CHAPTER 10 Operation and Maintenance of Sewerage Facilities

10.1 General

Sewerage facilities to be operated and maintained include sewers, intermediate pump stations (IPSs) and sewage treatment plants (STPs). Presently, O&M of existing IPSs and STPs are undertaken by contractors with minimal involvement of the PMC, while for sewers there is a team in PMC to conduct O&M work, as required basis.

10.2 Sewers

Sewers in this project will be constructed using a standardized detailed design-bid-build approach. The project management consultants will prepare detailed design and assist PMC for construction supervision.

Sewers are categorized into two from the view point of different O&M activities. These are main/sub-main sewers and sewer network including house connections. The former shall be managed by technical monitoring team of PMC, while for the latter not only technical countermeasures, but also the activities for the development of the relationship with people by the team of PMC shall be considered to get understanding from beneficiary residents on sewerage requirements with proper sewerage user payment. For the O&M of main/sub-main sewers, the city shall be divided into 3 areas (northern, central and southern areas) for proper O&M of sewer systems in the entire city.

10.3 STP and IPS

Currently Operation and Maintenance (O&M) of the majority of existing Sewage Treatment Plants (STPs) and Intermediate Pumping Stations (IPSs) has been undertaken by the Contractors who were awarded the Construction Contract. The contractor is usually to operate and maintain the STP/IPSs for an initial period of 5 years and at the end of the 5th year the Contractor is required to handover the STP/IPS operation either to PMC and/or to a newly selected Contractor to operate the plant for the future operation. This arrangement is common for PMC, even in India (private sector participation), and existing 9 STPs in PMC have been operated by the Contractors. Table 10.3.1 presents a quick synopsis of existing operation and maintenance tasks having been provided by various contractors excepting for the Old Naidu STP, which is being operated by PMC.

Table 10.3.1 A Quick Synopsis of Existing Operation and Maintenance Tasks

STP	Capacity	Liquid stream treatment	Solid stream treatment	Year of commissioning	Current O&M Agency	Current O&M Contract period	Current O&M since	Remarks
Bahiroba Nala	130 MLD	ASP	An Dig + Power	2003	Mahabal Enviro	5 years	2013	Mahabal doing O&M since 2008
Baner	30 MLD	SBR	Direct dewatering	2010	Gondwana	5 years	Jan 2011	
Bopodi	18 MLD	EA	Direct dewatering	2003	Gharpure	5 years	Nov 2012	
Erandawane	50 MLD	ASP	Aer Dig	2004	VA Tech	5 years	Sept 2014	
Kharadi	40 MLD	SBR	Direct dewatering	2012	Enviro Control	5 years	June 2012	
Mundhwa	45 MLD	SBR	Direct dewatering	2009	Degremont	5 years	Aug 2014	
New Naidu	115 MLD	ASP	An Dig + Power	2010	Enviro Control	5 years	July 2010	
Old Naidu	90 MLD	ASP		1988	PMC			
Tanajiwadi	17 MLD	Biotower + ASP	Direct dewatering	2004	VA Tech	5 years	Sept 2014	
Vitthalwadi	32 MLD	ASP	Aer Dig	2009	Ramky			
PS								
Botanical Garden					Gharpure		Nov 2012	
Kalyani Nagar					Mahabal			Mahabal doing O&M since 2008
Mangalwar Peth					PMC			
Mental Hospital					Mahabal			Mahabal doing O&M since 2008
New Kasba					Gharpure		July 2010	
Old Kasba					PMC			
Topkhana					Gondwana		Oct 2010	

10.3.1 Obligation of Contractor for O&M of STPs

It is recommended to take the following measures for this Project before commencement of O&M contracts with the Contractor/s after construction of STPs.

Contractor shall obtain the certificate on the completion and operational acceptance from PMC. The following set of information shall also be submitted by the Contractor/s.

1) An inventory of all civil works, mechanical, electrical equipment, electronics and other instrumentation provided at the STP/IPS with detailed specifications;

2) Completion drawings (As Built) showing all construction details with dimensions of all units of treatment plant covering all civil and mechanical works.

3) Completion drawings for all Electrical and Instrumentation works including routing of underground cables, conduit wiring details, panel board, list of all electrical equipment, fixtures and fittings with their location of installation, and test certificates, warrantee certificates, etc.

4) An inventory of the entire laboratory equipment with detailed specifications.

5) O&M Manual prepared by the Contractor and reviewed by the Consultants for the said STP/IPS including preventive maintenance schedules for each equipment. A step by step operation instruction shall be prepared and included in this O&M Manual. The maintenance manual shall provide trouble shooting charts for each equipment and a list of essential spares to be stocked for each equipment.

6) Plant flow diagram showing all hydraulic levels, layout plan drawing of the treatment Plant showing all treatment units, inter connecting pipe lines with sizes and their routing below ground level and roads and pathways marked in plan together with a brief write up explaining the treatment process.

10.3.2 Functional Responsibilities of the Contractor

1) The Contractor shall be responsible for effective O&M of the STPs. The scope of work includes treating and disinfecting the effluent in conformity with the production capacity, consumption of chemical and electricity, besides maintaining effluent quality requirements as shown below.

pH	=	6.5 - 8.5
Suspended solids	<	10 mg/l
Turbidity	<	5 NTU
BOD5	<	10 mg/l
Total phosphorus as P	<	2 mg/l
Total Nitrogen as N	<	10.0 mg/l
Total Coliform	<	2500/100ml after chlorinating

To ensure the above requirements the Contractor shall organize and carry out the O&M work in a professional manner using best quality of treatment chemicals, efficient use of electrical energy, and by deploying well trained staff at each STP/IPS.

2) The Contractor shall maintain the laboratory (required as part of contract) and shall carry out the routine analysis of various indices following established frequencies by PMC in the Contract.

3) The Contractor shall operate the Plant through the day for a year in application of 3 shifts of 8 hours per shift, etc.

4) The Contractor shall organize a three day training course for O&M of the STP for all his staff and also for personnel nominated by PMC. The course content shall include brief introduction to technology used for sewage treatment, recycling and reuse of treated water, effective use of electricity and generation of electricity through bio-gas for savings, disinfection, preparation of chemical solution of required concentration and dosage, details of specific unit operations of the STP, maintenance schedule of all the plant equipment, maintenance of log books, preventive maintenance works to be carried out for major equipment etc. The course content and faculty shall be got concurred by Employer.

5) Operation of the STP shall be carried out using the recommended procedure for each unit treatment process as per the detailed O&M Manual. The Contractor is responsible for laboratory testing of the raw sewage and treated effluent in the plant laboratory as routine process measurements.

6) Minor and major repairs to equipment installed at the STP have to be carried out by the Contractor during the O & M period of five (5) years (or as many years required by PMC).

7) Besides individual log books, Contractor shall be responsible for providing input in the mainte-

nance management system through Asset Management plan that is being implemented as part of project, in the computer shall also record the following:

Equipment wise records of

Date and details of Preventive maintenance

Date and details Break downs

Date and details Major repairs

Details of service contract

Servicing dates and preventive/remedial measures undertaken

8) The Contractor shall maintain separate registers showing the following details. Following registers shall be maintained by the head of the operating staff to be named by the Contractor in writing to the Employer.

a) Personnel: Name of the employees in each shift, their attendance records

b) Individual log book of each equipment, instrument etc.

・Daily　Record of Operation

・Date and Details of Preventive maintenance (spares and consumables used)

・Break down and major reason thereof

・Dates and duration of out of operation hours

・Details of breakdown maintenance (date, spares, consumables etc.)

・Dates of calibration and results thereof

c) Separate Registers shall be maintained

・Shift wise use of Chemicals separately for treatment and disinfection showing the amount of chemicals used either in kg or liters of chemical solution (with strength).

・Equipment wise Fuel and other consumables used,

・Shift wise power use and Power Produced (if at the plant power generation is installed)

・Shift wise quantity of sewage pumped into the Plant and effluent discharged

・Daily Test results of effluent water quality

・Other registers required to be maintained as stipulated by the Government Regulations with regard to labor i.e. payment of EPF, ESI, safety of workmen, accidents register etc.

・Calibration results of facilities (including reuse and power generation)

10.4 Monitoring and Control of Sewerage System in use of SCADA System

It is anticipated that all of the STPs and IPSs would be connected under a centralized SCADA system to monitor the effectiveness of treatment and overall operation and management of the STPs and IPSs

through an Asset Management Program. The water quality and other pertinent data including routine maintenance issues would be transferred to this centralized SCADA system for better control.

The influent and effluent water quality shall be collected at the individual SCADA system at the individual STPs (including flow data from IPSs), which will be transferred to centralized SCADA as recommended above. The operator stations work as HMI (Human Machine Interface) for assisting the operating staffs to control/monitor the STP properly. There are many set points given to the control logic for the equipment/plant loads as a manipulating value, for ex. levels, flows, etc. The data/SCADA servers play a role of data processing, generating reports such as daily, monthly and yearly, warning alarms. There are some ancillary/incidental devices provided at the central control room to make the local SCADA system complete, like printers, Ethernet managed switches and telecommunication devices. Fiber optic cables may be utilized as data transmission medium within the STP to link among the PLCs and the connectivity server. There are fiber optic cables, GPRS wireless network, Internet service provider's web-based fiber optic connection etc., available as data transmission medium to link the local SCADA systems and the central/master SCADA system. The fiber optic cables will be laid along the sewer lines by PMC by their own use purposes, while the GPRS wireless network and the web-based fiber optic cable will be pro-vided by internet service providers for the user of data transmission. It is necessary for the study team to survey availability, data transmission rate and reliability of data transmission services at the place for proposed IPSs and STPs under this project.

10.5 Sewage Treatment Plant and Additional Facilities for Effluent re-use and gas utilization

Recycle and reuse facilities (i.e., treatment units)-if included in the Contract, shall be constructed by the Contractor as part of STP Construction as well as operated by the same contractor. Once it is implemented, the contractor who operates the STP will also be responsible for the operation and maintenance of the recycle & reuse facility.

As part of this project, it is anticipated that electrical generation facility would be constructed to use bio-gas for the production of electricity. The electricity generated through bio-gas will offset the electricity costs that PMC will have to pay to Maharashtra State Electricity Distribution Company Limited (MSEDCL). To get the capital cost to operating benefit, the power generation facility is to be constructed only at two STPs, - i.e., Naidu and Bhairoba. Both of these facilities could be designed as composite facilities taking sludge not only from the STPs where it will be situated, but also from other STPs.

10.6 Water Quality Examination for inflow and effluent at STP

It is recommended that following measures shall be taken to ensure proper O&M of the STPs. During the first two years of the O&M Contract (1 year of DNP + 1 year of O&M), the raw sewage pumped into the Sewage Treatment Plant and the treated, and disinfected effluent shall be sampled as scheduled in Table 10.6.1 and analyzed in the laboratory (in-house) at the STP.

Table 10.6.1 Sampling/Analysis Locations and Frequencies

Parameter	Sampling Frequency	Sampling Method	Sampling points/location
pH	1.Daily	Flow-weighted 24-hour composite	a) Raw Sewage b) Plant Effluent
	2. Three times per week	Grab	Aeration Basin Zones a) Anaerobic (if applicable) b) Anoxic c) Aerobic
Turbidity	1. Daily	Flow-weighted 24-hour composite	Effluent from secondary clarifiers or from SBR basin
	2. Continuous	On-line	Effluent from secondary clarifiers or from SBR basin
COD	1. Daily	Flow-weighted 24-hour composite	a) Raw Sewage b) Plant Effluent
rbCOD	Weekly	Influent	Influent sewage
TSS	1. Daily	Flow-weighted 24-hour composite	a) Raw Sewage b) Plant Effluent
	2. Twice a week	Grab	Waste activated sludge (WAS)
VSS	1. Daily	Flow-weighted 24-hour composite	Raw Sewage
	2. Twice a week (Tue, Thu)	Grab	Waste activated sludge (WAS)
Residual chlorine	1. Daily	Grab	Plant Effluent
	2. Continuous	On-line	Plant Effluent

BOD	1. Three times per week	Flow-weighted 24-hour composite	a) Raw Sewage Influent b) Plant Effluent
TKN	1. Three times per week	Flow-weighted 24-hour composite	a) Raw Sewage b) Plant Effluent
Ammonia-N	1. Three times per week	Flow-weighted 24-hour composite	a) Raw Sewage b) Plant Effluent
	2. Three times per week	Grab	Aeration Basin Zones (as designed) a) Anaerobic (if applicable) b) Anoxic c) Aerobic
Nitrate-N	1. Three times per week	Flow-weighted 24-hour composite	a) Raw Sewage b) Plant Effluent
	2. Three times per week	Grab	Aeration Basin Zones a) Anaerobic (if applicable) b) Anoxic c) Aerobic
Alkalinity	1. Three times per week	Flow-weighted 24-hour composite	a) Raw Sewage b) Plant Effluent
	2. Three times per week	Grab	Aeration Basin Zones a) Anaerobic (if applicable) b) Anoxic c) Aerobic
Total phosphorous	1. Three times per week	Flow-weighted 24-hour composite	Raw Sewage and Plant Effluent
Soluble phospho-rous	1. Three times per week	Flow-weighted 24-hour composite	Raw Sewage and Plant Effluent
	2. Three times per week	Grab	Aeration Basin Zones a) Anaerobic (if applicable) b) Anoxic c) Aerobic

Fecal coliform	1. Three times per week	Flow-weighted 24-hour composite	a) Raw Sewage b) Plant Effluent
VFAs	1. Three times per week	Grab	a) Raw Sewage b) Anaerobic zone (from Digester – if provided)
MLSS	1.Twice a week	Grab	Aerobic zone
MLVSS	1.Twice a week	Grab	Aerobic zone
Flow rate	1.Continuous	On-line flowmeter	a) Raw Sewage (Plant Effluent) b) Plant Effluent c) RAS d) WAS e) Sludge
Temperature	1. Daily	Flow-weighted 24-hour composite	a) Raw Sewage b) Plant Effluent
Specific gravity and concentration	1. Three times per week	Grab	Chemicals Sludge for consistency
Volume	1. Three times per week	Grab	Chemicals/Screenings/Grit/ Gas generation if applicable
Electricity Generation	Daily	On-line	Gas Quality, Volume, Engine running and Electricity Generation.

For the subsequent four years, the sampling and analysis shall be conducted (on 24 hours-composite sample) once every week and shall cover all the days of the week during a seven week period. In addition, the Contractor shall be required to validate its analysis of effluent samples up to four times in a month from an approved laboratory (by Bureau of India Standards), which is not connected with the Project. The validation sampling shall be randomly selected based on PMC's decision and the cost of validation/analysis shall be borne by the Contractor.

During the entire operation and maintenance period, PMC shall nominate their official/counterparts for the inspection of specific STPs on a weekly basis. PMC shall also nominate a qualified person to carry out periodical inspection of the STPs and to conduct surprise checks, without prior notice to the Con-

tractor. This policy is at most required to ensure, PMC gets bets services from the Contractor(s) and meets all the effluent quality requirement ensuring pollution abatement of the River.
PMC shall check the treated effluent quality of the STP every day and request the Contractor to undertake appropriate remedial actions, if the performance of the plant is observed as not satisfactory i.e., non-meeting the functional guarantees.

It is further recommended that PMC shall further engage an approved (or Bureau of Indian Standards Certified) laboratory for assessing the effluent water quality indices, for which the samples shall be jointly collected by the PMC and Contractor. The selection of sample locations and number of samples shall be developed during the first year defect liability period. The results of such analysis shall be binding on both PMC and the Contractor.

During the Defect Notification Period (DNP) PMC shall carryout monthly, quarterly, half yearly and annual inspection of the treatment plant through its designated personnel as well as with the assistance of project management consultants and based on their suggestions, the PMC shall suggest necessary improvements to the Contractor for efficient O&M of the STP.

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10.8 Institutional Structure and Technical Capacity needs for PMC to manage sewerage systems

10.8.1 Sewerage Sector

The following are specific arrangements for the existing sewerage facilities.

- ✓ O&M of old STP at Naidu Hospital and IPS at Kasba: As mentioned above, out of the 10 STPs and 14 IPSs, PMC has outsourced O&M of 9 STPs and 13 IPSs to private contractors. However, O&M of 1 STP (Naidu Hospital) and 1 IPS (at Kasba) is carried out by in-house team headed by Superintending Engineer (Electrical), supported by Executive Engineer (1), Deputy Engineer (1) and Junior Engineers (3).
- ✓ Construction of the Sewer network: Superintending Engineer (Sewerage) is responsible for construction of sewer network, supported by a dedicated team of 11 engineers comprising of Executive Engineer (1), Deputy Engineers (3) and Junior Engineers (7). Their key function is to carry out works valued above INR 2.5 million and sewer lines with diameter of 450 mm or above.
- ✓ O&M of Sewer Network: For managing the sewer network, the city area is divided into four zones (as shown in Figure 10.8.1), each under a Zonal Commissioner assisted by an Executive Engineer. Each zone is further sub-divided into 15 wards (these are not related to the 152 Administrative Wards), each having one Deputy Engineer and one Junior Engineer to oversee O&M of sewer line, chambers etc. Accordingly, there are 4 Zonal Commissioners, supported by Executive Engineers (4), Deputy Engineers (15) and Junior Engineers (15).
- ✓ Zonal Commissioners, Executive Engineers, Deputy Engineers and Junior Engineers have their offices in the field. Superintending Engineers upwards in the hierarchy have their offices at PMC Headquarters.

