 21 old 36 phase - I Mahakavi Avenue		G. Murali
24	K. CHIRAKIAN P.F. Colony		Chirakian
25-	K. Gangadharan P.F. Colony, Vidavath		K. Gangadharan
26	N. Srinivasan P.F. Colony		N. Srinivasan

55		கைபடி எண்	கைபடி எண்
28	S. Valaipapathy 5, SPK Nagar, Cbe-641046		U. G. S.
29.	Dr. V. Rengarajulu 19. SPK Nagar Cbe-641046		J. W.
30	V.T.VALLUVAN no:23 Tanta Nagar USE-41. [TAUTA NAGAR ASSOCIATION]		L.
31.	R. BALAKRISHNAN (AD ADVT.)		R. K.
32.	N. Rameshwar, 85 Supergarden Avenue.		C. S.
33.	R. Prabhakaran 53 Super Garden Avenue		K. S.
34.	G. Jaganj David Dr. J. J. Nagar		P. R.
35	K. Karunkaran 4/75 Super Garden Avenue		S. G.
36	P. Rameshwar New A		M. S.
37	P. Shanmugasul New Thillai Nagar		M. S.
38	N. SELVARAJ		M. S.
39	M. Suresh Kumar New Thillai Nagar		M. S.

40	Ratnakar Shrinani	"	36.4
41	Shanmugam	Balaji Nagar	35.9.
42	Whandapani	"	35.8.
43	Mohan	"	35.9.
44	Bharathan	"	35.6.
45	It. Nair	"	36.0
46	ithangavel	"	36.4.
47	Hanogasan	Priyanka Nagar	36.2.
48	Pannir Selvam	"	36.2.
49	Ramachandran	Super garden	36.4.
50	R. prabhakaran	"	36.1.
51	Ravindran	"	35.7.
52	N. Selvaraj	New thillai Nagar	31 35.7.
53	Sannugr Sundharam	"	35.9.
54	Suresh Kumar	"	36.1.
55	Prishnamoorthy . B	Sri Pourn Avenue	3 35.5
56	Sowndappan	"	8 35.1

Name	Colony	ph.No	Temp/pulse.
57. Suresh	Golden Nagar		34.1.
58. Angadheeran	PF colony		34.0
59. Shuathamon	Raj Nagar Layout Vezhakkalam		36.1.
60. Nyanaivel	"		36.1
61. Manogaran	"		36.6.
62. Bala Subramaniam	"		36.0
63. Kumbharai Raj	Kumbari Nagar		36.0
64. Sreenivasan	Maharani Avenue	9	36.0
65. Sathyan	"		36.2.
66. M.K.S. Nathan	Gurusamy Nagar		34.0
67. B. Kandhasamy	Super Garden		36.1
68. Ramamoorthy	Gurusamy Nagar.		35.8
69. Anbalagan	"		33.4
70. Sankara Narayanan	"		36.0
71. Ramachandran	"	9	36.0
72. P. Viswanathan	Chithi Vinayagar colony		36.1

60th kumar	Kc Hall	4	36.1.
59 Chithambaram	Mb. Colony		35.9.
60 Dr. Manthi Sori	"		36.11.
59 N. kannan	"		36.2.
60 Janaki kannan	"	4	35.2.
61 Ranganathan	Gurusamy Nagar		36.2.
62 Kumaravelu	P.N. pudheer	6	35.3
63. G. Murali	Maharani Avenue		35.8
64 Ravichandran	New Anandhan Nagar		36.2
65. Venkatesan	Priyanka Nagar		36.2 ..
66. S. Vishwanath	Gurusamy Nagar.		36.0
67. Joseph Antony Raj	VVR Nagar.		35.11.
68. Jebaraj	Gurusamy Nagar.		35.8
69. Jagannathan	Mb. Colony		36.5
70. Sathamani. p	"		36.8.
71. Soenirasan. J	Ilangovalikal Veedu PN pudheer.		36.5
72. S. Subramaniyam	"		36.2.

73	Krishnan	"	36.2.
74	Marikandan	Priyanka Nagar	35.9.
75	Bhuvanadhasan	Maharani Avenue	35.6.
76	Ragavachari	Marutham Nagar	35.6
77	Dr. V. Dhayalan	United. Maharani Avenue	35.8
78	Kannakaran	Super garden	35.5
79	Raja Lingam	Boominampalayam	36.2.
80	Manogalan	Ramasamy Nagar	36.3
81	Hohan	Balaji Nagar	33.7
82	R. Krishnamoorthy	PE colony	35.0
83	Balaji	Boominampalayam	35.5
84	Sathasivam	Bharthi Nagar	36.5
85	Balakrishnan	"	36.3
86	S. Kumar	"	36.1
87	Ganapathi KR	Marutham Nagar	35.6
88	K. Chinnayyan	PF. colony	36.1
89	Shanmugam N	"	34.

89. Unni Rajan	Virjay Nagar.	35.2
90. T. Ganganadhasan	"	35.41.
91. Rajasekar	"	35.6
92. R. Sivakumar	Pr Ruchir	36.2.
93. Sundharavalli	"	35.9.
94. S. Valayapathi	Spk. Nagar.	35.9.
95. Dr. Rangarajan	"	1 32.0
96. P. Arumugam	Virjay Nagar	11 31.9
97. R. Vijaykumar	Gurusamy Nagar	36.1.
98. Jayaram	Virjay Nagar.	36.4.
99. Vigneswaran	Ilango vadigal St Pr Ruchir.	35.7
100. Sasitharan Sasitharan	Raj Arum Raj Avenue	35.8 35.8
101. Nagabaleshmi	M.S. Palanigappan Nagar	33.4.
102. Selvaraj	Virjay Nagar	35.5
103. Valluvan	TATA Nagar	35.6
104. Balakrishnan	"	35.3
105.		