The Sewerage sector organization structure described above is summarized in the Figure 10.8.2.

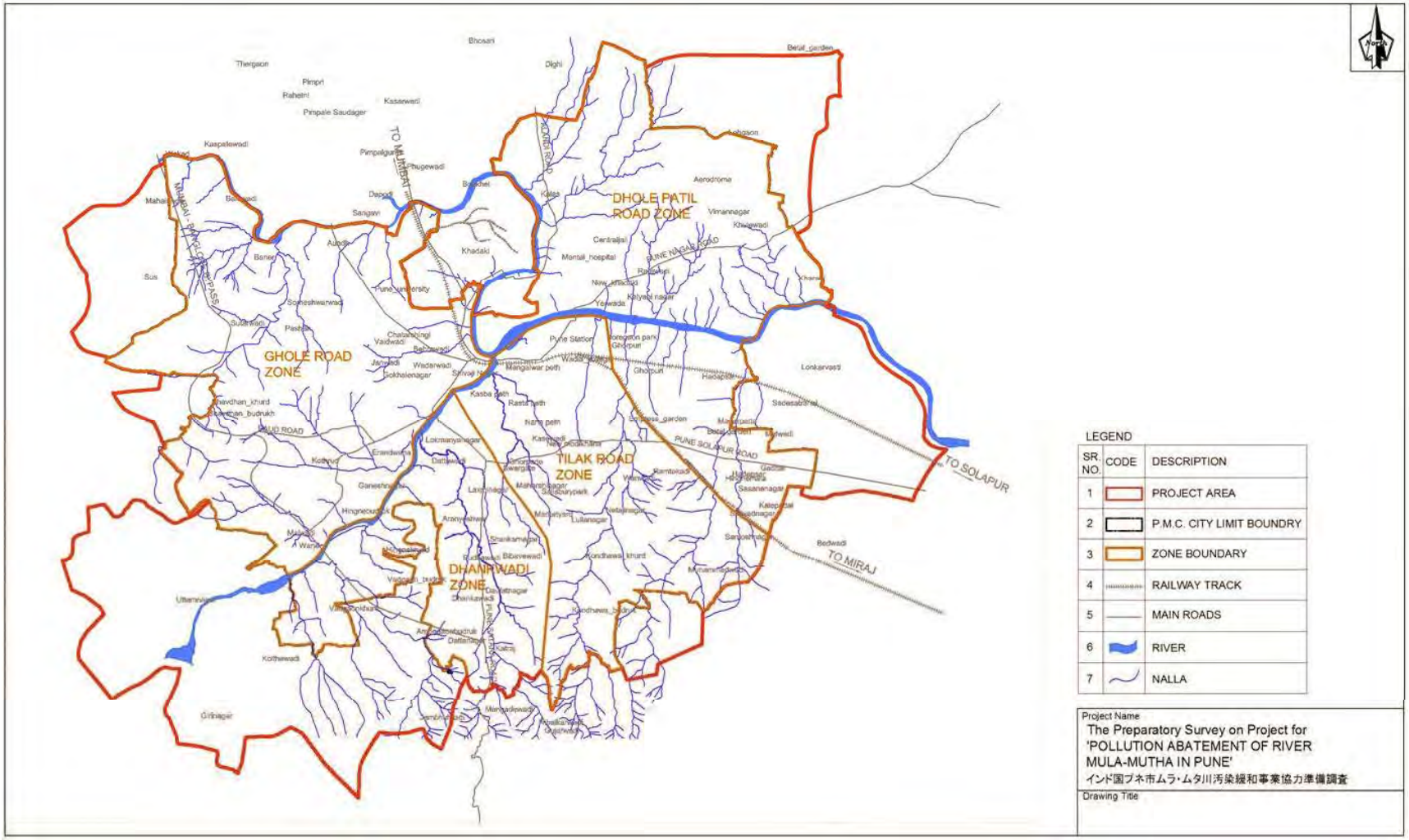


Figure 10.8.1 Location of Sewer Zones

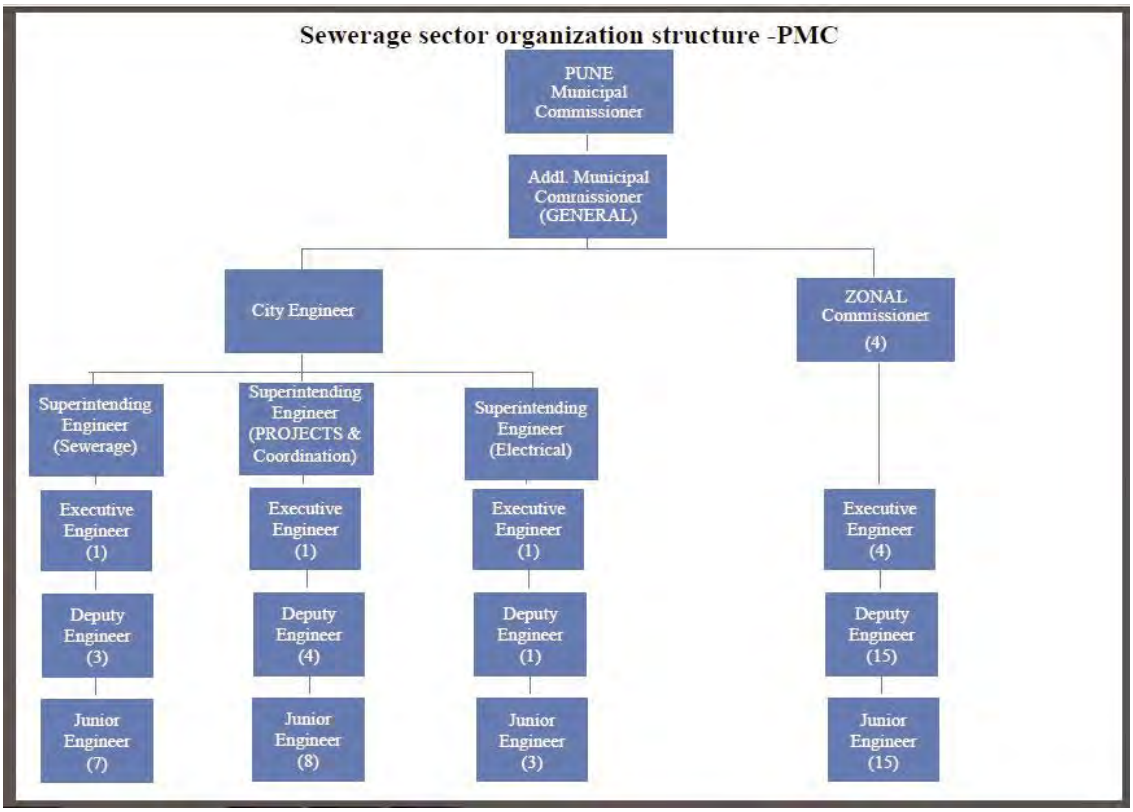


Figure 10.8.2 Sewerage Sector Organization Structure

10.8.2 Water Supply Sector

Hierarchy in the Water Supply Sector follows a similar pattern to the organization structure of Sewerage Sector till the City Engineer level as shown in the Figure 10.8.3.

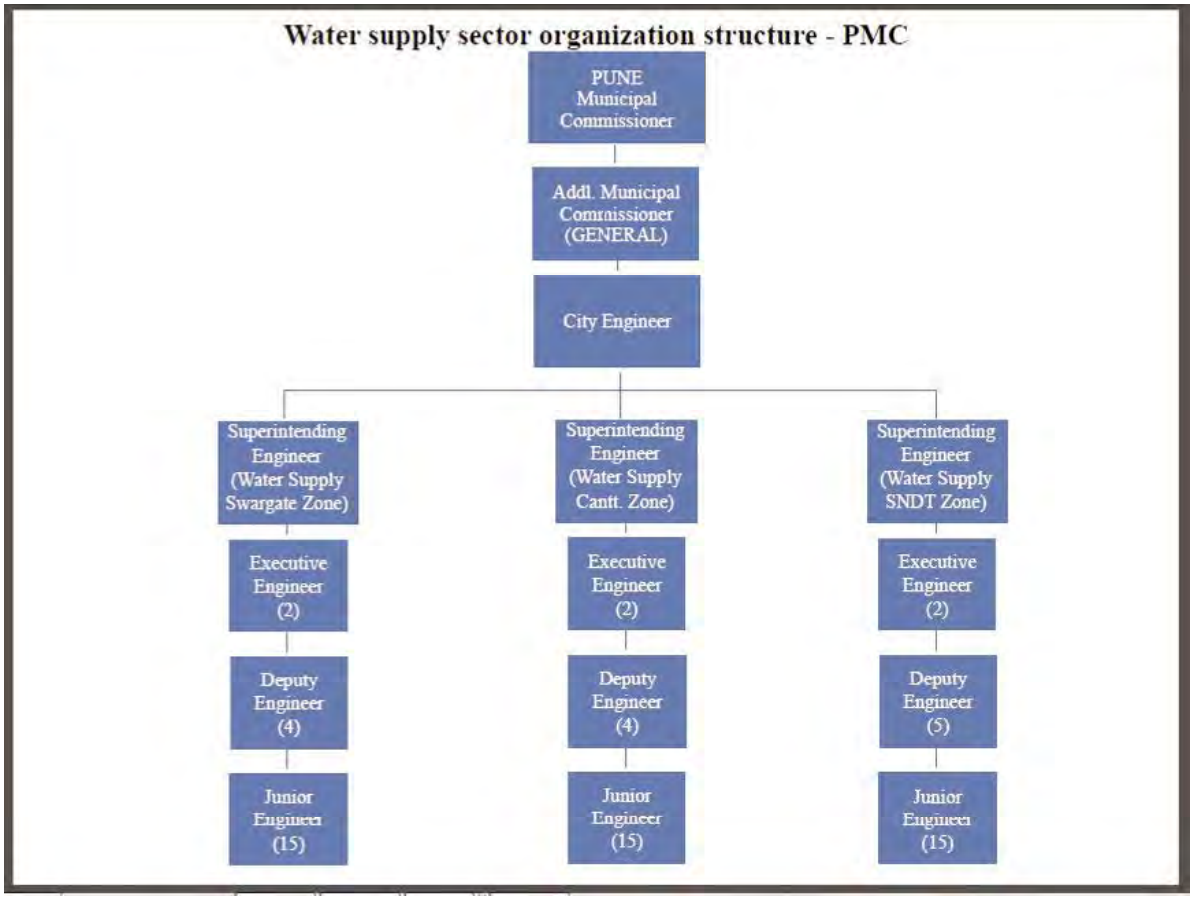


Figure 10.8.3 Water Supply Sector

For managing the water supply, Pune city area has been divided into three zones viz. sewer gate zone, Cantonment zone, and SNDT zone. These are field offices of PMC. Each Zone is headed by a Superintending Engineer who manage the water supply in their respective zones. A total team of 64 engineers [Executive Engineers (6), Deputy Engineers (13) and Junior Engineers (45)] undertake the assigned work to run the system from 6 offices (2 per zone). The engineering team is involved with planning, construction of the water supply network and O&M of the network, 6 WTPs and 20 WPSs. Similar to sewerage, here too task delegation is random and there are no separate units for planning, construction and O&M functions; the same team would be planning the project, supervising the construction and later managing the O&M.

It is worth highlighting that the construction of the WTP and WSP is not carried out by the above staff. Task of planning and construction supervision of WTP and WSP is entrusted to Superintending Engineer (Projects & Coordination) and his staff (mentioned under Sewerage sector above). After project completion, the WTP and WSP are handed over to the respective Zonal Superintending Engineer for

O&M works.

10.8.3 Recommended PMC organizational structure for O & M of existing as well as newly created sewerage facilities

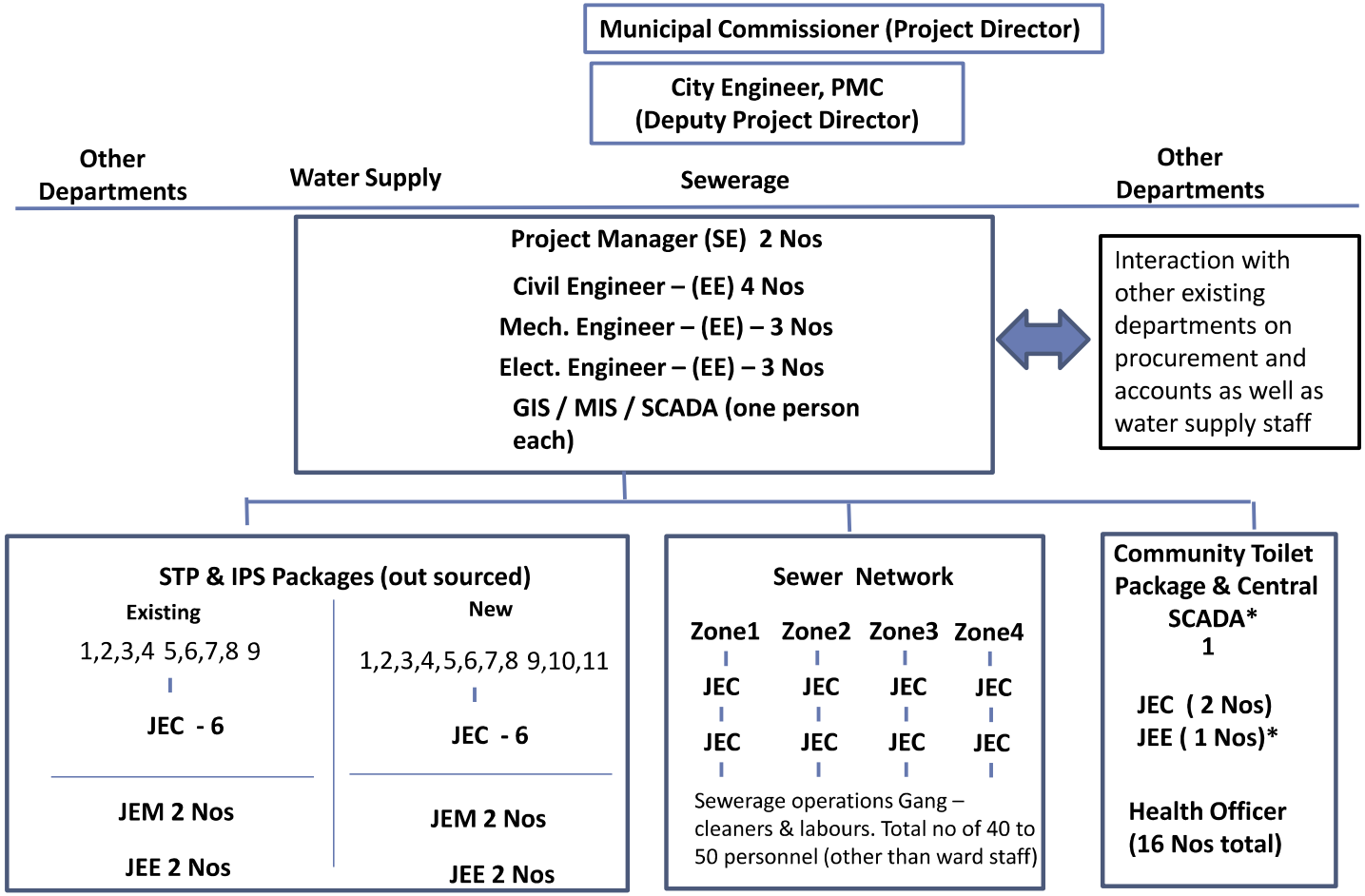
Once the project components are constructed and ready for operation and maintenance, the STP/IPS packages will be maintained and operated by the same contractor for five years, who constructed these packages. However, for the sewerage network facilities, which will be operated and maintained by PMC along with the existing sewerage network in the City and would require additional staff for addressing complaints and other operation issues. Initially, it is envisaged that the operation and management team would be required to address complaints on connection and flow issues for the newly sewered area while the existing sewerage team would continue to provide O&M. After a period of say 5 years, the operation and management team would require additional crews to maintain the sewers for cleaning and de-gritting/flow maintenance as well routine maintenance of pipe infrastructure.

The operations staff consists of central and local offices. The staff of the central office shall reserve specialist/engineer team, which can contribute to not only project component works, but also commonly to overall water sector of PMC; while staff assigned to local office work for specific operation and maintenance of packages of the Project and work as Project Operations head. The staffing requirements are summarized in Table 10.8.1 by central and local office.

Table 10.8.1 Project Operation and Management Unit in Central Office

Specialist/Engineer	No of Specialist/Eng.	Assignment
Civil Eng. Civil Eng.	3 1	(1) Total of 9 Existing STPs and 10 New STPs (2) 3 packages for Sewer + 1 package for Community Toilet
Mechanical Eng.	2	Total of 9 Existing STPs and 10 New STPs
Electrical Eng.	2	Total of 9 Existing STPs and 10 New STPs, + Central SCADA
GIS Spec.	2	Sewerage + STP New and Existing
MIS Spec.	2	-do-
SCADA Spec.	2	-do-

Local offices comprise of 4 kinds of groups broken down into “Sewer”, “STP and IPS”, “Community Toilet Facility” and “Central SCADA System”. One Project Manager (equivalent of Junior Civil Engineer JEC,) assigned to 2 STPs/IPSs, suggesting a total of 5 JECs for the existing STPs. Similarly, the same number of personnel would be assigned for the new STPs that are being constructed for the period of 2027. The project Managers shall be supported by Junior Mechanical and electrical engineers – a total of 1 no of junior mechanical engineer per 5 STPs. Similarly 1 electrical engineer per 5 STPs is required. This approach is considered for their newly constructed STPs as well, that are total 10 in numbers. This operation and maintenance philosophy needs to be followed in the future when the STPs and sewerage system shall be upgraded in 2037, which could increase the total no of STPs to additional 15 STPs. Recommended institutional arrangement presented in Figure 10.8.4.