MINUTES OF STAKEHOLDER CONSULTATION MEETING

Sub project : Providing UGSS to 4 added areas of Coimbatore Corporation in Zone VII – Kavundampalayam & Thudiyalur
[Wards 1(Pt), 2 to 9 & 43(Pt)]

Venue and date : SS Kamalesh Mahal, Thudiyalur on 15.12.2020

A. Brief of the consultation meeting

Date : 15.12.2020

Venue : SS Kamalesh Mahal, Thudiyalur

Organizer : TWAD Board & Coimbatore Corporation

Participants : Public of Kavundampalayam & Thudiyalur areas of Coimbatore Corporation

B. Topics discussed during the meeting

The Coimbatore Corporation City Engineer welcomed the gathering and the Commissioner, Coimbatore Corporation presided over the meeting at the venue of Public consultation meeting. The Executive Engineer, TWAD Board, Project Formulation Division, Coimbatore explained about the UGSS Scheme details elaborately. About 85 persons of Kavundampalayam and Thudiyalur attended the meeting and raised their doubts regarding the UGSS, Lift Stations, Pumping Stations, STP site and disposal etc. and got them cleared by TWADB & Corporation officials.

C. Reports / Materials disclosed to the participants

Notices regarding the details of the UGSS scheme to be implemented were issued to the public. Maps of project areas and Sewer Network Plans were displayed to the public at the venue and were explained in detail.

D. Suggestions and feedback of participants and response of project team

The public of Kavundampalayam & Thudiyalur are very much interested and welcomed the UGSS to their area. They assured to offer their full Co-operation while implementing the UGSS. They insisted that the scheme should be implemented without much disturbance to the public movement. Also they insisted to close the excavated trenches then and there immediately so as to avoid accidents. The project team gave assurance to implement the suggestions promptly.

Photographs:
Kavundampalayam, Thudiyalur





List of Participants: (insert scanned image of the attendance sheet)

Tamil Nadu Urban Flagship Investment Program

Stakeholder Consultation Workshop

Subproject: Providing UGSS to 4 added areas of Coimbatore Corporation
in Zone VII –Kavundampalayam & Thudiyalur [Wards 1(Pt), 2 to 9 & 43(Pt)]

Date: 15.12.2020

Venue: SS Kamalesh Mahal, Thudiyalur

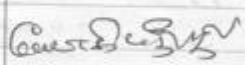
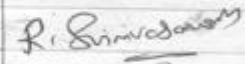
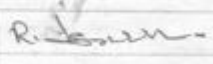
Organized by TWAD Board & Coimbatore Corporation (PIU)

கவுண்டம்பாளையம் மற்றும்
துடியலூர் பகுதிகளுக்கான
பாதாள சாக்கடைத்திட்டம்

பொதுமக்களின்
கருத்துக்கேட்புக்
கூட்டம்

வருகை பதிவேடு

நாள்.15.12.2020

21. எண்	தமிழ் மொழிப் பேரறிஞர் மகாபலாசாமி அண்ணா	மகாபலாசாமி அண்ணா	மகாபலாசாமி அண்ணா
①	S. HARIHARASUDHAN SS. E.B. COLONY TVS NAGAR - CBE 25		
②	V. பாலசுப்பிரமணியம் - Ward-6 பொங்கலா மை T.V.S. மை கோமல்	Ward-6 SWATCH - - BHARATI AMBASSADOR	
③	T. RAJKI MUTHU DNO 63 E.B. COLONY Near TVS Nagar CBE - 25		
4.	YOGI SRITI, SECRETARY. 36. EB Colony. TVS NAGAR, CBE. 25. RESIDENT'S WELFARE ASSN.		
5.	R. Srinivasamoorthy NO: 32, Ashwin Nivas Lakshmi Puram 4th Cross Coimbatore. 25		
6	R. J. Gangaiah 40/A. E.B. கோமல் T.V.S. மை. கோமல் 25		
7	M. DIVAKARAN HNO. 37 E.B. COLONY. TVS NAGAR ADABAM ROAD CBE		
8.	K. SUNDARA RAJAN 25, E.B. Colony 1st Cross, T.V.S. Nagar		

9.	சுவிஸ் லாஜிஸ் (பெரோ) K.B. சிவசுந்தரம் 1/60 அப்பிஸ் காலனி H. மாராபெரோ (கிழக்கு) E. சிவசுந்தரம், திருவள்ளூர்	சுவிஸ் லாஜிஸ் K.B. C
10.	M. Loganathan 68/1 Second Street Easwara Nagar East Thudiyalur	Thudiyalur
11.	R. Ganesan 1/79, Easwara Nagar K. Vadamadurai (East) Thudiyalur. CBE.	Thudiyalur
12.	K.S. Anand 1/82 Easwara Nagar East K. Vadamadurai Thudiyalur	K.S. An
13.	Raman Ganesan 1/80 Easwara Nagar East K. Vadamadurai CBE - 17	R. Ganesan
14.	P.R. Ganesan 1/7, Thirumangalam Nagar Thudiyalur.	Thudiyalur
15.	K. Dhanraj Rukkamal colony Thudiyalur.	Thudiyalur
16.	R. Kandarasamy Via Thirumangalam	Thudiyalur

செய்தல்கள்	பெயர்	தொலைபேசி	முகவரி	முகவரி	முகவரி
17.	R. Lakshmi S. S.	C-207	சென்னை		
18	A. Arulanantham & group	40, Shaj Gader	Thiruvananthapuram		
19	C.V. Thangavel	Meenakshi Gardens			
20	K. K. A. B. S.	116	VCS		
21	K. RANARAJU	C259, Cheran Colony	Thiruvananthapuram		
22	P. Ramesh.	Secretary	Cape Town Welfare Association		
23	V. S. S. S.				
24	S. S. S. S.				

37)	K. Kavi Chandramohan Ex. sec. L.M. word		K. Kavi Chandramohan	9
38	P. Muruganathan Vivek Nagar		P. Muruganathan	9
40	P. NACRANATHAN. URumandipolum. B3P		P. NACRANATHAN.	96
41	H. Venkatesan 21/30 Silkoy Nagar TNS Nagar. Coimbatore 25		H. Venkatesan	97
42	T.K. Senlhubar 30 PMT Varanthe US. 34		T.K. Senlhubar	90
48	A. Sankaranarayana 31. P.M.P. Varanthe ESC-28		A. Sankaranarayana	97
49	J. Balasubramanian 95-A. V.K.L. Nagar, Thudichon		J. Balasubramanian	97
50.	M. Rajan 9/1 10th St. Poompuhar TDLR. Nagar		M. Rajan	97
51	J. Ramon (President) No 1 Annai Garden N.B.C. Nagar CBE-29		J. Ramon	97
52.	S. Sankaran 43, NRC Nagar An Mills.		S. Sankaran	96-4

General Council Members - 2014			
52	T.R. Jeyaraj 201 (Gurumani)	T.R. Jeyaraj	97.0
53	M. Gnanapriya Samuel	M. Gnanapriya	97.0
54	Yogan Moorthy	Yogan Moorthy	96.0
55	K. Jayaraman	K. Jayaraman	97.0
56	K. Duraiswamy	K. Duraiswamy	97.0
57	A. G. M. Srinivasan	A. G. M. Srinivasan	96.0
58	T.N. H. Gnanapriya 201	T.N. H. Gnanapriya	97.0
59	G. Jagatheesh	G. Jagatheesh	96.0
60	Ramesh Kumar T.A.	Ramesh Kumar	94.0
61	H. Thirumalaiah	H. Thirumalaiah	97.0
62	N. V. Ramani	N. V. Ramani	97.0
63	K. Selvam	K. Selvam	97.0
64	M. Gnanapriya	M. Gnanapriya	97.0
65	R. Panner Selvam	R. Panner Selvam	96.0
66	A. Gopal Selvam (C.P.D)	A. Gopal Selvam	97.0
67	M. Gnanapriya, 3/191 Gnanapriya	M. Gnanapriya	96.0
68	R. Jayachandran Samuel	R. Jayachandran Samuel	96.0
69	NBL Nagar	NBL Nagar	97.0
70	J.S. Gopalani	J.S. Gopalani	97.0
71	NBC Nagar	NBC Nagar	96.0
72	Shanthi Bhusan	Shanthi Bhusan	96.0
73	Selvakumar	Selvakumar	97.0
74	Shanmuganathan	Shanmuganathan	97.0
75	Sri Sai Vigneshwara	Sri Sai Vigneshwara	97.0
76	Welfare Association	Welfare Association	97.0
77	Ward # 14	Ward # 14	97.0

Appendix10 :COVID-19 HEALTH & SAFETY PLAN / SOP

In response to COVID-19 outbreak, Ministry of Housing and Urban Affairs (MoHUA), Govt. of India, has defined the following Standard Operating Procedures (SOPs) and guidelines to ensure safety of construction site workers. SOP developed in line with the guidelines will be implemented during the execution of this project.

General Guidelines – Applicable to All

- All Protocol including Emergency Response will be laid out. Periodic tailgate sessions will be arranged to review site protocols in view of highly dynamic scenario ensuring social distancing norms. During these sessions, everyone including workers will be informed about the safety guidelines and important updates. Necessary arrangements for announcements shall be made at every site
- Mandatory Thermal Scanning of everyone entering and exiting a construction site will be done for fever with thermal scanners. If anyone leaves and re-enters the site during the shift, re-screening of the individual will be done prior to re-entry into the work site.
- Provision for hand wash & sanitizer (touch free recommended) will be made at all entry and exit points and common areas (including at distant locations like higher floors). Everyone will be required to wash & sanitize his/her hands before entering the site and using PPEs. Same procedure to be followed after removing PPEs and exiting the premise. Sufficient quantities of all the items should be available at the site.
- Mandatory use of PPEs (face mask, hand gloves and other as applicable) by everyone entering the premise. Re-usable PPEs should be thoroughly cleaned and should not be shared with others.
- There will be strict ban on Gutka, Tambaku, Paan etc. on site and spitting shall be strictly prohibited.
- Food should be consumed at designated areas only ensuring social distancing. Common sitting arrangements should be removed. Post lunch, waste should be disposed by individual in designated bins and area should remain clean.
- Areas with a probability of bigger gathering, for eg. cleaning area, toilets etc. should be identified and all arrangements should be made to ensure social distancing.
- Entire construction site including site office, labour camp, canteens, pathways, toilets, entry / exit gates will be disinfected on daily basis. Housekeeping team should be provided with necessary PPEs.
- There will be total Ban on non-essential visitors at sites (including from Head office staff, consultants etc.).
- Hospital/clinics in the nearby area, which are authorized to treat COVID-19 patients, should be identified and list should be available at Site all the time
- A doctor will be present periodically (at least once a week) at site on allotted time for any medical assistance.
- Appropriate signage at construction site spelling out safety practices in the language which is understood by all.

Guidelines for Workers

- On day 0, before resuming the work on site post lockdown period, mandatory medical check-up will be arranged for all workers. The workers coming from outside will be quarantined for a period of at least 15 days. Only medically fit workers will be deployed at site and medical assistance will be arranged for unfit workers. Medical checkup camp should be arranged every month.
- The labours staying at site will not be allowed to go outside. All the essential items will be made available to labours at site only. If necessary, the workers can go out wearing PPEs, after informing supervisor. Similarly, no outside labour will be allowed at site without following proper procedure and instructions.
- Start time on site will be staggered to avoid congestion at the entry gates. Number of workers working at a particular time / place will be reduced by making arrangements for different shifts / areas. Accordingly, additional staff such as security guards, supervisors etc. will be deployed.
- During attendance, training and other sessions, social distancing guidelines will be followed along with provision of no-touch attendance.
- Workers to avoid contact with sick people and avoid going to site if they are feeling sick, have fever, cough or shortness of breath. In such case, supervisor should be informed immediately. Workers with such symptoms should not come to site and should be placed in isolation and medical assistance will be provided on immediate basis.
- Workers should not shake hands when greeting others and while working on the site.
- Mandatorily wear face masks while working on site. While not wearing masks, cover your mouth and nose with tissues if you cough/sneeze or do so in the crook of your arm at your elbow.
- Avoid large gatherings or meetings of 10 people or more. Stay at least 6 feet away from others on job sites and in gatherings, meetings, and training sessions. Not more than 2/4 persons (depending on size) will be allowed to travel in lifts or hoists. Use of staircase for climbing should be encouraged.
- Workers should not share their belongings like food, water bottles, utensils, mobile phones etc. with others. The utensils should be washed properly post use at designated place.