Dy Director (SE) – Deputy Director, Superintendent Engineer (sewerage sector), EE – Executive Engineer (Civil, Mech. Elect., GIS etc), JEC – Junior Engineer (Civil and/or GIS as needed) equivalent to Project Manger. JEM – Junior Engineer (Mechanical), JEE – Junior Engineer (Electrical and I&C)

Figure 10.8.4 Recommended Operation and Maintenance Unit

10.8.4 HRM of O&M of water supply and sewerage

Adequate number of well trained and competent staff is essential for operating and maintaining the existing as well as newly constructed sewerage facilities. This is true for both water and sewerage sector. Adoption of appropriate human resource management and recruitment is essential for PMC to cope-up with the increasing O&M of sewerage facilities.

10.8.5 Technical capacity needs – Capacity Building & training needs

The major focus of the "capacity building" component under the project is to improve the capabilities of PMC staff working in both water and sewerage sectors including planning, implementation and more importantly the sustainable management of the sewerage facilities.

The requires are not only development of competencies of the officials to a level where they are capable to plan, implement and manage the project, but also the improvements in organizational (of the stakeholders) environment encompassing structure, process and facilities (laboratory, computers, software) within these organizations.

Based on the assessment of existing capacities of PMC staff, a general capacity building framework shall be prepared. Briefly, the proposed capacity building package defines the objectives (the institutional competencies to be developed) and the key interventions or inputs that will be required. Interventions and inputs include the customized training programs and study visits besides technical advisory inputs, on-job training to be done by the advisers. In many instances, the interventions have included the introduction of new management and administrative systems and tools – both manual and computer-based.

10.8.5.1 Design of Capacity Building Programs

(1) Identification of Key Result Areas

Based on the analysis of project objectives and activities, following Key Result Areas were identified for needed improvements:

- Sewerage planning, design and management, and Sewerage operation and maintenance
- Sewage Treatment plant design, operation and management, including sludge handling and management, treatment process assessment, Operation and Maintenance of STPs, laboratory measurement and analysis, SCADA and Instrumentation, Mechanical and Electrical Systems, Process - biological nutrient removal, membrane filtration unit operations, etc., with operation and management to achieve the desired effluent quality. Treated sewage reuse for non-potable purposes and its management

- Project Management, organizational management and Human Resource Management
- In Country and Out of Country Site Visits for River/Lake and River/Lake Management Projects.
- Design of Training Programs
- Based on the feedback (needs) and project objectives, common training programs for a group of officials shall be designed. Instead of developing training programs separately for different officials of different stakeholders, efforts shall be made to develop programs, which could meet the combined competency up-gradation needs of officials of PMC. Depending on their level and using adult learning principles, training methodologies shall also be recommended for each group. The preliminary design therefore mainly consists of focus areas (major topics to be covered) during training program and training methodologies.

(2) Training methodologies

This training plan includes a mix of various training activities. It includes:

- Class room Trainings with case studies and group work (Focused on Knowledge up-gradation and attitude change)
- Demonstration based learning (Knowledge and skill Up-gradation)
- Skill based trainings (focused on skill up-gradation)
- In-Country Study Visits; (focus on Attitude change combined with knowledge up-gradation)
- Participation in local training & workshops; (focus on Attitude change combined with knowledge up-gradation) and
- International Study Visits; (focus on Attitude change combined with knowledge up-gradation)

(3) Class room Trainings

These training include specific tailor-made programs for the officials of PMC. Each program shall have well defined learning objectives. A reputed technical expert or experienced person from consultant or outside resource would be engaged in providing trainings to ensure that right mix of training methodologies are employed during the training to meet the learning objectives. Typically, the class-room training would consist of couple of half day in class sessions per month followed by in-country as well as project site visits to get practical experience.

(4) In-Country Study Visits

Local study visits are an effective means to understand and learn practical solutions and management approaches, while undertaking similar project activities, elsewhere. These visits would permit observing actual operations of project activities in other parts of the country. The Project recognizes that these study visits besides providing knowledge up-gradation and even change in attitudes, would pro-

vide positive motivation to the participants and shall assist in strengthening teamwork and cooperation. It also assists in initiating contacts and liaison with counterpart professionals engaged in similar activities. This could be even helping in getting useful management information from people engaged in similar project activities. A small group of participants have been proposed for these in country study visits.

(5) International Study Visits

International Study visits are an effective means to understand and learn advanced practical solutions and new/emerging management approaches, while undertaking similar project activities globally. These visits would permit observing actual operations of project activities in other parts of the world. These would provide a forum for our professionals to engage in discussions with counterpart professionals engaged in similar activities in the world and to learn from their experiences. The major output of these study visits would be to draw a future plan of actions, where we can adopt/adapt some of the technological advances, management approaches etc. while undertaking similar (or even other) projects.

10.8.6 O&M Systems and processes

10.8.6.1 Management Information System (MIS)

As part of the Project a Management Information System (MIS) will be developed, that would linked to project management activities during construction for various packages and monitor project activities for effective project management. This task would include efficient data management (i.e., drawings, communications, decisions, etc.) so that all the information can be logged appropriately and effectively communicated to each part, - be it a contractor or consultant or owner (PMC).

10.8.6.2 Asset management

It is envisaged that during the project implementation phase, a GIS based Asset Management system would be developed. The asset management system would involve entire itinerary of all the equipment, including pipe sizes, valves, to pumps to STP operational parts that would provide effective information to the operator and owner on all of the assets. This information would then be used to determine the weakest link in operating the sewerage systems – sewer as well as STPs/IPSs. This asset management data would also help PMC to determine when particular equipment needs to be rehabilitated or maintained and up to when it will be maintained and whether it has any operational issues. Lastly, the same asset management data base could be used for assessing what would be capital improvement cost in the future as and when the assets starts getting closer to their normal life span and operational limits.

CHAPTER 11 Environmental and Social Considerations

11.1 General

The environmental and social study was carried out based on JICA guideline (JICA Guideline on Social and Environmental Considerations, 2014) through the study on the Indian legislative requirements including EIA for the proposed project, baseline survey for social and physical aspects, anticipation of possible impacts by the project components including STPs, IPSs, sewage collection systems in and outside Baner area. For the environmental elements which may cause adverse impact on environmental and social aspects, their mitigation measures, environmental management / monitoring plan were prepared.

In addition, the effect of reduction of GHGs (Greenhouse Gases) emission was also studied for the introduction of the biogas power generation facilities at the proposed Naidu and Bhairoba STPs.

11.2 Project Requirements for Environmental Procedures in India (Maharashtra State)

11.2.1 Environmental and Other Clearance Required for Sewerage Project

(1) Projects requiring EIA

EIA Notification 2006 is a legal basis for regulating environmental clearance for development of projects. According to the notification, projects are classified either Category A or Category B depending on the types; scales of the projects and potential impact level to be caused by them. For Category A projects which have large scales and cause potential significant impact, EC (Environmental Clearance) shall be obtained from the EAC (Expert Appraisal Committee) of MoEF (Ministry of the Environment and Forests). For Category B project which have smaller scales comparing with category-A projects and may have less impact level, on one hand, an EC shall be obtained from the SEAC (State Level Expert Appraisal Committee) such as Maharashtra state. The list of the projects which require EC is shown in Table 11.2.1. As mentioned later for detail, the sewerage project such as the proposed project does not require EC.

Table 11.2.1 List of Projects or Activities Requiring Prior Environmental Clearance (EC)

Project or Activity		Category		(2) Conditions if any
		A	B	
1		**Mining, extraction of natural resources and power generation (for a specified production capacity)**		
(1)	(2)	(3)	(4)	(5)
1(a)	Mining of minerals	≥ 50 ha. of mining lease area Asbestos mining irrespective of mining area	<50 ha ≥ 5 ha .of mining lease area.	General Condition shall apply
1(b)	Oil and gas development & production	All projects		Note
1(c)	11.2.1.2 River Valley projects	(i) ≥ 50 MW hydroelectric power generation; (ii) ≥ 10,000 ha. of culturable command area	(i) < 50 MW ≥ 25 MW hydroelectric power generation; (ii) < 10,000 ha. of culturable command area	General Condition shall apply
1(d)	Thermal Power Plants	≥ 500 MW (coal/lignite/naphta & gas based); ≥ 50 MW (Pet coke diesel and all other fuels –)	< 500 MW (coal/lignite/naptha & gas based); <50 MW, ≥ 5MW (Pet coke, diesel and all other fuels)	General Condition shall apply
(1)	(2)	(3)	(4)	(5)
1(e)	Nuclear power and processing projects	All projects	-	
2		Primary Processing		
2(a)	Coal washeries	≥ 1 million ton/annum throughput of coal	<1million ton/annum throughput of coal	General Condition shall apply
2 (b)	Mineral beneficiation	≥ 0.1million ton/annum mineral throughput	< 0.1million ton/annum mineral throughput	General Condition shall apply
3	11.2.1.3	Materials Production		
11.2.1.4 (1)	11.2.1.5 (2)	(3)	(4)	(5)
11.2.1.6 3 (a)	11.2.1.7 Metallurgical industries (ferrous & non ferrous)	a)Primary metallurgical industry All projects b) Sponge iron manufacturing ≥ 200TPD c)Secondary metallurgical processing industry All toxic and heavy metal producing units ≥ 20,000 tonnes /annum	Sponge iron manufacturing <200TPD Secondary metallurgical processing industry i.)All toxic and heavy metal producing units <20,000 tonnes /annum ii.)All other non –toxic secondary metallurgical processing industries >5000 tonnes / annum	General Condition shall apply for Sponge iron manufacturing
3(b)	Cement plants	≥ 1.0 million tonnes /annum production capacity	<1.0 million tonnes/annum production capacity. All Stand alone grinding units	General Condition shall apply
4		Materials Processing		
(1)	(2)	(3)	(4)	(5)
4(a)	Petroleum refining industry	All projects	-	-
4(b)	Coke oven plants	≥2,50,000 tonnes/annum -	<2,50,000 & ≥25,000 tonnes /annum	-

Project or Activity		Category		(2) Conditions if any
		A	B	
4(c)	Asbestos milling and asbestos based products	All projects	-	-
4(d)	Chlor-alkali industry	≥300 TPD production capacityor a unit located outside the notified industrial area / estate	<300 TPD production capacity and located within a notified industrial area/ estate	Specific Condition shall apply
4(e)	Soda ash Industry	All projects	-	-
4(f)	Leather/skin/hide processing industry	New projects outside the industrial area or expansion of existing units outside the industrial area	All new or expansion of projects located within a notified industrial area/ estate	Specific condition shall apply
5		Manufacturing/Fabrication		
5(a)	Chemical fertilizers	All projects	-	-
5(b)	Pesticides industry and specific intermediates (excluding formulations)	All units producing technical grade pesticides	-	-
(1)	(2)	(3)	(4)	(5)
5(c)	Petro-chemical complexes	All projects -	-	-
5(d)	Manmade fibres manufacturing	Rayon	Others	General Condition shall apply
5(e)	Petro-chemical based processing	Located outside the notified industrial area/ estate -	Located in a notified industrial area/ estate	Specific Condition shall apply
5(f)	Synthetic organic chemicals industry	Located outside the notified industrial area/ estate	Located in a notified industrial area / estate	Specific Condition shall apply
5(g)	Distilleries	(i)All Molasses based distilleries (ii) All Cane juice/ non-molasses based distilleries ≥30 KLD	All Cane juice/non-molasses based distilleries – <30 KLD	General Condition shall apply
5(h)	Integrated paint industry	-	All projects	General Condition shall apply
(1)	(2)	(3)	(4)	(5)
5(i)	Pulp & paper industry	Pulp manufacturing and Pulp& Paper manufacturing industry -	Paper manufacturing industry without pulp manufacturing	General Condition shall apply
5(j)	Sugar Industry	- -	≥ 5000 tcd cane crushing capacity	General Condition shall apply

Project or Activity		Category		(2) Conditions if any
		A	**B**	
5(k)	Induc-tion/arc furnac-es/cupola furnaces 5TPH or more	- -	All projects	General Condition shall apply
6		Service Sectors		
6(a)	Oil & gas transporta-tion pipe line	All projects -		-
(1)	(2)	(3)	(4)	(5)
6(b)	Isolated storage & handling of hazard-ous chem-icals	-	All projects	General Condition shall apply
7		Physical Infrastructure including Environmental Services		
7(a)	Air ports	All projects	-	-
7(b)	All ship breaking yards in-cluding ship breaking units	All projects	-	-
7(c)	Industrial estates/ parks/ complex-es/ areas, export processing Zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complex-es.	If at least one industry in the proposed industrial estate falls under the Category A, entire industrial area shall be treated as Category A, irrespective of the area. Industrial estates with area greater than 500 ha. and housing at least one Category B industry.	–Industrial estates housing at least one Category B industry and area <500 ha. Industrial estates of area> 500 ha. and not housing any industry be-longing to Category A or B.	Special condition shall apply Note: Industrial Estate of area below 500 ha. and not housing any industry of category A or B does not require clearance.
7(d)	Common hazardous waste treatment, storage and dis-posal fa-cilities (TSDFs)	All integrated facilities having incineration &landfill or incin-eration alone	All facilities having land fill only	General Condition shall apply
(1)	(2)	(3)	(4)	(5)
7(e)	Ports, Harbours	≥ 5 million TPA of cargo han-dling capacity (excluding fishing harbours)	< 5 million TPA of cargo handling capacity and/or ports/ harbours ≥10,000 TPA of fish handling capacity	General Condition shall apply

Project or Activity		Category		(2) Conditions if any
		A	B	
7(f)	Highways	i) New National High ways; and ii) Expansion of National High ways greater than 30 KM, involving additional right of way greater than 20m involving land acquisition and passing through more than one State.	i) New State High ways; and ii) Expansion of National / State Highways greater than 30 km involving additional right of way greater than 20m involving land acquisition.	General Condition shall apply
7(g)	Aerial ropeways		All projects	General Condition shall apply
7(h)	Common Effluent Treatment Plants (CETPs)		All projects	General Condition shall apply
7(i)	Common Municipal Solid Waste Management Facility (CMS-WMF)		All projects	General Condition shall apply
(1)	(2)	(3)	(4)	(5)
8		Building / Construction projects/Area Development projects and Townships		
8(a)	Building and Construction projects		≥20000 sq.mtrs and <1,50,000 sq.mtrs. of built-up area#	#(built up area for covered construction; in the case of facilities open to the sky, it will be the activity area)
8(b)	Townships and Area Development projects.		Covering an area ≥ 50 ha and or built up area ≥1,50,000 sq .mtrs ++	++All projects under Item 8(b) shall be appraised as Category B1

(2) Environmental Clearance Process

There are 4 stages in the environmental clearance process.

- Stage 1: Screening
- Stage 2: Scoping
- Stage 3: Public Consultation
- Stage 4: Appraisal

1) Stage 1: Screening

In the case of Category B projects, a project proponent shall prepare an application form for the SEAC's examination on determining whether the proposed project require a preparation of EIA (Environmental Impact Assessment). The projects requiring an EC report shall be termed Category B1. Projects of Category B2 are not required to prepare an EC report. In projects of Category B, the projects of Category B1 are only "Townships and Area Development projects" which is shown as "8b" in Table 11.2.1, and other projects are categorized as B2.

The process flow of EC for Category B projects is shown in Figure 11.2.1.