Guidelines for Material, Tools, Machinery, Vehicles etc.

- At all point of time, easy access to parking should be ensured since public transit is limited.
- All vehicles and machinery entering the premise should be disinfected by spray mandatorily.
- All construction material arriving at site should be left idle for 3 days before use to ensure safe usage.
- Non-touch waste bin with disposable garbage bag should be installed for waste collection at all common access areas. Proper disposal of garbage should be ensured.
- Wipe down interiors and door handle of machines or construction vehicles, the handles of equipment and tools that are shared, with disinfectant prior to using.

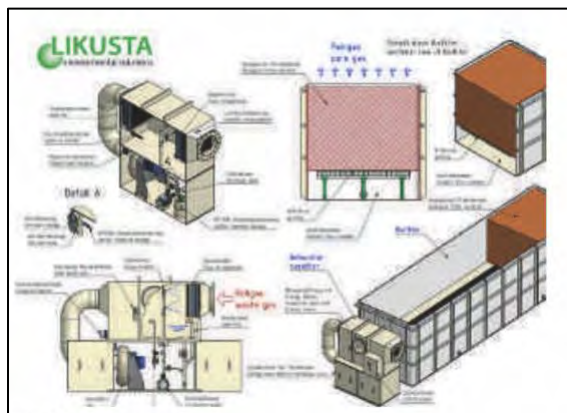
Appendix11 :MECHANICAL ODOUR CONTROL DEVICES

The conventional and engineered odour control unit that are commercially available are bio filter, scrubber, carbon filter, biotrickling filter/bio scrubber. The details of odour control system

Biofilter

Bio-filter systems are designed as single or multistage units according to the actual requirement for instance with a preset humidifier, bio-or chemical scrubber. The bio filter system will give results in deodorization and purifies the exhaust air

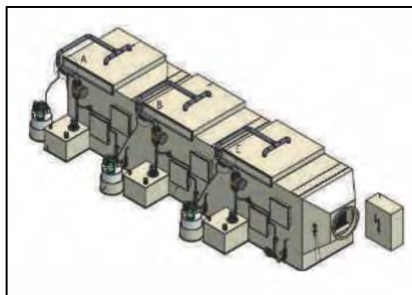
The plastic materials such as PE, PP, FRP, as well as coated steel, stainless steel, gratings made of recycle plastic or FRP will be used in the biofilter.



Biofilter chart

Wet Scrubber

Gas scrubbing system absorb gaseous pollutants in liquids as water, sometimes with added chemical. Most contamination contain corrosive gases. The material used in the scrubber must be capable to endure permanent contact with high and low pH gases and scrubbing solutions. Material range: PE, PP, PVDF, PVC as well as FRP in a composite construction. Processes based on physical – chemical - absorption as well as biological or chemical oxidation are possible.



3 – stage cross flow scrubber

Bio - trickling filter

Bio - trickling filter combines the advantage of bio filter and bio scrubber processes for purifying waste gas. The process is a combination of absorption and adsorption as well. Bio trickling filter

are used for applications, whenever organic odours in combination with high H_2S concentrations have to be eliminated (e.g. composting, sewage treatment).

Waste gas flows through a bio media trickling layer. An automatic controlled spraying nozzle system is installed above the bio media trickling layer in order to spray water with nutrients and minerals onto the trickling layer. The nutrient liquid ensures optimum biological process conditions for the surface of the trickling layer's carried material. The microorganisms convert the pollutants into CO_2 and water. The nutrient liquid re-enters the filter by spraying nozzles due to a circulation system.

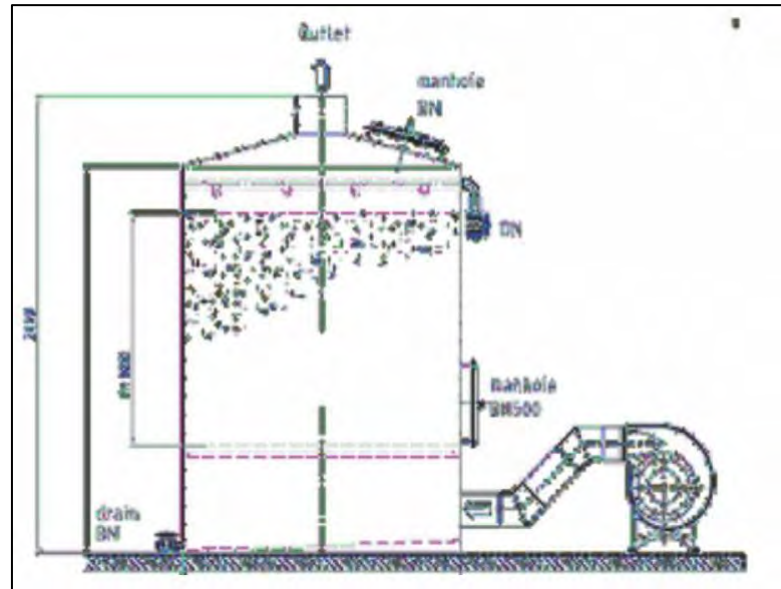
As packing for the trickling layer we use a special corrosion resistance synthetic material. This is extremely durable and convinces with an over 10 year performance time. No high weighted packing material. Alternative the use of inherent material is possible. In comparison to bio scrubber there is no need of using oxidizing agents at all.



Bio trickling filter

Activated Carbon Filter

Activated Carbon Filters are designed and used for the removal of vapors and odours which still may be present within the air or gas flow. The activated carbon filters adsorb vapors and bind them to the surface of the activated carbon. The zero odour level is reached by contacting the air through a bed of activated carbon in an absorber. The carbon bed removal at the nominal working points, but also at unexpected or seasonal peak concentrations. The contact time between the air and the activated carbon should be between 2- 4 seconds.



Carbon filter sketch

1. Odour Control System Cost for Zone V

Odour Control System Cost for Zone V							
Sl. No.	Description of work	Probable Quantity	TNBP & Other Specification	Unit	Rate in INR		Amount
					In Figures	In Words	
	Tender Inviting Authority :- The Chief Engineer, TWAD Board, Coimbatore.						
	Note :- While quoting the rates, bidders have to taken into account the cost for taking insurance as given in Section-IV : Contract data and the cost for complying with the Environmental Management Plan (EMP) as furnished in Technical specifications.						
	SCHEDULE - IV :Odour control system – Active Activated Carbon Filter for 6 Stations						
1	Manhole Type Passive Activated carbon filter for Lifting Station 5H at Podhigai Residency Suction well volume : 3.35 m3 Total quantity : 1No Air change rate : 12 Air flow : 3.35m3x12 ACR=41 m3/h		Special Specification				
	Pump speed shall be of 9600 rpm for high duty Manhole Type Passive Activated carbon filter - Model: AKFM-60 Manhole type passive activated carbon filter vessel made of FRP, built in gratings, grilled openings in the side wall of the vessel,manhole cover on the top of the vessel with Lifting handle for access. Type : AKFM -60 Manufacturer : LikuTech Origin : India Maximum Filter vessel capacity : 60 m3/h Weight of carbon (kg) : 30 Vessel construction : FRP Grating & Accessories Documentation and Engineering Local Transportation	1.00 No.		1 No. (Each)	60000.00		60000.00

2	Manhole Type Passive Activated carbon filter for Lifting Station 5A at Kamachi Nagar, Lifting station 5B at Onappalayam, Lifting station 5C at SMR Nagar, Lifting station 5D at Sri ram Nagar, Lifting station 5F at Maharani Avenue Phase 4 & Lifting station 5G at GKS avenueSuction well volume in m3: 12.87, 12.57, 15.69, 14.13, 9.44 & 8.17Total quantity : 6 Nos Air change rate : 12 Max Air flow : 15.69 m3x12 ACR= 188.28 m3/h	6.00	Nos.		1 No.(Each)	77922.22		467533.33
2 (i)	Manhole Type Passive Activated carbon filter - Model: AKFM-200 Manhole type passive activated carbon filter vessel made of FRP, built in gratings, grilled openings in the side wall of the vessel,manhole cover on the top of the vessel with Lifting handle for access. Type : AKFM -200 Manufacturer : LikuTech Origin : India Maximum Filter vessel capacity : 200 m3/h Weight of carbon (kg) : 40 Vessel construction : FRP Grating & Accessories Documentation and Engineering Local Transportation							

3	Activated Carbon Filter System for Lifting station 5E at Vadavalli Crossing Model: AKFR 1500 Suction well volume : 121.68 m3 Screen well volume : 42.86 m3 Grit well volume : 26.18 m3 Total Tank Volume : 190.72m3 Air Change rate : 12 Total airflow required : 2,289 m3/h H2S inlet concentration : 150 ppm/12 ACR =12.5 ppm avg	1.00	No.		1 No.(Each)	1648000.00		1648000.00
3 (i)	Pre-Filter Type: VF 2000 Filter vessel of FRP material, filter insert made of PP mesh. Manufacturer: Liku Tech Origin: India Media: PP mesh Material casing: FRP							

3(ii)	Activated Carbon Filter Filter vessel made of FRP, round construction, manhole for maintenance and carbon filling in the top of the vessel, revision opening in the side wall of the vessel, waste air inlet and outlet made of FRP, FRP grating on support for the carbon bed, spraying system for activated carbon regeneration including stainless steel ball valve and PVC nozzle, connection for drainage including stainless steel ball valve, four sampling points with stainless steel ball valves, differential pressure switch Type: AKFR 1500 Manufacturer: Liku Tech Origin: India Total Airflow (m³/h): 2289 Nominal carbon volume (m³): 1.9 Weight of carbon (kg): 950 Superficial contact time (s): 3.1 Diameter (mm): 1500 Height (mm): 1700 Vessel construction: FRP Filtering surface (m²): 1.77 Carbon bed depth (m): 1.07						
3(iii)	Activated carbon (950 Kgs of Activated Carbon per system) The activated carbon will be delivered in 25 kg or 500 kgs bags whichever fits your requirement and has to be filled into the filter vessel on site. Therefore the bags are equipped with an outlet opening in the bottom of the bag. Type of carbon: Catalytic carbon, regenerable by water Moisture, as packed: < 5 % Apparent						

	density (kg/m ³): 500 +/- 30 Pellet diameter (mm): 4 Hardness no.: > 97						
3 (iv)	Fan (1 Duty fan per system) Type: Radial fan Manufacturer: Nadi Airtechnics limited or equivalent Origin: India Capacity (m ³ /h): 2289 Static pressure (Pa): 2500 Material housing: SS 316 Material impeller: SS316 Motor power rating (kW): app.2.2 Motor power supply. 415 V, 50 Hz Drive: Direct driven						
3(v)	Interconnecting ductwork Interconnecting ductwork between pre-filter, fan and carbon filter. Manufacturer: Liku Tech Origin: India Material: FRP Diameter (mm): Suitable for AKFR 1500 Including: 1 x Volume control damper						
3 (vi)	Switch cabinet Switch cabinet for the above mentioned odour control system. Mounted at the filter vessel. Including: 1 x Main switch 1 x Soft Starter for fan 2.2 kW 1 x On / Off switch for fan 1 x Status lights for fan						
3 (vii)	Documentation and engineering · Basic Eng. · Drawings · P+ID · Functional description · List of Equipment · Operating and maintenance manuals						

4	Activated Carbon Filter System for ZONE 5-MPS AT STP SITE CHOKKAMPUDUR Suction well volume : 356.08 m3 Screen well volume : 99 m3 Grit well volume : 121.88 m3 Total Volume : 576.96 m3 Air Change rate : 12 Total airflow required : 6,924 m3/h H2S inlet concentration : 150 ppm/12 ACR =12.5 ppm avg	1.00	No.		1 No.(Each)	5926265.00		5926265.00
4 (i)	Pre-Filter Type: VF 4000 Manufacturer: Liku Tech Origin: India Media: PP mesh Casing material: FRP							