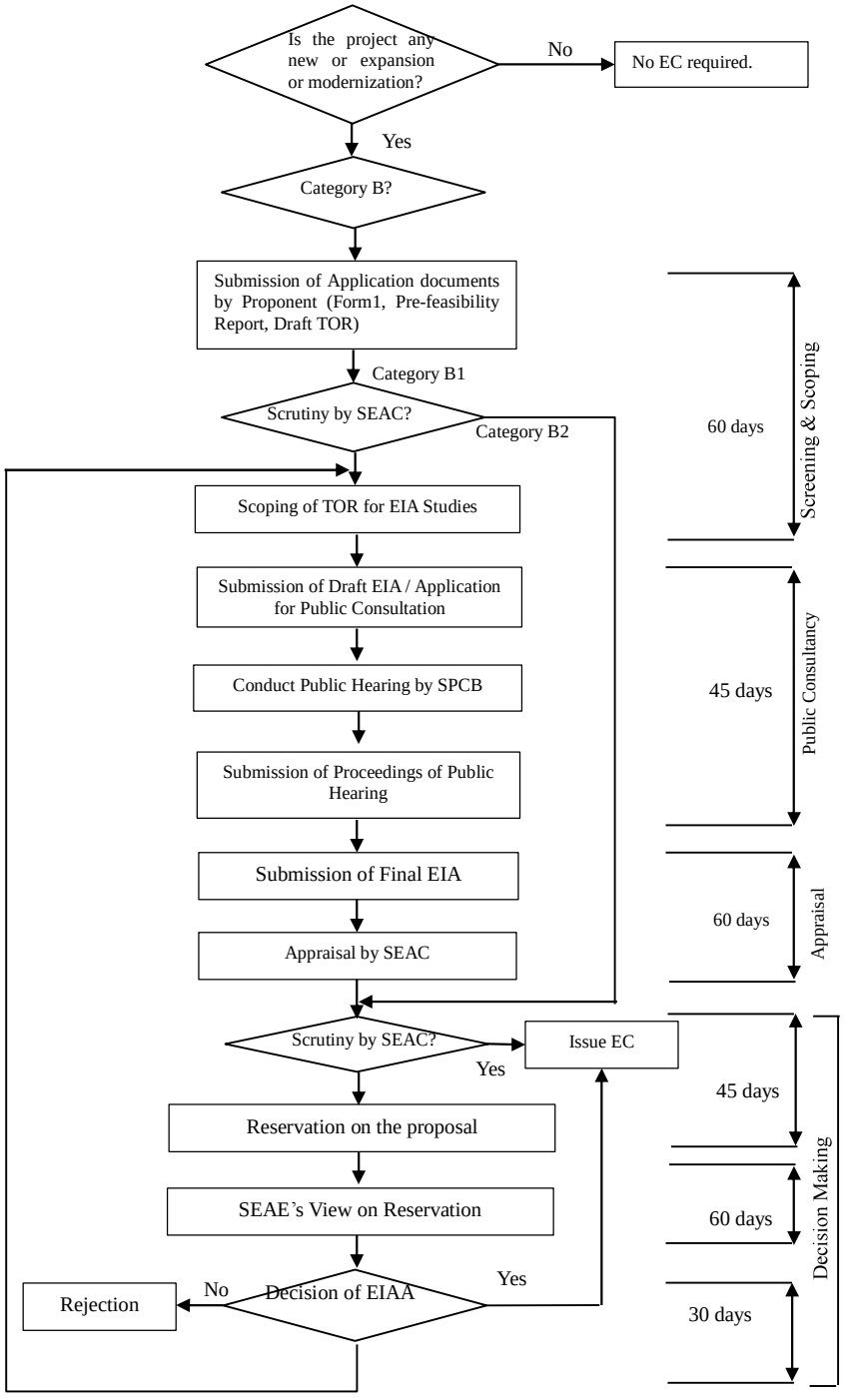


Figure 11.2.1 Environmental Clearance Flow for Category B Projects

2) Scoping

Scoping refers to the process by which a review is undertaken by the EAC (Expert Appraisal Committee) in the case of Category A projects, and SEAC (State level Expert Appraisal Committee) in the case of Category B1 projects. All projects of Category B require scoping. The projects for construction, township, commercial complex and housing including sewerage projects shall not require scoping and will be appraised on the basis of Form 1 and a conceptual plan.

3) Public Consultation

Public Consultation refers to the process by which the concerns of local affected persons and others who have a plausible stake in the environmental impacts of the projects are ascertained with a view to taking into account all the material concerns regarding the project or activity design as appropriate. All Category A and Category B1 projects or activities shall undertake public consultation, except a) Irrigation projects, b) all projects located within industrial estates or parks, c) expansion of roads, d) all building / construction projects, e) all projects as determined by the Central Government.

4) Appraisal

Applicants shall submit the final EIA report and outcome of the public consultations including public hearing proceedings to the regulatory authority concerned (EAC or SEAC) for obtaining the EC. The appraisal of all projects which are not required to submit an Environmental Impact Assessment report shall be carried out on the basis of the prescribed application Form 1 and Form 1A as applicable. After the final EIA report is received by the EAC or SEAC, it takes about 60 days to approve the report.

5) Environmental Clearance for Sewerage Projects

Sewerage projects do not require EIA report nor undertake public consultation meetings. However, the projects should require scoping and preparation of application Form 1. A project proponent, after identifying the site and carrying out a pre-feasibility study, is required to apply for the prior environmental clearance in Form 1**.**

6) Clearances other than Environmental Clearances

The clearances other than environmental clearance are shown as below. PMC will have to obtain the NOCs (No Objection Certificate) from relevant authorities as shown below.

<u>NOC for Crossing of Main / Sub Main sewers in R/W of Railway Line</u>

- Basis for legal or regulations: Guideline on Pipeline Crossing under Railway Track, 2009

- Responsible agency who grants a permission: Ministry of Railways (Central railway)
- Period from application to final permission for construction: 4 months
- Required condition for permission: PMC has to pay a charge depending the size of R/W to Central Railways

NOC for Main / sub main sewers Laying along river side

- Basis for legal or regulations:
  Guidelines, Water Management Act 2000
- Responsible agency who grants a permission:
  Irrigation department, Maharashtra state
- Period from application to final permission for construction: 15 days
- Required condition for permission:
  After obtaining approval of DPR, from PMC (Internally) PMC may have to seek approval from State Government and also pay the necessary charges to the concerned Department.

NOC for Main / sub main sewers Laying under Road Area

- Basis for legal or regulations:
  Circular no 62 of PMC's bylaw
- Responsible agency who grants a permission: Road Department, PMC
- Period from application to final permission for construction: 15 days
- Required condition for permission:
  The roads and sewers are in jurisdiction under different departments of same PMC. Both departments report to City Engineers who is a competent authority to deal with multi department issues.

NOC for Main / sub mains La sewers Laying Sewer Lines along Nalla

- Basis for legal or regulations:
  No information available.
- Responsible agency who grants a permission:
  Drainage department, PMC
- Period from application to final permission for construction: 15 days
- Required condition for permission:
  Same as the case of construction of sewers pipes under road areas. Both departments shall report to City Engineers who is a competent authority to deal with multi department issues.

NOC for Tree Cutting or Re-plantation in Project Sites

- Basis for legal or regulations:
  the Maharashtra (urban areas) Preservation of Trees Act (1975)
- Responsible agency who grants a permission: Tree Authority Committee of PMC
- Period from application to final permission: 30-60 days

- Required condition for permission: Cost for obtaining approval - INR 4,000 (per tree), The Tree Authority must ascertain what trees (if any) will be cut down as a result of construction. If trees are to be cut down, a project proponent should plant trees to replace them.

NOC for Effluents outflow from STPs

- Basis for legal or regulations:
  - Guideline of MOEF / CPCB (Central Pollution Control Board)
  - Water Prevention and Control of Pollution Act, 1974
- Responsible Agency who gives the Permissions: MPCB (Maharashtra Pollution Control Board)
- Period from Application to Final approval.: 1month, PMC is currently preparing the process of this NOC
- Required condition for permission: There are three types of consent issued under the provisions of Water Prevention and Control of Pollution Act, 1974, namely, 1) Consent to Establish, 2) Consent to Operate and Renewal of Consent to Operate. Sewerage department of PMC has to prepare an application document.

11.2.2 Outline of Project Components

(1) Project Component

The proposed project consists of three kinds of components of STPs, IPSs, sewage collection systems including main / sub main sewers as shown in Table 11.2.2. The location map of each component is shown in Figure 11.2.2

Eleven (11) STPs, four (4) IPSs, and sewage collection system with a total distance of 113km in and out Baner area is to be implemented in the proposed project.

Table 11.2.2 Project Component

STPs (Sewage Treatment Plants)

Component	Project Site	Treatment Method	Capacity in MLD
1. STP			
	Mundhwa	SBR	20
	Bhairoba	A2O + Power	75
	Naidu	A2O + Power	127
	Tanajiwadii	EA	15
	Vadagaon	EA	26
	Warje	EA	28
	Botanical Garden	SBR	10
	Baner	SBR	25
	Kharadi	SBR	30
	Dhanori	EA	33
	Matsya Beej Kendra	EA	7

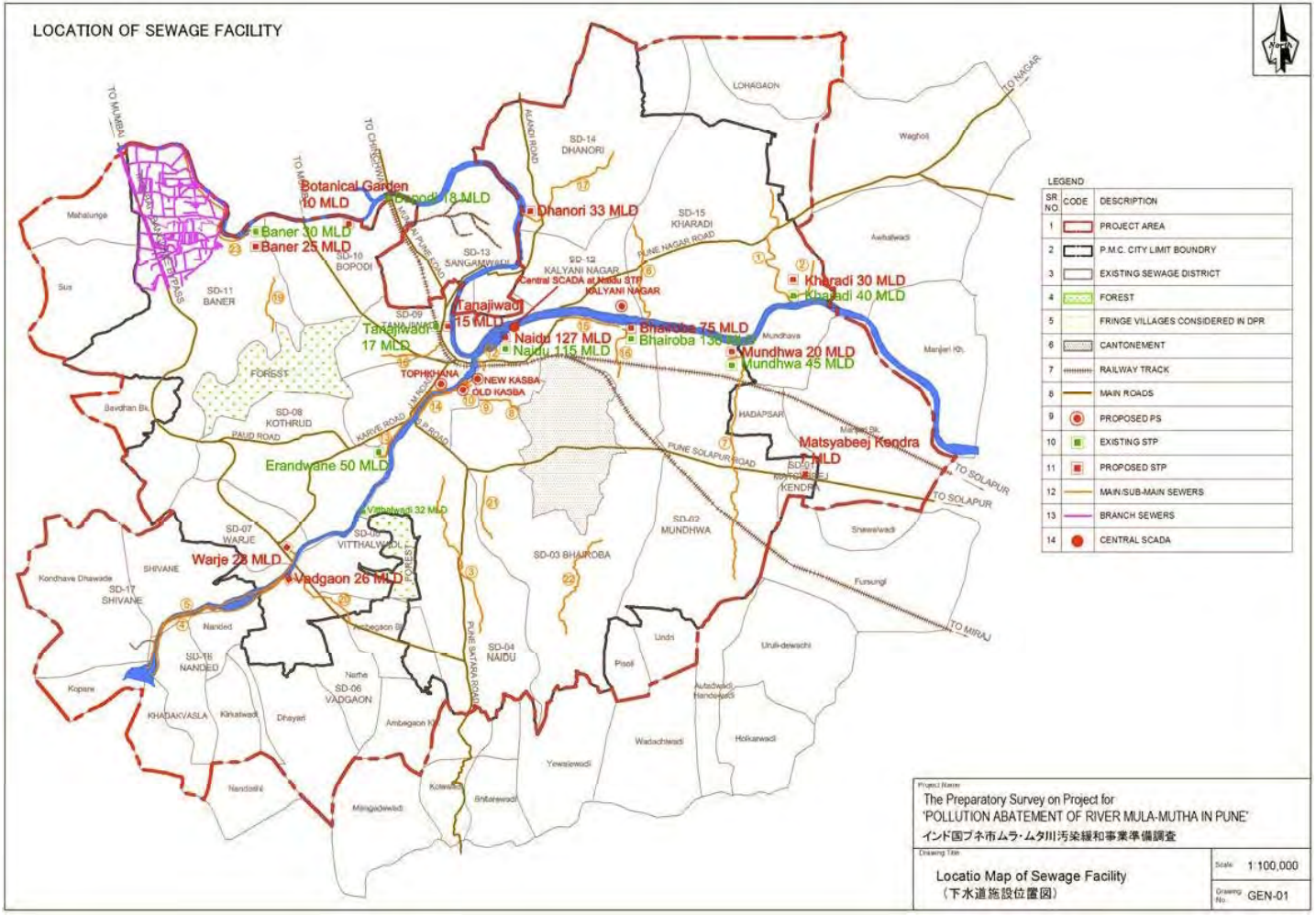
IPSs (Intermediate Pump Stations)

Component	Project Site	Capacity in m^3/day
2. IPS		
	Kasba (Old)	20
	Kasba (New)	75
	Kalyani Nagar	127
	Mangalwar Peth	15

Sewage Collection Systems including Main / Sub Main sewers

Component	Project Site	Distance in km
3. Collection System and Main / sub mains		
Main and Sub-main Sewers	Outside Baner Area	70
Main and Sub-main Sewers	Inside Baner Area	43

Source: JICA Survey Team



Source: JICA Survey Team

Figure 11.2.2 Location Map of Project Component

(2) Study on Alternative Plan

1) Basic Condition

The facility plan of the proposed project should be carried out in full consideration of the existing sewerage systems, since a drastic change of the system will be unrealistic by taking the current sewerage coverage of about 70 % with the operation of existing nine (9) STPs into consideration.

As for the securement of the project sites, accordingly, PMC has already prepared their land use plan for the public use including the lands for the proposed STPs in the lands inside the existing STP sites or their adjacent areas (otherwise the government lands (central government or Maharashtra state) and partially private lands) in the DP (Development Plan)

2) Zero Option

In case of Zero Option (the case without the proposed project), only 55 % of the sewerage generated can be treated by existing STPs for the future sewage generated in 2027 for the increased population, which will increase the water pollution in the downstream water bodies.

3) Technical Option

As for study on technical option the sewage treatment process and sludge treatment method for the proposed STPs were studied. In this regard proposed methods in sewerage DPR were reviewed taking the limited land area for the STPs, construction cost and easiness of O & M into consideration.

Technical options on sewage treatment process and sludge treatment method were studied by dividing the proposed STPs into four (4) groups of A, B, C and D as shown in Table 11.2.3 in terms of the treatment capacities and the land area of the STPs. SBR + biogas generation were selected for Naidu and Bhairoba STPs, which receive large amount of sewage inflow, while SBR or EA were selected for other STPs with their smaller treatment capacities comparing with Naidu and Bhairoba STPs. As for sludge treatment for Naidu and Bhairoba, the same method of thickening, digestion and dewatering with rotating drum type at existing Naidu STP, which has been constructed recent years and operated well, was selected. For other STPs without primary sedimentation, the sludge treatment by direct dewatering using rotating drum type was selected. The technical option for the proposed STPs is shown in Table 11.2.3.

Table 11.2.3 Technical Option for Proposed STPs

Condition / Treatment Method		Group			
		A	B	C	D
Influent Flow (MLD)		Naidu: 125 Bhairoba: 74	Mundhawa: 45 Vadgaon: 18 Warje: 27 Botanical Garden: 19 Dhanori: 32 Baner: 25 Kharadi: 30	Matya Beej Kendra: 8	Tanajiwadi: 16
Land Area (ha)		Naidu: 4.75 Bhairoba: 2.7	Mundhawa: 1.17 Vadgaon: 2.75 Warje: 1.07 Botanical Garden: 1.6 Dhanori: 1.0 Baner: 0.95 Kharadi: 1.16	Matya Beej Kendra: 0.5	Tanajiwadi: 0.5
Water Treatment Process Proposed	DPR	SBR (Sequential Batch Reactor) method	SBR, EA, ASP	MBR	MBR
	JICA Study	A2O + Power	Mundhawa: SBR Vadgaon: EA Warje: EA Botanical Garden: EA Dhanori: EA Baner: SBR Kharadi: SBR	SBR	EA
	Reason for selection in JICA study	ASP is applied for the STPs with large capacities and primary sedimentation tanks, while the primary sedimentation tank is not provided for SBR. GHGs reduction can be expected through installing biogas generation in the STPs with large capacity.	SBR and EA which does not include primary sedimentation tank can reduce construction cost and realize easy O&M work.	MBR method proposed in DPR requires higher O&M cost compared to MBR and EA.	EA was selected since future expansion can be realized.
Sludge Treatment Method Proposed	JICA Study	Thickening, digestion and dewatering by using rotating drum type method	Dewatering of excess by using rotating drum type method		
	Reason for selection in JICA study	Taking the current good operation of existing Naidu STP into consideration, the same method of sludge treatment was adopted	The proposed STPs will not have primary sedimentation tanks.		

Source: JICA Survey Team

11.3 Specific Environmental and Social Aspects in the Project Area

11.3.1 Social Aspect

11.3.1.1 Current Social Conditions

This section of the report is prepared based on the findings from the social condition survey which was conducted by the JICA Study Team for this Project. The social condition survey included current sewerage and hygiene conditions and the affordability and willingness to pay for improved sewerage service in the Project area. It also assessed the public potentials to participate in the Project.

A number of 200 households (in slums and non-slum areas) and 100 business establishments like small shops, factories and hotels were totally surveyed. Household survey in slum area was considered due to high percentage of slum population in the Project area. Sampling number is summarized in Table 11.3.1.

Table 11.3.1 Sample Size of the Survey

Status	Sample Size	Percentage
Households- slum	80	27
Households- non Slum	120	40
Small shops	50	17
Factories	15	05
Hotels	35	11
Total	300	100

Details of the social survey methodology, analysis, tables and figures are included in Supporting Report and survey results in Data Report.

(1) Sanitation Status; Water and Sewer Access

(I) Connection to the water supply and sewer network

The social survey indicates that almost all households are connected to the water supply and sewer networks. A considerable percentage of business establishments, however, are not connected because they do not see a need to be connected to water or sewer networks. The survey also showed a high level of unawareness on how the water and sewage sewer services are charged by PMC.

As shown in Table 11.3.2, all the 120 non-slum households are connected to the PMC water supply network. Out of 80 slum households, 79 (99%) are also connected and the only remaining household (1%) uses water from the neighbor's connection. Out of 100 business establish-

ments, 73 (73%) are connected, while 27 (27%) are not connected. Of the non-connected respondents, 10 use water from neighbors, 10 purchase mineral water bottles, and 7 take water from the nearby sources.

The table also shows that daily access to water supply through the network is not available to all of the 272 connected customers. A total of 18 surveyed customers, mostly in non-slum areas, reported a non-daily access.

Respondents were also asked if the current water charge is expensive, fair, or cheap. As high as 44% respondents stated that the present water charges are fair and 13.5% said the charges are expensive. A notable number of 86 out of the 272 responded "No opinion" which indicates their lack of information on the water charge rate and method by PMC.