4(ii)	Activated Carbon Filter Filter vessel of FRP material with stainless steel reinforcement, angular construction, manholes for maintenance and carbon filling in the top of the vessel, revision openings on one side of the vessel, waste air inlet and outlet of FRP, plastic grating, spraying system for activated carbon regeneration with SS 316 ball valve, connection for drainage including SS 316 ball valve, four sampling points with SS 316 ball valves, differential pressure switch. Type: AKFE 4000 Manufacturer: Liku Tech Origin: India Total Airflow (m³/hr): 6924 Nominal carbon volume (m³): 6 Weight of carbon (kg): 3000 Superficial contact time (s): 3.1 Length (mm): app. 4000 Height (mm): app. 2100 Width (mm): app. 2150 Vessel material: FRP Filtering surface (m²): app.8 Bed depth (m): 0.75						
4(iii)	Activated carbon (3000 KGS PER VESSEL) The activated carbon will be delivered in 25 kg or 500 kgs bags whichever fits your requirement and has to be filled into the filter vessel on site. Therefore the bags are equipped with an outlet opening in the bottom of the bag. Type of carbon: Catalytic carbon, regenerable by water Moisture, as packed: < 5 % Apparent density (kg/m³): 500						

	+/- 30 Pellet diameter (mm): 4 Hardness no.: > 97						
4 (iv)	Fan Type: Radial fan Manufacturer: Nadi Airtechnics limited or equivalent Origin: India Capacity (m³/hr): 692 Static pressure (Pa): 2100 Material housing: Stainless Steel 316 Material impeller: Stainless Steel 316 Motor speed at 50 Hz (rpm): app. 1400 Motor power rating (kW): app.7.5 Power supply: 415 V, 60 Hz Drive: Direct driven						
4(v)	Interconnecting ductwork Interconnecting ductwork between pre-filter, fan and carbon filter. Manufacturer: Liku Tech Origin: India Material: FRP Diameter (mm): Suitable for AKFE 4000 Including: 1 x Volume control damper						

4 (vi)	Switch Cabinet Switch cabinet for the above mentioned odour control system. Mounted at the filter vessel. Including: 1 x Main switch 1 x Soft Starter for fan 7.5 kW 1 x On / Off switch for fan 1 x Status lights for fan						
4 (vii)	Documentation and engineering · Basic eng. · Drawings · P+ID · Functional description · List of Equipment · Operating and maintenance manual						
5	Local Transportation Odour control system for all the 9 stations in Zone V is packed at Chennai factory and delivered till Coimbatore site	1.00 Lot		1 Lot. (Each Lot)	236275.41		236275.41
6	Additional Option						
	H2S Monitor for Active ACF system (1 unit for system outlet) H2S monitor for the measurement of the H2S concentration at the system. outlet. Monitoring for: H2S Output Signal: 4...20 mA Measuring range: 0...20 ppm(outlet) Unit Price for single H2S Monitor: 2,50,000.00 INR Note: If required we can supply Handheld monitor instead of H2S monitor as economical option	2.00 Unit		1 Lot.(Each Lot)	250000.00		500000.00
	Exclusions · Mobile crane for erection during installation. · External ducting from the source point to the Inlet of our OCS · Off-loading and positioning the goods						

	to the location · Any civil work like excavation, backfilling, concreting. · Condensate water drain from fans, pre-filters and carbon filters. · Power supply cable between your MCC and panel board for OCS. · Control cable if any from our panel to your DCS / SCADA etc., · Any necessary GATE passes / Entry permit · Any HSE safety induction for our team · No TPI or Inspection cost involved · Any Installation or commissioning works · Spare motors can be provided based on Client's request at additional cost · Supervision of Installation & Commissioning will be extra at actual						
	Total for Schedule - IV (Carried over to Final Abstract)						8838073.74

2. Odour Control System Cost for Zone VII

Zone - VII SCH IV- Supply of Odour control system – Active Activated Carbon Filter for 3 Stations

Sl. No.	Description of works	Probable quantity in figures	TNBP No. other specification	Unit in	Rate in		Amount in figures
					Figures	Words	
1	Manhole Type Passive Activated carbon filter for Lift station 1 at Siva castle –ZVIB, Lift station 2 at Lakshmi garden, Lift station 3 at Easwaran Garden –Z1 Suction well volume in m3: 8.86, 7.13 & 9.67 Total quantity : 3 Nos Air change rate : 12 Max Air flow : 15.69 m3x12 ACR= 188.28 m3/h	3.0 Nos 0 .		1 No. (Each)	77922.22		233766.67

1	Manhole Type Passive					
(i)	Activated carbon filter - Model: AKFM-200 Manhole type passive activated carbon filter vessel made of FRP, built in gratings, grided openings in the side wall of the vessel, manhole cover on the top of the vessel with Lifting handle for access. Type : AKFM -200 Manufacturer : LikuTech Origin : India Maximum Filter vessel capacity : 200 m3/h Weight of carbon (kg) : 40 Vessel construction : FRP Grating & Accessories Documentation and Engineering Local Transportation					
2	Activated Carbon Filter System for Zone 7A Cheran Colony Model: AKFE 3000 Suction well volume : 232.38 m3 Screen well volume : 89.70 m3 Grit well volume : 52.44 m3 Total Tank Volume : 374.52 m3 Air Change rate : 12 Total airflow required : 4,495 m3/h H2S inlet concentration : 150 ppm/12 ACR =12.5 ppm avg	1.0 No. 0		1 No.(Each)	4058165.00	4058165.00
2	Pre-Filter					
(i)	Type: Liku Tech VF 3000 Filter vessel of FRP material, filter insert made of PP mesh. Manufacturer: Liku Tech Origin: India Media: PP mesh Material casing: FRP					
2(ii)	Activated Carbon Filter Filter vessel of FRP material with stainless steel reinforcement, angular construction, manholes for maintenance and carbon filling in the top of the vessel, revision openings on one side of the vessel, waste air inlet and outlet					

	of FRP , plastic grating, spraying system for activated carbon regeneration with SS 316 ball valve, connection for drainage including SS 316 ball valve, four sampling points with SS 316 ball valves, differential pressure switch Type: AKFE 3000 Manufacturer: Liku Tech Origin: India Total Airflow (m³/hr): 4495 Nominal carbon volume (m³): 4 Weight of carbon (kg): 2000 Superficial contact time (s): 3-5 s Length (mm): app. 3100 Height (mm): app. 2100 Width (mm): app. 2150 Vessel material: FRP Filtering surface (m²): app. 6 Bed depth (m): 0.67						
2 (iii)	Activated carbon (2000 Kg) The activated carbon will be delivered in 25 kg or 500 kgs bags whichever fits your requirement and has to be filled into the filter vessel on site. Therefore the bags are equipped with an outlet opening in the bottom of the bag. Type of carbon: Catalytic carbon, re-generable by water Moisture, as packed: < 5 % Apparent density (kg/m³): 500 +/- 30 Pellet diameter (mm): 4 Hardness no.: > 97						
2(iv)	Fan Type: Radial fan Manufacturer: Nadi Airtechnics limited or equivalent Origin: India Capacity (m³/hr): 4495 Static pressure (Pa): 2100 Material housing: Stainless Steel 316 Material impeller: Stainless Steel 316 Motor speed at 50 Hz (rpm): app. 1400 Motor power rating (kW): app. 5.5 Power supply: 415 V, 60 Hz Drive: Direct drive						

2 (v)	Interconnecting ductwork Interconnecting ductwork between pre-filter, fan and carbon filter. Manufacturer: Liku Tech Origin: India Material: FRP Diameter (mm): Suitable for AKFE 3000 Including: 1 x Volume control damper						
2 (vi)	Switch Cabinet Switch cabinet for the above mentioned odour control system. Mounted at the filter vessel. Including: 1 x Main switch 1 x Soft Starter for fan 5.5 kW 1 x On / Off switch for fan 1 x Status lights for fan						
2 (vii)	Documentation and engineering · Basic eng. · Drawings · P+ID · Functional description · List of Equipment · Operating and maintenance manuals						
3	Activated Carbon Filter System for MPS KOUNDAMAPALAYAM GRIT WELL Model : AKFE 4000 Grit well volume : 667 m3 Air Change rate : 12 Total airflow required : 8004 m3/h H2S inlet concentration : 150 ppm/12 ACR =12.5 ppm avg	1.0 No. 0		1 No.(Each)	6686575.00		6686575.00
3 (i)	Pre-Filter Type: VF 4000 Manufacturer: Liku Tech Origin: India Media: PP mesh Casing material: FRP						

3(ii)	Activated Carbon Filter Filter vessel of FRP material with stainless steel reinforcement, angular construction, manholes for maintenance and carbon filling in the top of the vessel, revision openings on one side of the vessel, waste air inlet and outlet of FRP, plastic grating, spraying system for activated carbon regeneration with SS 316 ball valve, connection for drainage including SS 316 ball valve, four sampling points with SS 316 ball valves, differential pressure switch. Type: AKFE 4000 Manufacturer: Liku Tech Origin: India Total Airflow (m³/hr): 8004 Nominal carbon volume (m³): 7.2 Weight of carbon (kg): 3600 Superficial contact time (s): 3.1 Length (mm): app. 4000 Height (mm): app. 2100 Width (mm): app. 2150 Vessel material: FRP Filtering surface (m²): app.8 Bed depth (m): 0.9						
3 (iii)	Activated carbon (3600 KGS PER VESSEL) The activated carbon will be delivered in 25 kg or 500 kgs bags whichever fits your requirement and has to be filled into the filter vessel on site. Therefore the bags are equipped with an outlet opening in the bottom of the bag. Type of carbon: Catalytic carbon, regenerable by water Moisture, as packed: < 5 % Apparent density (kg/m³): 500 +/- 30 Pellet diameter (mm): 4 Hardness no.: > 97						

4(iv)	Fan Type: Radial fan Manufacturer: Nadi Airtechnics limited or equivalent Origin: India Capacity (m³/hr): 8004 Static pressure (Pa): 2100 Material housing: Stainless Steel 316 Material impeller: Stainless Steel 316 Motor speed at 50 Hz (rpm): app. 1400 Motor power rating (kW): app.11 Power supply: 415 V, 60 Hz Drive: Direct driven						
3 (v)	Interconnecting ductwork Interconnecting ductwork between pre-filter, fan and carbon filter. Manufacturer: Liku Tech Origin: India Material: FRP Diameter (mm): Suitable for AKFE 4000 Including: 1 x Volume control damper						
3 (vi)	Switch Cabinet Switch cabinet for the above mentioned odour control system. Mounted at the filter vessel. Including: 1 x Main switch 1 x Soft Starter for fan 11 kW 1 x On / Off switch for fan 1 x Status lights for fan						
3 (vii)	Documentation and engineering · Basic eng. · Drawings · P&ID · Project Management · Procurement · Functional description · Operating and maintenance manuals · Spare parts list						