As seen in the same table, almost all surveyed households in both slum and non-slum areas are connected to the sewer network. A high percentage of business establishments (27%), however, are not connected. The reason stated by the owners is that they do not see any need to be connected because they can use their nearby-homes when need any toilet facilities. It should be, however, noted here that open urination and defecation is still widely practiced by many especially in poor areas.

Table 11.3.2 Connection to Water Supply Network

Status		Households (200)		Business establishments (100)	Total Average %
		Slum (80)	Non-Slum (120)		
Connected to water network (272)		79	120	73	91.3
Running water	Daily	75	107	72	93.4
	1-2 days	1	7	1	3.3
	3-4 days	0	4	0	1.5
	5-6 days	3	2	0	1.8
Water charge	Expensive	8	19	10	13.5
	Fair	35	75	41	44.1
	Cheap	0	0	0	0
	No opinion	36	26	22	30.6
Connected to sewer network (287)		80	119	88	95.6

(II) Sanitary status; toilet facilities and waterborne diseases

Surprisingly though 95.6% of the surveyed population is connected to the sewer network it does not reflect a proper hygienic sanitation status, especially in the slum areas and for business establishments. To measure the sanitary status, access to toilet facilities, and frequency of waterborne disease among the surveyed population were examined.

(a) Access to toilet facilities: The survey result showed that 1/3rd of the respondents (100 out of 300) especially slum residents and business establishments do not have any toilets in their premises. The reason is that the premises, especially the houses in slum areas, are too small to contain space for toilets. As shown in Table 11.3.3, 51 out of 80 slum residents and 45 out of 88 business establishments while connection to sewer do not have a toilet within the premises.

Limited number of public toilets and poor maintenance give no option other than open defecation and urination by those without access to private or public toilets. Table 11.3.3 shows that those without private toilets use alternatives such as public toilets, neighbor's toilet, and open defecation. Business establishments' owners whose homes are close by the workplace said that they go home when needed. The responses, however, do not seem realistic. It appears like the respondents were not frank about the alternatives which are understandable. An observation of the slum areas, however, showed that public toilets are few and dispersed, poorly or even not maintained, and sometimes out of order. They also cost about 40-50Rs per month for use which is high for the poor. This situation gives no other option than open defecation which is observed widely in the slum areas or open urination which is common in the City regardless the respondents' claim of not such practices.

Table 11.3.3 Connection to Sewer Network and Alternatives to Private Toilets

Status	Households (200)		Business establish-ments (100)	Total Average
	Slum (80)	Non-Slum (120)		
Connected to sewer network (287)	80	119	88	95.6%
No toilet	51	4	45	33.3%
Toilet use:				
Public Toilet	51	0	0	51%
Neighbors' toilet	0	1	0	1%
Open defecation	0	4	0	4%
Go home if at workplace	0	0	45	45%

(b) Occurrence of waterborne/water related disease and frequency

As a result of low sanitary condition, the public especially slum residents are suffering from a high occurrence of waterborne/water related diseases. The surveyed households (in slum and non-slum areas) were given a list of waterborne/water related diseases and were asked how many times there were affected with any of them in the past three years. Out of total 200 surveyed households, 28 were affected with mostly among the slum residents. A closer look at slum and non-slum areas indicated that a high number of 22 out of 80 slums residents (27.5%) responded such infections against only 6 out of the 120 non-slum residents as shown in Figure 11.3.1.

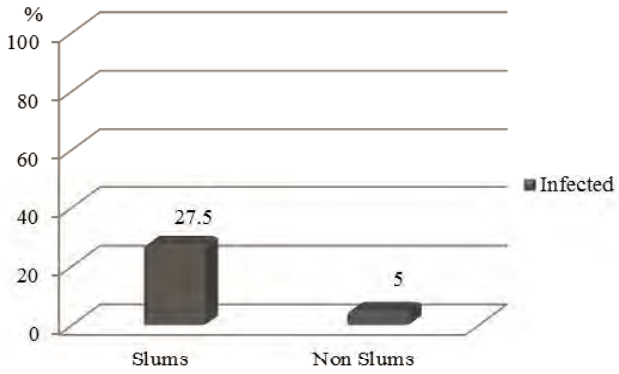


Figure 11.3.1 Respondents Affected by Waterborne/Water related Diseases in Past Three Years

The frequency of waterborne diseases, however, was mostly about 1-2 times in the past three years as seen on Table 11.3.4. A few of 6 also responded a frequency of 3 or over.

Table 11.3.4 Waterborne/Water related Disease Infection in the Past Three Years and the Frequency

Frequency	Households (200)		Total Average
	Slum (80)	Non-Slum (120)	
Occurrence in the past three years (28 cases)			
0 times	58	114	86%
1-2 times	13	3	8%
3-4 times	3	2	2.5%
5 and more	6	1	3.5%

(2) Willingness to Connect and Pay

(I) Willingness to connect

The survey data analysis shows that the future connections would be fairly an easy task for the Project especially for new household connections, but further efforts would be needed for the business establishments' connections. Out of the total 300 surveys, only 1 household and 12 business establishments (4.3%) are not connected to the sewer. The 13 non-connected were asked if they would be willing to connect. In case of tenants they were also asked if they would request their landlords to connect. As shown in Table 11.3.5, while the only not-connected household showed interest in future connection, just 1 out of the 12 business establishments responded positive to the future connections which presents that willing to connect among the not-connected business establishments is as low as 8.3%.

(II) Willingness to pay for improved service

The survey also revealed that though most of the residents would agree to be charged more for an improved sewer system, yet the Project needs to convince some others. Those who are already connected (287) were asked if they would pay extra for an improved sewer system. They were explained why an increased rate would be needed for cost recovery including the construction, operation and management costs. It should be noted that non-connected customers who were very few (13 out of 300) were excluded from this analysis based on the perception that they have no experience or knowledge about the current sewerage service quality at their premises, the related service issues, or monthly expenses.

As seen in Table 11.3.5, 223 out of 287 of the respondents (77.7%) showed interest in paying extra for the improved services. Yet, a considerable total number of 64 (22.3%) did not welcome the idea of increased rate.

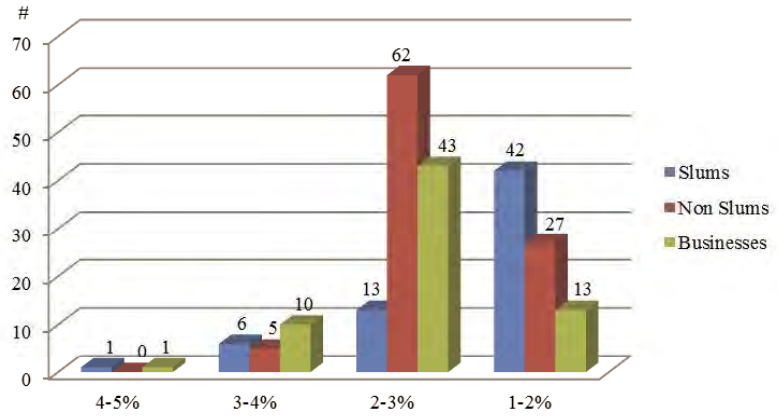
Table 11.3.5 Willingness to Connect and Pay for Improved Sewer Service

Status	Households (200)		Business establishments (100)	Total Average
	Slum (80)	Non-Slum (120)		
Not-connected to the sewer (13)	0	1	12	4.3%
willing to connect	0	1	1	15.4%
Already connected to the sewer (287)	80	119	88	95.7%
willing to pay for improved service (223)	62	94	67	77.7%

(III) Amount willing to pay for improved services and financial status

Though the result portraits a modest challenge for the Project to obtain public's interest to an increased rate, it might be more challenging than it looks. The reason is that those who are willing to pay more (223 respondents) only interested in a very small increase.

The respondents were requested to choose from a range of percentages that would be a fair increase in their current monthly charge for sewerage services. The range included 4-5%, 3-4%, 2-3% and 1-2%. The result showed that only a few (23 out of 223) are interested in 3-5% increase while the rest (89.61%) are satisfied with only up to 3% increase. The breakdown shown



at

Figure 11.3.2 indicates that though most of non-slum and business establishments are willing to pay an extra of 2-3%, the slum residents however are interested mostly in only 1-2% increased charges.

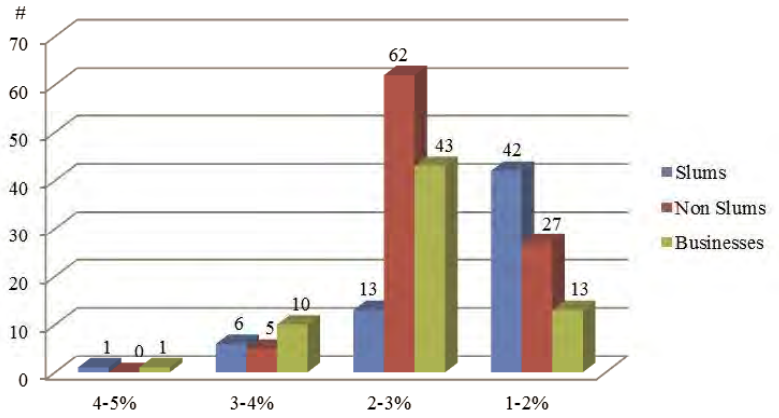


Figure 11.3.2 Satisfactory Future Increase in Current Monthly Charge

According to the answers to monthly income and payments for sewerage services, respondents already pay a small fraction of their monthly income for sewerage services. As seen in Table 11.3.6, the estimated monthly income for the surveyed population of slums, non-slums, and business establishments are 14,172Rs, 67,811Rs, and 75,548Rs, respectively, with an average of 52,510Rs. Currently, slum residents pay an average of 17Rs per month for sewerage services, non-slum residents pay 28Rs, and business establishments pay 29Rs which are 0.12%, 0.04%, and 0.04% of their monthly incomes, respectively. The average amounts the respondents are willing to pay for the improved service per month is a low of 25.5Rs per month with only 0.5Rs increase to their current pay.

Table 11.3.6 Current Pay and Increased Amount Willing to Pay

Status	Households (200)		Business establishments (100)	Total Average
	Slum (80)	Non-Slum (120)		
Already connected to the sewer (287)	80	119	88	-
Connected customer average monthly income	14,172	67,811	75,548	52,510
Current monthly pay for sewer	17Rs	28Rs	29Rs	25Rs
Current monthly sewer pay's share of income	0.12%	0.04%	0.04%	0.06%
Agreed increase in monthly sewer charge	1-2%	2-3%	2-3%	2%
Amount willing to pay per month	17.2-17.3Rs	28.6-28.9Rs	29.58-30Rs	25.5Rs

(3) Public Awareness and Involvement Attitudes

The Project has planned to consider public awareness and participation as an important key toward the success. PMC neither has a public relations department nor enough experience of organized and planned awareness projects. Giving such situation, PMC would face some challenges in preparing a well-planned program for the Project. One could be to assess the public's current awareness towards the River pollution, the Project, and its benefits and their motivation in getting involved in the Project. Other challenge could be related to the awareness level differences among the slum and non-slum residents and that whether different programs are needed based on such residency status. Choosing type of public engagement, kind of activities, and discussed topics are also among other challenges. The following two sections present findings from the social survey to address the above challenges. The recommendations on how PMC could tackle these challenges are provided in section 11.3.1.3.

(I) Assessing current level of public awareness

The survey participants were evaluated based on nine quantitative measures shown in

Table 11.3.7. The purpose was to examine the current awareness level towards the water pollution in the rivers, importance of a well-functioning sewerage system, and public hygiene.

Responses to the measures revealed that an average of 80% of the surveyed residents are aware of the water pollution in the rivers and the PMC's sewerage related issues, also the significance of this Project. They are also aware of health hazards of drinking water that is contaminated by sewage. As expected, only a low percentage of respondents (34%) were aware of PMC's existing STPs or have heard about the Project (15.6%). It shows that the public is ready to move, but need to be provided with further information about the severity of the situation. A higher awareness level would also encourage public's participation in the Project.

Table 11.3.7 Current Level of Public Awareness

Measures	Households (200)		Business establish-ments (100)	Average %
	Slum (80)	Non-Slum (120)		
River Pollution and Sewage Related Public Hygiene:				
(1) Aware that River Mula-Mutha is polluted.	80	120	99	99.6%
(2) Recognize more than one sign for the river pollution.	47	86	68	67%
(3) Aware that raw sewage discharge is the main cause of the pollution.	80	120	100	100%
(4) Aware that drinking contaminated water can cause diseases.	80	120	100	100%
(5) Aware of at least one sewage negative impact on public hygiene.	80	120	100	100%
(6) Aware that PMC city has sewage treatment plants.	14	47	41	34%
(7) Agree that PMC needs more STPs.	75	111	98	94%
The Project:				
(8) Heard about the Project.	7	23	17	15.6%
(9) Believe the Project will have positive impacts on the City/users life.	80	117	100	99%

When providing further information and awareness, the Project should pay attention to all groups of the City residents equally including slum, non-slum, and business establishments. As seen on Figure 11.3.3, an average of 75%, 80%, and 80% of the slum, non-slum, and business establishments responded positively to the measures, respectively. This indicates that all of the three groups have almost the same level of awareness. The Project public awareness program should plan awareness activities regardless of the above residency status.

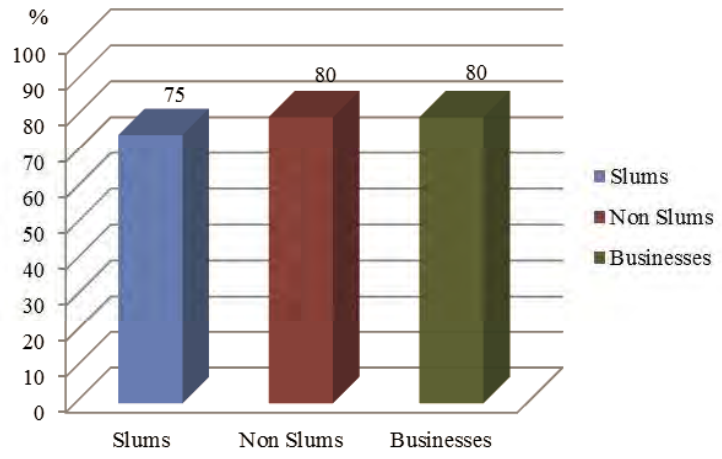


Figure 11.3.3 Average Level of Public Awareness

(II) Assessing public involvement attitude

In order to assess if the public in general is interested in participating in the PMC projects, the surveyed residents were asked if they have had participated in any of the past PMC's projects. The findings revealed that though the general attitude toward participation is positive among the

surveyed population but the engagement is still low. The results showed that lack of organized and planned public participation programs was a significant factor for the past low public participation. Figure 11.3.4 presents the reasons that why the surveyed population did not get involved in the past. As seen, there are a number of planning-related reasons including deficient details on how or when to get involved (43%), insufficient information on projects and the issues to be solved (2%), inconvenient public meeting times or locations (3.5%), also no feedbacks on the public's input on planning and implementation (7%) which add up to a total of 55.5%. On the other hand, "no interest or impact on personal life" and "No time to attend" received a high percentage of 30% and 14.5% which represent lack of motivation among some which still could had been addressed by well-planned public participation programs.

Figure 11.3.4 Reasons for Lack of Participate in Past Projects

For this Project, the respondents were asked if they want to get involved; the reasons, the best ways to be communicated, and what they want to know most about this Project. The result showed that majority of the respondents (68.6%) would like to get involved in the Project. It should be noted that his level of willingness, however, is lowest among the slums and highest among the non-slums residents. When preparing public awareness more attention should be giving to engagement of the slum population. As seen on Table 11.3.8, 49 out of 80 slum residents, 95 out of 120 non-slum residents, and 62 out of 100 business establishments would like to get involved in the Project and participate.

Table 11.3.8 Willingness to Get Involved with this Project

Measures	Households (200)		Business establishments (100)	Average %
	Slum (80)	Non-Slum (120)		
Willing to get involved	49	95	62	68.6

The reasons for their willingness to get involved include conservation of river, streams, and en-

vironment, help proper planning, timely execution and quality work, have a clean city and pollution free city, good service facilities, precaution from waterborne diseases, and transparency in work.

The result also showed that the public would prefer to be communicated for this Project mostly through TV and newspapers and they would want to know mostly about personal benefits and service areas though interested in knowing about other aspects of the Project. They were asked to rank from 1 to 12 (1 being the most and 12 being the least) for the best way of communication, also from 1 to 9 (1 being the most and 12 being the least) for what they want to know about the Project.

Table 11.3.9 shows the average rank numbers by slum and non-slum residents also business owners for both rankings. A look at the rank numbers present that the surveyed groups have almost a same level of interest in ways of communications and things they prefer to know the most about the Project.

Table 11.3.9 Ranks of Communication Method and Desired Information

Measures		Households (200)		Business establishments (100)
		Slum (80)	Non-Slum (120)	
Average ranks (from 1 being most to 12 being least)				
Way to be communicated	SMS	6	6	5
	E-mail	8	8	7
	Newspapers	2	3	2
	Mail	8	8	7
	Phone	7	7	6
	In person at door	7	5	8
	City Facebook/website	7	7	7
	Public neighborhood meetings	5	4	6
	Public meetings at City hall	7	6	8
	Radio	6	7	6
	TV	3	5	3
	Other	12	12	12
Average ranks (from 1 being most to 9 being least)				
Want to know about	Service area	4	4	3
	Laws and regulations	6	6	5
	Personal benefits	3	3	4
	Construction period	4	4	4
	Connection period	6	5	5
	Connection cost	4	4	5
	Connection process (application procedure)	6	7	6
	Sewage tariff fees	4	4	4
	Other	9	9	9

The average ranks, however, are shown in Figure 11.3.5 and Figure 11.3.6. As seen, after newspapers and TVs, the respondents also prefer to receive Project related information by SMS and

neighborhood meetings.

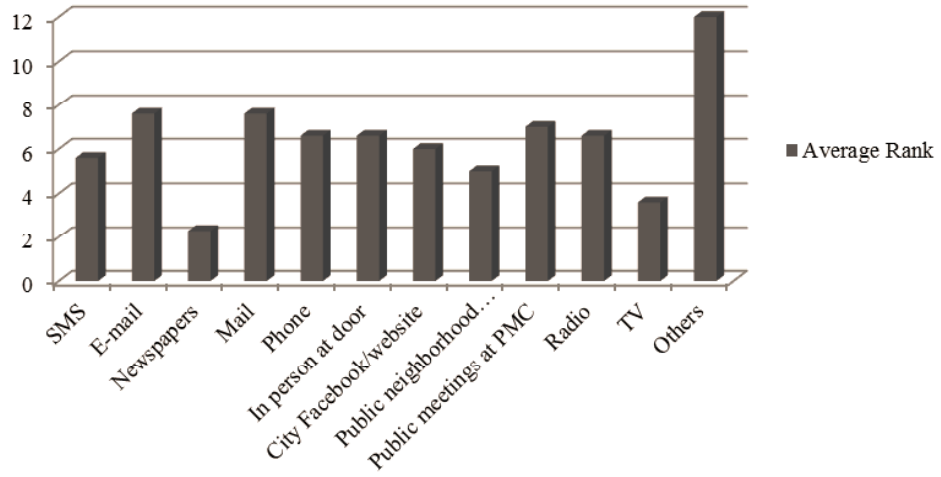


Figure 11.3.5 Total Average Rank of Communication Methods

(from 1 being best to 12 being least)

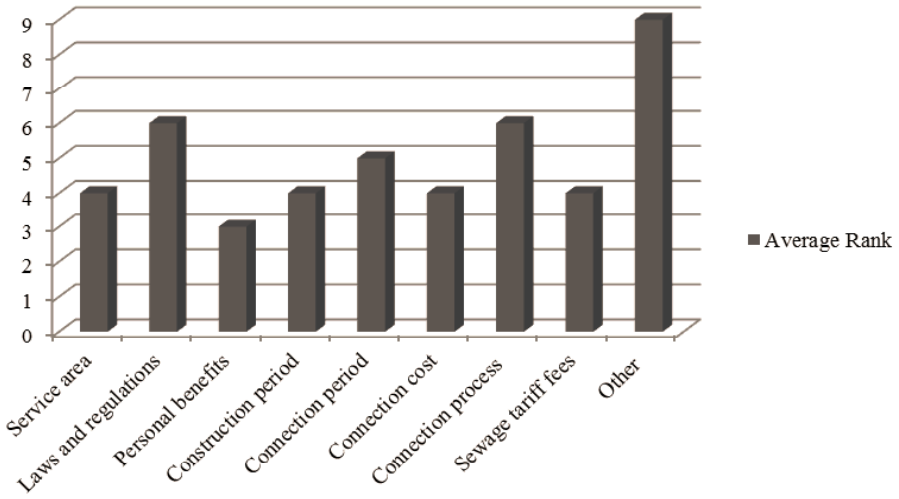


Figure 11.3.6 Total Average Rank of Desired Information

(from 1 being best to 9 being least)

11.3.1.2 Social Conditions Requiring Considerations

Though the concept of public participation has been introduced and accepted by the government authorities in India in general and particularly by PMC, it has still not been widely utilized. PMC does not have a public relation section/department on its organizational chart or any

community development specialist. The Environment and Public Health departments have done very limited public awareness activities which not only indicates PMC's lack of enough experience in conducting awareness/participation programs and campaigns but also it brings up a question on how PMC views the importance of public input in success of public projects including this Project as well. It indicates that PMC as the implementation agency of this Project with its limited organized public awareness and participation experience will have a challenging work ahead.

In order to ease the challenge, it is recommended that the following social considerations to be taken into account when planning the Project public awareness and participation;

- Majority of the public has the minimum awareness towards the water pollution in the rivers and its impact on the City and their life. However, this awareness level needs to improve among all three categories of slum and non-slum population, and business establishments.
- Sanitation should be improved by encouraging water and sewerage system connection and awareness on waterborne and water related diseases. PMC should work to make sure 100% connection is met and promote private toilet facilities in premises. It is also important for PMC to improve public toilets and construct new ones considering proper locations for women, men, and kids especially in slum areas.
- Majority of people are willing to pay for improved sewerage services, however in a small amount of increased rate. The Project should take into consideration when setting the increased sewage rate. If the increased rate is more than what the community expects, especially among the slum residents, the Project will need to pay more attention for public consensus.
- Currently the community has not a very clear idea how their current sewage rate is calculated as it is a taxation system-based amount by location. The Project should make sure that the community understands how a meter system works if it is utilized as recommended by the JICA Survey, also that how the future rate would be calculated and the benefits a volumetric charge system would have to offer.
- Though the general attitude toward participation is positive the engagement is still low. The reason is the PMC's lack of well-planned public participation programs. For this Project, the public participation program should be well organized and framed. It should also consider proper time and location for activity events and promote public motivation and interests. The Program should also pay attention to the best way of communication and facts

people prefer to know about the Project as well.

11.3.1.3 Public Awareness and Participation Planning

The DPR has a section called "public awareness and participation, and stakeholder's consultation". Though it states that the public awareness and participation is necessary for the Project but it misses to clearly present what awareness need to be provided to the public and why public participation is needed. On the other hand, without a clear design and implementation plan, the DPR lists many activities in the table 6.2. Out of the 12 type of public activities listed on the table only one type -the public debates/meetings- provides some sort of opportunity for participation as a two-way communication.

It is also important to strengthen PMC's capacity to take on these expansive activities in terms of its mindset of importance of public input and involvement in general and its experience of conducting expansive public awareness and participation programs. A clear directive and planned program with strategic preparations could strengthen PMC's in-house capacity to achieve the Project's expectation of the public.

Before planning for the Project's public awareness and participation program it is recommended that the followings questions to be answered:

- who is/are considered as the public (stakeholder)?
- why public awareness is needed? how the Project benefits from it?
- what awareness need to be provided to the public?
- why do public participation? Is there any decision that needs public participation/input?
  - what is/are the issues/problems/opportunities/concerns that need(s) public participation?
  - what does Project hope to achieve by public participation in the decision-making process?
  - what is the public's expected role in the solving the issues; consultation, involvement, or collaboration?
  - what participation are needed by different stage of the Project?
  - will the regulations, processes, mandates, PMC's culture, Project timing, and Project staff allow and support public participation? what is PMC's history of public participation?
  - will the Project decision maker(s) (PMC, Consultants) promise to take action on the

public's participation?

Next section provides recommendations for practical preparation of the Project public participation plan, including overall objectives and goals, strategic planning, and activities. It provides recommendations for best practices and tools to help PMC plan a directive and effective public participation process.

Figure 11.3.7 depicts a recommended framework for the plan. Although the diagram presents the tasks in a series of linear steps, activities in the process can occur concurrently or can be adapted as new information becomes available or circumstances change.

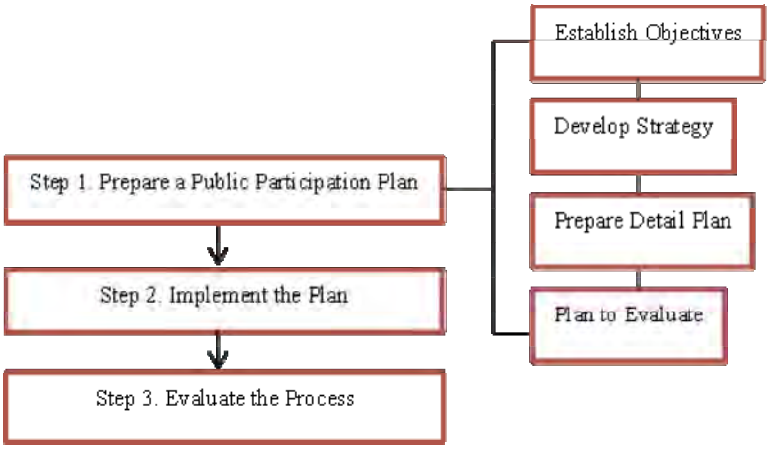


Figure 11.3.7 Recommended Framework for the Project's Public Participation Planning

It is important to use the public input in the pre-planning stage. Involving the Project's key stakeholders in the development of the plan can help build trust, increase awareness and highlight issues and concerns early in the process. In fact, for a meaningful and successful process, it is best that the awareness/participation plan is developed in partnership with the stakeholders.

(1) Goal and Objectives

It is important to determine why the Project needs public awareness and participation and what participations and therefore achievements are expected. The goals of the plan should focus on:

i. to create a bilateral communication with the stakeholders to hear their interests, concerns, and comments on the Project. This will help solicit public input, disseminate project information, and involve the public through comments and their objections if any.

ii. to build consensus and trust between the community and Project decision makers.

iii. to inform public about the Project decisions that may concern them.

Measurable objectives are needed to achieve the goals. Below are some suggestions:

- ✓ Project team (as the project's internal stakeholders including PMC, project consultants, JICA, and the contractors) understands the views and reasons behind the views of the external stakeholders regarding the Project design, timeline, process, decisions on sewerage fees and connection design.
- ✓ At least 90% of the stakeholders understand the Project positive impacts
- ✓ There is zero public conflict regarding the location of new STPs.
- ✓ At least 90% of the stakeholders consent to the improved service charge/fee
- ✓ At least 90% of the stakeholders willing to connect and pay if not a customer yet
- ✓ At least 90% of the stakeholders cooperate with construction related traffic and noise
- ✓ At least 90% of stakeholders understand and consent to the meter-based sewerage charges (in case of such plan)
- ✓ At least 90% of the stakeholders agreed with the new public toilet design, location, and community-based maintenance plan

(2) Strategy and Devices

The DPR provides a very brief strategic plan based on formation of a Committee on Awareness Generation and Public Participation. According to the DPR, the committee will approve and supervise action plans prepared for awareness campaign by different NGOs or groups for each city ward. Volunteers, community leaders, NGOs, school students, city groups, industrial groups, staff unions of private, Government and Corporations, Members of assembly, corporates, media representatives, lower level staff of corporation and staff of related government departments, etc. will be contributing in the awareness campaign.

However, the formation of the 'Committee', its constitution, mandate, and procedure for functioning methods for approval and supervision of the action plans will yet need to be developed. On the other hand, the committee needs to prepare a strategic plan with set goals and objectives which can be used as a tool to approve and supervise action plans proposed by the NGOs and groups for the city wards.

It is recommended to consider the following steps when preparing the plan:

i. Conduct a preliminary research

ii. Identify potential stakeholders (internal and external)

iii. Contact stakeholders (initial informal)

iv. Determine level of public participation for the stakeholders

v. Select public participation activities for each level

vi. Identify time lines for activities

vii. Allocate budget by the plan stage

viii. Develop a documentation process

(3) Project Stakeholders

In addition to preparation of a complete list of primary and secondary stakeholders (in pre-planning stage), the level of participation for each of the stakeholders should be also determined. Level of participation generally includes Only Informed, Consultancy, Involvement, and Collaboration. Furthermore, the spectrum of participation should be assessed for each stakeholder as None, Low, Medium, and High. This will help assess what participation can be expected from each stakeholder. Table 11.3.10 suggests a list of stakeholders which could be expanded or modified.

Table 11.3.10 Suggested Project's Stakeholders

Stakeholders			
Internal		- Project consultants - JICA	- Contractors of Project - PMC Municipal Corporation
External	Primary	- People of PMC - People and municipalities in downstream villages - Development corporations	- Business owners - Farmers and Industries
	Secondary	- Ministry of Environment and Forests (MoEF) - National River/ Lake Conservation Directorate (NRCD) - Central Pollution Control Board (CPCB) - Maharashtra Pollution Control Board (MPCB) - State Government Irrigation Department - Ward Councilors - Maharashtra State Government - PMC City Engineer - Maharashtra State Electricity Board - Media - Colleges, universities, school districts - Elected officials (state, regional or federal legislators)	- Outsourced private companies for Q&M of STPs and PSs: Mahabal, Emviro Engineering, Vetech Wabag, Dharpure, Chaudhari Ltd., Ramky Infrastructure Ltd., Enviro Control - Private sector entrepreneurs - NGOs (i.e. environment, land use, transportation, work force, housing, environment justice - Adjacent cities or jurisdictions - City council - Neighborhood associations if any - Business associations - Advocacy groups (local and regional) - Central Public Health Environmental Engineering Organization

(4) Activities Detail Plans, Timeline, and Budget

DPR has listed a number of activities for the public awareness program in three categories of mass media, events, and group and meetings. As noted earlier it is important to evaluate and strengthen PMC's capacity to conduct such activities and achieve the Project goals for public participation.

Table 11.3.11 shows a revised list of the activities including those noted in DPR and some additions. The table also presents the activity types by the stakeholder's participation level. For example, advertising at radios and TVs should be used as a tool only for awareness and information for targeted stakeholders. Interviews, as another example, however should be designed for those stakeholders that can engage with the Project by providing consultative inputs and active involvements. It should be noted that if an activity does not work, it should be adopted or modified.

Table 11.3.11 Activities by Stakeholder's Participation Level

Types of Activities	Level of Stakeholder Participation			
	Informed	Consultancy	Involvement	Collaboration
Information				
Advertising at radio, TV, cable TV	*			
Presentations/Seminars	*			
Central Information Contact	*			
Community Fairs/Events	*			
E-mail	*			
Field Offices	*	*		
Information Centers	*			
Information Kiosks/Exhibits/Displays	*			
Print and Electronic Media	*			
Print Materials/Mail Outs	*			
Events at Schools	*			
Site Tours/Field Trips	*	*		
Symposiums/Expert Panels	*	*		
Telephone Hotlines	*	*		
Web Sites and Social Media	*	*		
Consultation				
Meetings with Unions	*	*		
Comment Forms		*		
Focus Groups		*		
Interviews		*	*	
Public Meetings	*	*		
Evaluation Surveys		*		
Ward Meetings	*	*	*	
Involvement				
Debates/Roundtables			*	
Small Group Meetings			*	
Workshops			*	*
Collaboration				
Advisory Groups			*	*
Action Groups		*	*	*

As mentioned earlier, the social survey respondents showed more interest in receiving information via TV and print media like newspapers, and attending public neighborhood meetings. They also want to know more about the personal benefits from the Project, tariff fees, and con-

nection costs. Thus, when planning the awareness and participation program, it is recommended that more weight to be given to these types of activities and discussed topics.

It should also be noted that these activities do not necessarily need to be prepared separately for residents of slums and non-slum areas, also the business establishments. However, other factors like age or gender could be considered for the concept and level of the activities.

In addition, the project timeline and budget for public awareness and participation should be determined for each stage including designing (April 2016 to September 2017), construction (May 2017 to April 2021), and post-construction (May 2021 to April 2026).

Below are recommendations on how to prepare a detailed plan for each of the activities:
i. Plan a strategy for each activity; Type of activity, Target audience, Objective, Timing
ii. Plan a methodology for each activity
iii. Plan the communication requirements for each activity; Key/target messages, Technical information, Communication material, Media relations
iv. Plan how to monitor and evaluate each activity

(5) Evaluation Plan

Evaluation should be an explicit part of the plan design throughout the Project stage and also in end of each stage. The purpose is to identify:

- Effectiveness of information and outreach
- Public satisfaction with the participation activities
- The appropriateness of activities to stated objectives and goals,
- The impact of the participation on the decision making process
- The impact of the participation on the project outcomes
- The actual costs of public participation

Followings are some suggested methods:
(i) Informal feedback; by talking to stakeholders on a routine basis to ask how they perceive the process and its outcomes.
(ii) Interviews; when it is needed to gather a lot of feedback.
(iii) Survey; short and to the points like interested in connection and paying the new rate

At the end of each Project stage the formal feedback on how the process achieved its objectives for public participation is a necessity such as:

(iv) Questionnaires; short, to-the-point questionnaires can be used periodically or at the end of events to get a sense of things like attention to connection and pay the fees.

(v) Formal feedback/surveys; statistically valid information.

11.3.1.4 Social Condition Improvement and Influence Prediction

The purpose of the Project public awareness and participation is new customer connections and their willingness to pay for the improved sewerage services. In the "Evaluation Plan" section of this report, it is discussed how important it is to evaluate the Project's public participation program progress and effectiveness of its process in reaching out to the public. In addition, however, it is important to evaluate the social condition improvement which helps predict any issues, concerns, or positive influences.

For this purpose, it is essential to conduct a before-and-after analysis of the social condition at different stages of the Project. The social survey results conducted for the preparatory study can be utilized as a base for the comparison purposes to see how the condition improved. A customized questionnaire should be prepared and conducted. The focus of the questions should be on the public's willingness to connect and pay, also overall the project's positive impacts on the City and their life.

The following indicators need to be monitored to make sure that the program is on the right direction as planned.