4	Activated Carbon Filter System for MPS KOUNDAMAPALAYAM SCREEN WELL Model : AKFE 6000 Grit well volume : 981 m3 Air Change rate : 12 Total airflow required : 11,772 m3/h H2S inlet concentration : 150 ppm/12 ACR =12.5 ppm avg Pre-Filter (i) Type: VF 6000 Manufacturer: Liku Tech Origin: India Media: PP mesh Casing material: FRP Activated Carbon Filter (ii) Filter vessel of FRP material, angular construction, manholes for maintenance and carbon filling in the top of the vessel, revision openings on one side of the vessel, waste air inlet and outlet of FRP, plastic grating, spraying system for activated carbon regeneration with SS 316 ball valve, connection for drainage including SS 316 ball valve, four sampling points with SS 316 ball valves, differential pressure switch. Type: AKFE 6000 Manufacturer: Liku Tech Origin: India Total Airflow (m³/hr): 11772 Nominal carbon volume (m³): 10.2 Weight of carbon (kg): 5100 Superficial contact time (s): 3.1 Length (mm): app. 6100 Height (mm): app. 2100 Width (mm): app. 2150 Vessel material: FRP Filtering surface (m²): app.12 Bed depth (m): 0.85	1.0 0	No.		1 No.(Each)	9685063.00	9685063.00
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4(iii)	Activated carbon (5100 KGS PER VESSEL) The activated carbon will be delivered in 25 kg or 500 kgs bags whichever fits your requirement and has to be filled into the filter vessel on site. Therefore the bags are equipped with an outlet opening in the bottom of the bag. Type of carbon: Catalytic carbon, re-generable by water Moisture, as packed: < 5 % Apparent density (kg/m³): 500 +/- 30 Pellet diameter (mm): 4 Hardness no.: > 97							
4 (iv)	Fan Type: Radial fan Manufacturer: Nadi Airtechnics limited or equivalent Origin: India Capacity (m³/hr): 11772 Static pressure (Pa): 2500 Material housing: Stainless Steel 316 Material impeller: Stainless Steel 316 Motor speed at 50 Hz (rpm): app. 1400 Motor power rating (kW): app.15 Power supply: 415 V, 60 Hz Drive: Direct driven							
4 (v)	Interconnecting ductwork Interconnecting ductwork between pre-filter, fan and carbon filter. Manufacturer: Liku Tech Origin: India Material: FRP Diameter (mm): Suitable for AKFE 6000 Including: 1 x Volume control damper							
4(vi)	Switch Cabinet Switch cabinet for the above mentioned odour control system. Mounted at the filter vessel. Including: 1 x Main switch 1 x Soft Starter for fan 15 kW 1 x On / Off switch for fan 1 x Status lights for fan							

4 (vii)	Documentation and engineering · Basic eng. · Drawings · P&ID · Project Management · Procurement · Functional description · Operating and maintenance manuals · Spare parts list						
5	Activated Carbon Filter System for MPS KOUNDAMAPALYAM SUCTION WELL Model : AKFE 8000 Suction well volume : 2426 m3 Air Change rate : 12 Total airflow required : 29,112 m3/h H2S inlet concentration : 150 ppm/12 ACR =12.5 ppm avg	1.0 0	No.	1 No. (Each)	22669090.0 0	22669090.0 0	
5 (i)	Pre-Filter Type: VF 8000 Manufacturer: Liku Tech Origin: India Media: PP mesh Casing material: FRP Including differential pressure gauge						

5(ii)	Activated Carbon Filter Filter vessel of FRP material, angular construction, manholes for maintenance and carbon filling in the top of the vessel, revision openings on one side of the vessel, waste air inlet and outlet of FRP, plastic grating, spraying system for activated carbon regeneration with SS 316 ball valve, connection for drainage including SS 316 ball valve, four sampling points with SS 316 ball valves and differential pressure switch. Type: AKFE 8000 Manufacturer: Liku Tech Origin: India Total Airflow (m³/hr): 14,556 Nominal carbon volume (m³): 12.8 Weight of carbon (kg): 6400 Superficial contact time (s): 3.1 Length (mm): app. 8000 Height (mm): app. 2100 Width (mm): app. 2150 Vessel material: FRP Filtering surface (m²): app. 16 Bed depth (m): 0.8						
5 (iii)	Activated carbon 12800 Kg (6400 KG PER VESSEL) The activated carbon will be delivered in 500 kg big bags and has to be filled into the filter vessel on site. Therefore the big bags are equipped with an outlet opening in the bottom of the bag. Type of carbon: Catalytic carbon, regenerable by water Moisture, as packed: < 5 % Apparent density (kg/m³): 500 +/- 30 Pellet diameter (mm): 4 Hardness no.: > 97						

5(iv)	Fan (1 Duty fan only) Type: Radial fan Manufacturer: Nadi Airtechnics limited or equivalent Origin: India Capacity (m³/hr): 29,112 Static pressure (Pa): 2500 Material housing: Stainless Steel 316 Material impeller: Stainless Steel 316 Motor speed at 50 Hz (rpm): app. 1400 Motor power rating (kW): app. 30 Power supply: 415 V, 50 Hz Drive: Direct driven						
5 (v)	Interconnecting ductwork Interconnecting ductwork between pre-filters, fan and carbon filters. Manufacturer: Liku Tech Origin: India Material: FRP Diameter (mm): 1000 / 710 Including: 1 x Y-Piece 2 x Volume control damper at the inlet of the carbon filter vessels 2 x Reducer 2 x Transition piec						
5 (vi)	Switch cabinet Switch cabinet for the above mentioned odour control system. Mounted at the filter vessel. Including: 1 x Main switch 1 x Soft Starter for fan 30 kW 1 x On / Off switch for fan 1 x Status lights for fan						
5(vii)	Documentation and engineering · Basic eng. · Drawings · P&ID · Project Management · Procurement · Functional description · Operating and maintenance manuals · Spare parts list						
6	Local Transportation Odour control system for all the 9 stations in Zone V is packed at Chennai factory and delivered till Coimbatore site	1.0 Lot 0		1 Lot. (Each Lot)	1263724.59		1263724.59
7	Additional Option						

	H2S Monitor for Active ACF system (1 unit for system outlet) H2S monitor for the measurement of the H2S concentration at the system. outlet. Monitoring for: H2S Output Signal: 4...20 mA Measuring range: 0...20 ppm(outlet) Note: If required we can supply Handheld monitor instead of H2S monitor as economical option Exclusions · Mobile crane for erection during installation. · External ducting from the source point to the Inlet of our OCS · Off-loading and positioning the goods to the location · Any civil work like excavation, backfilling, concreting. · Condensate water drain from fans, pre-filters and carbon filters. · Power supply cable between your MCC and panel board for OCS. · Control cable if any from our panel to your DCS / SCADA etc., · Any necessary GATE passes / Entry permit · Any HSE safety induction for our team · No TPI or Inspection cost involved · Any Installation or commissioning works · Spare motors can be provided based on Client's request at additional cost · Supervision of Installation & Commissioning will be extra at actua	2.0 0 Unit		1 Lot. (Each Lot)	250000.00		500000.00
	Zone VII - SCH IV - Total						45096384.26