Indicator to be Monitored	Description
Progress in public awareness level	Public's understanding of the Project and its positive impacts.
Progress in public engagement level	Public's attendance at events/activities with motivation and interest.
Effective awareness materials	Preparation of the materials, distribution, and effectiveness.

Bellow also shows the monitoring plan for the above indicator.

Indicator	Monitoring Methods
Progress in public awareness level	• Quality and quantity of announcement at TV/radio/social media/PMC's website. • Planning and implementation of seminars and meetings for awareness purposes; format of meetings, information to be presented, invited target groups, place and time of meetings, speakers, distributed materials. • Public attendance at seminars and meeting; number and attended group of the public, questions and answers, discussed

	concerns and comments. • Awareness level assessment using both short to-the-point questionnaires and surveys.
Progress in public engagement level	• Workshop and meeting planning and implementation; quality and quantity, frequency, target attendees, time and place, effectiveness. • Attendance at meetings/events/workshops; number of attendees, motivations and interests. • Before-and-after analysis of social condition improvement • Informal and formal interviews.
Effective awareness materials	• Quality and quantity of published materials; cost, design and effective messages for each group of the public i.e. slum residents, children. • Material distribution methods and plan; time and places of advertising, stage of the Project, target audience. • Effectiveness of materials using feedbacks.

11.3.2 Physical Environmental Aspect

11.3.2.1 Natural Environment

(1) Topography

Natural conditions in the PMC area are discussed in Chapter 2. In this Section, some conditions are summarized as an introductory part of environmental study.

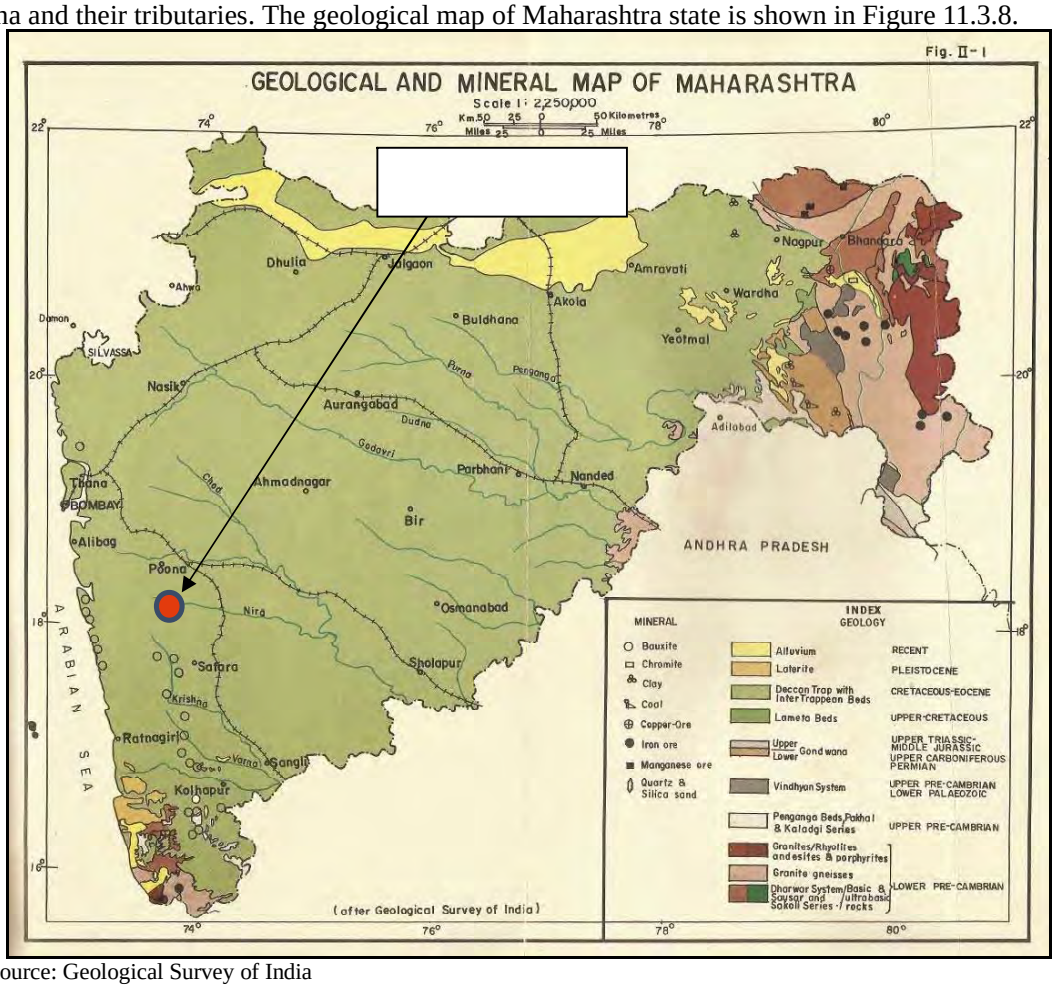
PMC is a plateau city situated near the western margin of the Deccan plateau. It lays on the leeward side of the Sahyadri of the Western Ghats and is about 50 km from the crest of the Ghat country. PMC is located about 100 km east from the Konkan which is the west coast of Maharashtra state. It is almost 160 km southeast of Mumbai. It is situated at a height of 560m above the mean sea level at the confluence of Mula and Mutha rivers. Mula-Mutha river later flows into the Bhima River. The city is surrounded by hills on the east and the south. The Sinhagad-Katraj-Dive ghat range is the southern boundary of the urban area. The highest point within the city is the Vetal hill (800 m) whereas the highest point of the urban area is the Sinhagad fort (1400 m).

(2) Geology

Maharashtra state is underlain by the basaltic lava flows of upper Cretaceous to lower Eocene age (which is called as Deccan Trap). The shallow alluvial formation of Recent age also occurs as narrow stretch along the major rivers flowing in the area. PMC is underlain by basaltic lava flows of upper cretaceous econe age associated with basic intrusive. The soil texture contains alluvial deposits of sand, gravels, fine silts and clays along the bank of the rivers. The thickness of this type of soil varies from 8 to 18 meters. The soil texture of the remaining city is made of

silicates, phyllosilicates and okenite group with basalts containing dykes and laterites.

Alluvium occurs in small areas along banks and flood plains of major rivers like Mula and Mutha and their tributaries. The geological map of Maharashtra state is shown in Figure 11.3.8.



Source: Geological Survey of India

Figure 11.3.8 Geological Maharashtra State

(3) Hydrology

Mula-Mutha watershed which belongs to an upper Bhima basin lies entirely in the PMC district of Maharashtra State. The watershed lies on the leeward side of the Western Ghats) and is a part of the Deccan trap volcanic province. Mula and Mutha rivers which are seasonal in nature originate in Sahyadri ranges and are the tributaries of the mighty Bhima River.

PMC is crossed by many rivers and streams, which rise near the Sahyadris. The major rivers within the city limits include Mula River, Mutha River and Mula-Mutha River. The total length of Mutha River within the city limits is approximately 10.40 km, Mula River is 22.37km and

Mula-Mutha River is 11.75. There are 3 important lakes in the city, they are Pashan Lake (62.60 Ha), Katraj Lake (7.20 Ha) and Snake Park Lake (18.60 Ha). The prime sources of water supply in PMC city are the surface water sources which include dams i.e. Khadakwasla about 20 kms north-west Panshet, Warasgaon and Temghar dams and lakes i.e. Pashan and Katraj lakes. The 29% untreated sewerage is disposed into the Rivers Mula-Mutha which is highly polluted has threatens the health of the citizens. PMC city is also further divided into 23 basins or watersheds which form the drainage channel of the city. Each basin comprises of network of natural drains discharging storm water into Mutha and Mula rivers. The increase urbanization and encroachment has resulted in increased land and vegetation erosion.

(4) Hydrogeology

Basaltic lava flows occupies more than 95% of the area of the district. These flows are normally horizontally disposed over a wide stretch and give rise to table land type of topography also known a plateau. These flows occur in layered sequences ranging in its thickness from 7 to 45 m and represented by 6 massive unit at the bottom and vesicular unit at the top of the flow. The water bearing properties of these flows depend upon the intensity of weathering, fracturing and jointing which provides availability of open space within the rock for storage and movement of ground water. The thickness of weathering in the district varies widely up to 20 m bgl (below ground level). The ground water in the district occurs under phreatic, semi – confined and confined conditions. Generally the shallower zones down to the depth of 20 to 22 m bgl form the phreatic aquifer. The water bearing zones occurring between the depth 20 and 40 m bgl when weathered or having shear zones yield water under semi-confined condition. The deep confined aquifers generally occur below the depth of 40 m bgl. In Deccan Trap Basalt, the yield of the dug wells in different formations ranges from 30 to 150 lpm/day depending upon the local hydrogeological conditions. The yields of boreholes also show wide variations and it ranges from traces to 30.62 lps (Lavle).In alluvium along Mula and Mutha rivers the granular detrital material like sand and gravel usually occurring as thin layer in the district yields water.

According to the State's Groundwater Survey and Development Agency (GSDA), the average groundwater level for PMC is around 4m but it has gone down further to 3m. As per the sixth Groundwater Assessment, out of PMC region's 263 watersheds (the region draining into a river, river system or other water body), 25 are over-exploited while eight are critical and 40 are semi-critical. Due to excessive use, groundwater level is depleting alarmingly, over-exploited and critical watersheds.

As per the PMC's Environment Status Report 2010-11, the depth of the city's bore wells is be-

tween 10.5m and 130m. As the PMC supplies only 10% of its water for commercial use, commercial establishments rely on groundwater for the remaining 90%. (Source: PMC Mirror.in dated May 2012) Given the drought situation in Maharashtra, the State Assembly passed the Maharashtra Groundwater Development & Management Act, 2009 on April 2012 which is awaiting the Governor's nod to become an Act. The provisions of this bill stipulate that digging of the bore wells will be allowed only up to 200 ft. (60m).

(5) Flora and Fauna

Flora

The vegetation pattern of the city is conducive almost for all types of tropical species indigenous and exotic both. The city has a tree cover distributed throughout the urban-scape. Approximately 380 species of trees are observed in PMC city. A tree census is being conducted by PMC Municipal Corporation. Approximately 70% of tree census was completed upto June 2011. According to the tree census, 23.33 lakh trees are identified in 170 sq.km. area. Katraj and Sinhagad area around PMC city have the maximum forest cover as compared to other forest areas in the city.

Fauna

PMC City has the presence of varied natural habitats such as forests, plantations, grassland, water bodies, rivers, gardens and hills which has contributed to the rich species diversity of fauna. Over the years there has been a change in the native fauna of PMC because of urbanization and introduction of exotic species. Development of the city has resulted in the habitat loss and posed a threat on the faunal community. The current faunal diversity of urban PMC is shown in Table 11.3.12.

Table 11.3.12 Summary of Fauna Species identified in PMC City

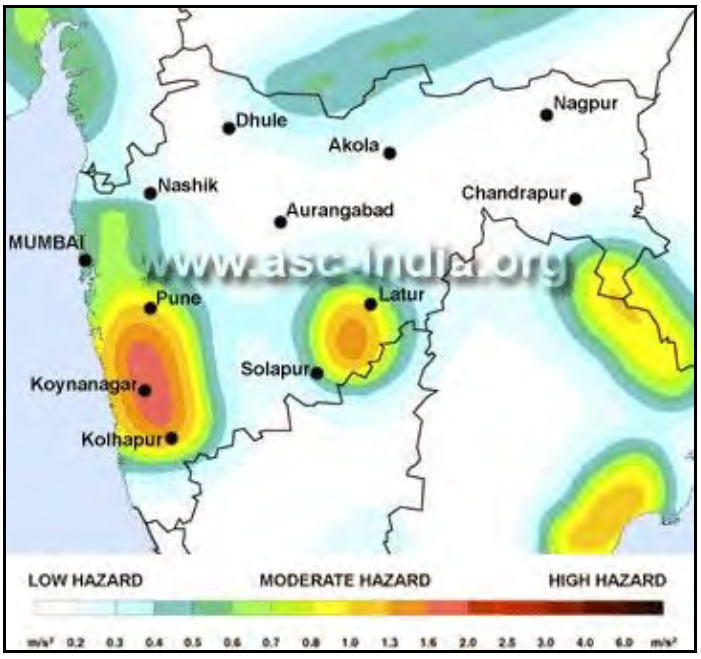
Group	Unit	Quantity
Aquatic insects	Family	13
Snails	Species	15
Ants	Genus	12
Butterflies	Species	170
Fishes (only in lakes)	Species	110
Amphibians	Species	14
Reptiles	Species	52
Birds	Species	332
Mammals	Species	65

Source: City Sanitation Plan, PMC

(6) Natural Disaster

1) Seismicity

According to the IS 1893 Part I, 2002, the Maharashtra state has been sub-divided into three earthquake damage risk zones. In PMC district, the South-West area of Taluka Bhor and Velhe fall into high damage risk zone, the Zone IV. The remaining part of the district falls under a moderate damage risk zone, the Zone III. PMC city is located in Zone III of the moderate damage risk zone. This makes PMC vulnerable to earthquakes of the intensity of 7.0 on the Richter scale or grade VIII on the MMI Scale. A major earthquake measuring 6.3 on the Richter scale, took place on the 30th of September 1993, at Killari in Latur District. The tremor of this earthquake was felt in 11 districts surrounding Latur including PMC. The seismic hazard map in Maharashtra state is shown in Table 11.3.9.



Source: http://asc-india.org/maps/hazard/haz-maharashtra.htm

Figure 11.3.9 Seismic Hazard Map in Maharashtra State

2) Flood Prone Areas

PMC Agglomerated area, specifically PMC city faced the worst floods in its history on 12th July 1961. The floods were caused due to the dam burst at Panshet dam due to heavy rains in the upper watershed region. About 40% area of PMC city was submerged under water for almost 24 hrs. The city had faced heavy losses due to this flood. PMC city was again flooded on 22nd & 23rd August 1997 due to heavy rainfall in the catchments of all the dams near PMC city. All the three dams were filled to their optimum capacity, and thus to prevent the dams from

breaking the Irrigation Department had no choice other than releasing water from Khadakwasala dam in the basin of river Mutha. Recently in 2005 July and August, heavy rains resulted in flooding of the PMC's low lying areas.

11.3.2.2 Air and Water Pollution, and Noise Problem

(1) Air / Traffic

The transport, domestic and industrial sectors are the major contributors to the rise in ambient air pollution levels. The prime source of PM10 (particulate matter) is the increasing numbers of vehicles in the city (600-800 vehicles registered per day as per RTO, Transport). This is one of the major concerns for air pollution.

PM_{10}

The comparative analysis of PM_{10} of various cities as given in figure below denotes that PMC has the second highest emissions with 38,400 tons/ year as compared to other cities except in Chennai which has the highest emission of 50,200 tons/ year. As per the recent study conducted by Maharashtra Pollution Control Board (MPCB), PMC has PM_{10} (Particulate Matter) accounting to 99 $\mu g/m^3$ which is more than the permissible limit of 60 $\mu g/m^3$, resulting in increasing incidences of respiratory disease. As per the Environmental Status Report, PMC (2011-2012), it was also found that level of PM_{10} is high in residential areas because of re-suspended road blown dust particles during the movement of vehicles while in the commercial area the maximum contribution source is from the transport and followed by Road dust and use of DG Set. In the industrial area, the re-suspended dust is the major contributor of PM10 followed by construction/ Brick Kilns.

SOx

The SOx levels in 3 different locations in PMC i.e. Navi Peth, Oasis Hotel and Mandai area for the period of 4 years from 2008 to 2011 as per ESR (Environmental Status Report) (2011-2012) shows that SOx levels are all below the permissible standard. However, the diesel engines which have more proportion of sulfur oxide have to constantly monitored.

Increased number of vehicles has been a major source of air pollution in the recent years. Till March 2010, 1,920,000 vehicles were registered in the city and the growth continues at the rate of 600 – 700 new vehicles per day. The following table depicts that the air quality in the city. The monitoring result of the ambient air quality is shown in Table 11.3.13.

Table 11.3.13 Monitoring Results of Ambient Air Quality in PMC

No.	Area	2008			2009			2010		
		SOx	NOx	RSPM	SOx	NOx	RSPM	SOx	NOx	RSPM
1	Navi Peth	16.9	51.3	147.8	29.9	46.2	149.1	29.1	42.7	137.9
2	Oasis Hotel, NDA Road	21.3	51.6	132.8	19.4	36.7	139.2	29.6	52.6	150.4
3	Mandai	17.2	68.2	122.8	17.8	37.5	148.2	37.2	66.6	152.2
Standard		60		50	60		50	60		50

Note:
RSPM: Respirable Suspended Particulate Matter
Source: Environmental Status Report, 2011 – 2012

(2) Water Pollution

Surface Water

PMC has carried out monitoring for water quality of rivers and nallas in Pune city. The following are the water quality examination results of Mula, Mutha rivers. JICA Preparatory Survey included water quality examination in 2014 at the rivers and three nallahs in the city. The results are shown in Table 11.3.14.

Both rivers are heavily polluted with their high BOD and COD values directly caused by the discharged sewage from the nallas. The BOD values in Mutha River are higher than those of Mula river. This is because of the diluted water of Mula River, since the river flow of Mula river is larger than Mutha river. The high values of BOD (15 mg/l as minimum in Mula and 80 mg/l as maximum in Mutha river) exceed the environmental standard of 3 mg/l and indicates that those river quality is far beyond the standard for drinking purpose.

As for the water quality for the nallas, on one hand, the results are higher values comparing with those of the rivers. The BOD concentrations in nallas dropped from the values of 100 to 115 mg/l in 2009 -2011 to 70 to 80 mg/l in 2012 and 2013. This is because the commissioning of the STPs has been made after 2011 and also because the expansion of the sewerage networks has been carried out after since then.

Table 11.3.14 Water Quality Examination Results for Surface Water

Mula River

Unit in mg/l

Water Body	Location	Parameter	2009	2010	2011	2012	2013	2014
Mula	Aundh	BOD	22	22	18	18	22	
Mula		COD	35	60	45	60	60	
Mula		DO	2.9	2	3.6	3.5	2.5	
Mula	Holkar Bridge – PMC - MPCB	BOD	30	25	22	20	25	
Mula		COD	35	55	60	65	60	

Water Body	Location	Parameter	2009	2010	2011	2012	2013	2014
Mula	Annual Average	DO	2.75	1.6	2.75	2.9	2.4	
Mula	Harris Bridge PMC - MPCB Annual Average	BOD	45	28	20	15	28	
Mula		COD	75	85	55	50	55	
Mula		DO	0.5	1	3.25	2.75	2.1	
Mula	Wakdewadi PMC - MPCB Annual Average	BOD	28	18	25	15	30	11.1
Mula		COD	30	50	60	50	50	58
Mula		DO	2.5	1.9	2.5	2.5	2.7	8.2
Mula	Sangam Bridge PMC - MPCB Annual Average	BOD	40	22	20	18	25	76.5
Mula		COD	35	80	50	60	60	263.12
Mula		DO	2	1.1	3.1	3.2	2.5	0
Mula	Yerwada PMC - MPCB Annual Average	BOD	45	20	28	18	30	10.95
Mula		COD	35	65	65	60	60	35.7
Mula		DO	0.5	0.6	1.5	2	2.4	3.3
Mula	Mundhwa PMC - MPCB Annual Average	BOD	35	30	30	30	45	16.5
Mula		COD	100	70	80	90	95	81.6
Mula		DO	0.4	0.6	1.25	2.3	2.8	0.8
Mula	Near Botanical Garden JICA Survey	BOD						11.7
Mula		COD						75
Mula		DO						8.6
Mula	Near Botanical Garden	BOD						18
Mula		COD						96.14
Mula		DO						7.8

Source:

- Environmental Status Report (ESR) for 2009 – 2013, PMC
- JICA Survey Team

Mutha River

Unit in mg/l

Water Body	Location	Index	2009	2010	2011	2012	2013	2014
Mutha	Vadgaon-JICA Survey	BOD						9.4
Mutha		COD						35
Mutha		DO						5.13
Mutha	Warje - JICA Survey	BOD						60
Mutha		COD						175
Mutha		DO						1.75
Mutha	Vithalwadi	BOD	35	30	25	20	25	
Mutha		COD	60	75	55	65	65	
Mutha		DO	1	NA	2.4	2.5	2.7	
Mutha	Mhatre Bridge	BOD	30	15	25	20	30	
Mutha		COD	30	45	60	65	105	
Mutha		DO	0.75	0.75	2.3	1.6	2.5	
Mutha	Erandwane	BOD	80	35	30	20	40	
Mutha		COD	70	150	90	70	120	
Mutha		DO	NA	NA	0.8	1.2	2.1	
Mutha	Joshi Bridge	BOD	40	35	35	22	18	
Mutha		COD	80	110	100	70	55	
Mutha		DO	0.1	0.1	0.6	0.9	1.8	
Mutha	Sawarkar	BOD	40	40	40	22	25	

Water Body	Location	Index	2009	2010	2011	2012	2013	2014
Mutha	Bridge	COD	50	150	100	75	80	
Mutha		DO	0.1	0.1	0.6	1	2	
Mutha	Railway Bridge	BOD	65	35	35	18	40	
Mutha		COD	40	105	100	60	140	
Mutha		DO	NA	NA	0.8	1.3	2.5	

Source:
1) Environmental Status Report (ESR) for 2009 – 2013, PMC
2) JICA Survey Team

Nallah

Unit in mg/l

Year	Ambil Nalla			Nagzari Nalla			Bhairoba Nalla		
	DO	BOD	COD	DO	BOD	COD	DO	BOD	COD
2009	0.1	105	175	0.1	90	180	0.1	105	240
2010	NA	105	210	NA	100	250	NA	105	250
2011	NA	115	205	NA	115	275	NA	115	275
2012	0.1	70	225	0.1	70	240	0.1	70	225
2013	0.15	75	200	0.15	70	175	0.15	80	240

Source: Environmental Status Report (ESR) for 2009 – 2013, PMC

Groundwater

10 samples of groundwater from wells were located in Dhankawadi ward in the southern part of the city. The owners of the wells were private households and they used them when there is a shortage or no water supply from PMC. The results indicate high level of EC for most of the samples and those of Alkalinity and TDS for the partial samples comparing with the standards, which show that groundwater was polluted by human activities. The results of the water quality analysis for above samples are shown in Table 11.3.15.

Table 11.3.15 Results of Water Quality Analysis in Dhankawadi Ward, PMC

Sample No.	pH	EC	Hard-ness	Cal-cium	Mag-nesium	Alka-linity	Chlo-ride	TDS	Nitrate	Sulphate
1	7.2	700	347	92	12	300	115	50	84.4	55
2	7.8	670	320	84	11	280	85	48	10.9	30
3	7.2	668	423	95	18	300	71.7	53	8.9	35
4	7.8	552	350	68	17.5	260	80.1	16	7	37.5
5	7.7	498	96	28.6	16.3	300	81.8	160	14.4	28
6	7.1	726	216	47.6	41	300	181.9	140	14.4	30
7	7.3	968	202	49.2	37.3	346.7	148.5	560	30	55
8	7.2	750	217.3	48	37.2	280	106.8	420	26.7	50
9	7.2	747	217.3	53	40	306.7	135	380	22.2	38
10	7.6	158	74.7	16	14.2	193.3	68.4	40	2.22	6
Standard	8.5	300	300	75	50	120	250	500	45	200

Source: Ground water quality assessment of Dhankawadi ward of PMC by using GIS, International Journal of Geomatics and Geosciences, Volume 2 Issue 2, 2011

(3) Noise Problem

Noise which is the unwanted sound has been recognized as a nuisance. It is more prominent in the urban areas. It has become a cause of concern for the citizens. Vehicular movement on the

road owing to traffic jams, honking are the main causes of noise problem in the city today. The noise levels in most of the locations exceed the environmental standards, which is caused by the traffic congestion and their honking. As for residents' complaints on the noise caused by existing STPs, no complaints from the surrounding residents of the existing STPs were received through JICA Preparatory Survey. The results of the noise levels at major areas of the city is shown in Table 11.3.16 and Table 11.3.17.

Table 11.3.16 Noise Level in Major Commercial Area

Location	Noise Level (dB(A))	Standard
Indradhnushya Env. Center,Mhatre bridge	69.1	65
Nal Stop	75.7	65
RTO (Regional Transport Office)	75.2	65
Swargate	76.7	65
Mandai	81.0	65
Near E square	76.8	65
Bremen Chowk	74.8	65
Ambedkar chowk	76.4	65
Wadgaon Bk.(NH4)	76.2	65
Pashan (NH4)	71.9	65
Near MPCB Office, wakdewadi	69.8	65
KK Market, satara road	71.3	65
Rajiv Gandhi Bridge	74.6	65
Harrison Bridge	68.5	65
Near PMC Building	69.9	65
Kamgar Statue	73.6	65

Source: City Sanitation Plan, 2011, PMC

Table 11.3.17 Noise Level in Residential Area

Location	Noise Level (dB(A))	Standard
Sant Dnyaneshwar Ghat	69.9	55
Near Ramoshi Gate Police Chowky	71.4	55
Pulachiwadi	59.5	55
Sant Malimaharaj Ghat	60.7	55
Katraj Lake	55.6	55
Near Phadake Houd	66.9	55
Erandwane	57.3	55
Khadakwasla	48.8	55
Raja ram Bridge	59.5	55
Ramvadi Octrai Naka	67.9	55

Source: City Sanitation Plan, 2011, PMC

11.3.3 Environmental Laws and Regulations for Implementation of Sewerage Project

(1) Laws and Regulations on Administration

1) Urban Plan and Land Use Plan

Maharashtra Regional Town Planning (MR & TP) Act, 1966

The Act provided that all municipal corporations, councils and other local authorities to prepare

a Development Plan (DP) for the entire area within its jurisdiction as their obligatory mandate. The purpose of preparing a DP is to use the land for the best purposes which is most suitable for residential, commercial, industrial, agricultural, recreational, etc.

A DP generally indicates the manner in which the land use shall be regulated by a planning authority, and also indicate the manner in which the development of land therein is to be carried out. It provides all or any of the following matters;

- Allocation of the land for purposes such as residential, industrial, commercial, agricultural, recreational,
- Existing and future provisions of water supply, drainage, sewerage, sewage disposal, other public utilities, amenities and services including providing electricity and gas services.

Under the provisions of section 38 of MR&TP Act 1966 at least once in twenty (20) years from the date on which a development Plan has come into operation, the Planning Authority shall revise the Development Plan. The Planning Authority of PMC revised the 1987 Development plan as per section 38 of MR&TP Act 1966 by the resolution No. 512 dated 23rd February 2007.

2) Transfer of Mandatory Responsibility of Sanitation Service to ULBs

The 74th Constitutional Amendment:

The 74th Constitutional Amendment, enacted by the Parliament in 1993, mandates the State Government to transfer a responsibility of water supply and sanitation (WSS) services to the urban local bodies (ULBs) such as Nagar Panchayat (City council), Nagar Palika (Municipality) and Nagar Nigam (Municipal Corporation) such as PMC in the ascending order of magnitude. This amendment is aimed to strengthen ULBs through devolution of powers towards decentralization.

The Twelfth Schedule, which has been added to the 74th Constitutional Amendment, includes the following major functions in accordance with Article 243:

- Urban planning including town planning
- Regulation of land-use and construction of buildings
- Planning for economic and social development
- Roads and bridges
- Water supply for domestic, industrial and commercial purposes
- Public health, sanitation conservancy and solid waste management
- Fire services
- Urban forestry, protection of the environment and promotion of ecological aspects
- Safeguarding the interests of weaker sections of society, including the handicapped

and mentally retarded

- Slum improvement and up-gradation
- Urban poverty alleviation
- Provision of urban amenities and facilities such as parks, gardens, playgrounds
- Promotion of cultural, educational and aesthetic aspects
- Burials and burial grounds; cremation grounds and electric crematoriums.
- Cattle pounds; prevention of cruelty to animals.
- Vital statistics including registration of births and deaths
- Public amenities including street lighting, parking lots, bus stops and public conveniences
- Regulation of slaughter houses and tanneries.

3) The Easements Act, 1882

The Easements Act is a law for public services. Any vacant space of the ULB earmarked or proposed to be earmarked for sewerage components and lying unutilized for a reasonably long period shall not be alienated anew by the ULB unless it is enacted by the state legislature under the relevant act. If such a land has been earmarked for a specific purpose at the time of town planning the same shall not also be questioned by the public later on.

(2) Laws and Regulations on Control for Water Environment

1) Water Prevention and Control of Pollution Act, 1974 and its Amendments

The Water (Prevention and Control of Pollution) Act and the Environment Protection Act promulgated in 1974 and 1986, respectively deal with the prevention and control of water pollution. The latter is considered as an umbrella act covering all aspects of the environment, under which the central government can take appropriate measures for;

- Protecting and improving the quality of the environment, and
- Preventing, controlling and abating environmental pollution.

The Pollution Control Board (PCB) was established under this act both at the Central Government called as Central Pollution Control Board (CPCB,) and also at the State Government level for each state, known by the name of the State like Andhra Pradesh Pollution Control Board (APPCB).

The Act vests regulatory authority on the State Pollution Control Boards and empowers them to establish and enforce effluent standards for industries and local authorities discharging effluents. The followings are the important provisions under this Act:

- Provide the State Pollution Control Board (SPCB) any information which is sought for

preventing or controlling pollution of water regarding the construction, installations, operation or the treatment and disposal system of an industrial establishments

- Not to discharge intentionally of any effluent into the stream, sewers or on land of quality which is not conforming to the standards prescribed by SPCB
- Provide information to SPCB and other designated agencies of any accident or unforeseen events, in which effluents not conforming to the prescribed standards are being discharged or likely to be discharged in to a stream or sewer or on land
- Comply with the directions issued in writing by SPCB, within the specified time.
- Comply with the condition as prescribed in the "Consent to Establish" or "Consent to Operate" for discharge of effluent in to stream or sewers or on land.
- The Responsibilities pursuant to this law is as follows;
- Obtain "Consent to Establish", prior to taking any steps to establish any industry or any treatment and disposal system which is likely to discharge effluents.
- Obtain "Consent to Operate", prior to commencing operation of any industry or any treatment and disposal system which is likely to discharge effluents.
- Apply for renewal of the "Consent to Operate: before the expiry of validity period along with the prescribed fee.

2) The Environment (Protection) Act, 1986, 2004 (amended)

The Environment (Protection) Act was conceived as an "umbrella legislation" seeking to supplement the existing laws on the control of pollution (the water Act and the Air Act) by enacting a general legislation for environment protection and to fill the gaps in regulation of major environmental hazards.

· Section 3 (1) of the Act empowers the Centre to " take all such measures as it deems necessary or expedient for the purpose of protecting and improving the quality of the environment and preventing, controlling and abating environmental pollution".

· It also authorizes the government to make rules on any aspect related to environment protection.

· No industries can discharge any solid, liquid or gaseous substances beyond the permissible limit as laid down by the Central Government on its behalf.

· Comply with the directions issued in writing by the Central Government within a specified time as mentioned in the order.

· Furnish information to the prescribed agencies of any accident or unforeseen events, in which environmental pollutants occurred in excess of the prescribed standards are being dis-

charged, of are likely to be discharged in the environment.

The following is the provisions regarding the responsibilities pursuant to the law;

· Obtain prior "Environmental Clearance" from MoEF in case of a new project or for modernization/expansion of the existing project and in respect of projects falling under EIA notification

(3) Other Environmental Relevant Laws and Regulations

The following shows other relevant laws and regulations.

1) EIA Notification 2006

EIA Notification 2006 is a legal basis for regulating environmental clearance for various kinds of projects. The notification provides the detailed process on environmental clearance for screening, scoping and public consultation for development projects.

2) Air (Prevention and Control of Pollution) Act, 1981 - as amended in 1987

This is the act providing for prevention, control and abatement of air pollution. The act provides the mandatory consent of the state board prior to construct or operate any industries plant in any sensitive area of air pollution, the statute on emission discharge of any pollutants in excess of the emission standards prescribed by SPCB, state's mandatory prescription such as emission standards for pollution sources of fixed source or mobile emission sources.

3) The Land Acquisition Act, 1894

The Act seeks to set out the circumstances and the purposes for which private land can be acquired by the Central/ State Government. The act provides the procedure of the project government's preliminary notification on the necessity of the land securement for public or private purpose, declaration of intended acquisition, publication of declaration, public notice and compensation.

4) The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013

The act regulates land acquisition and provides laid down rules for granting compensation, rehabilitation and resettlement to the affected persons in India. The Act has provisions to provide fair compensation to those whose land is taken away, brings transparency to the process of acquisition of land to set up factories or buildings, infrastructural projects and assures rehabilitation of those affected. The Act establishes regulations for land acquisition as a part of India's

massive industrialization drive driven by public-private partnership. The Act replaced the Land Acquisition Law, 1894, a nearly 120-year-old law enacted during British rule.

(4) Environmental Standards

Refer to Chapter 2 for details on environmental standards.

11.4 Identification of Possible Environmental Impacts and Necessary Measures

11.4.1 Manner of Impact Identification and Examination

The project is classified as Category B since the sector will not affect significant adverse impacts and the project site is not located in the vulnerable areas such as national parks or other environmentally vulnerable areas, which are listed in the JICA Guideline (JICA Guideline on Environmental and Social Considerations, April, 2010, JICA). The environmental components and items should be set considering the impact levels to be generated by the activities at each project phase (Scoping). The anticipated environmental impacts will be identified for the selected environmental items which were set at the scoping.

11.4.2 Setting of Environmental Components and Items

The environmental components and items should follow the requirements of the JICA Guideline. The project component should be assessed on the following items as shown in Table 11.4.1 on natural, social, pollution and others such as global issues pursuant to the Guideline.

Table 11.4.1 Environmental Components and Items

No.	Environmental Component / Item	Impacts to be Assessed	Survey Method
Natural Environment			
1	Protected Area	Potential impact on protected areas or national parks by the project	• Literature survey • Interview survey
2	Ecosystem	Potential impact on ecosystem by the project	• Field reconnaissance • Interview survey
3	Hydrology	Potential impact on hydrological situation of surface and ground water by the project	• Field reconnaissance • Literature survey • Gathering relevant data / information • Feature or activities of project component
4	Geology	Potential impact on geological situation by the project	• Field reconnaissance • Gathering relevant data / information • Feature or activities of project component
Social Environment			
5	Resettlement	Potential impact on involuntary resettlement or land issues by the project	• Field reconnaissance • Interview survey • Gathering relevant data / information • Feature or activities of project component

No.	Environmental Component / Item	Impacts to be Assessed	Survey Method
6	Poverty	Potential impact on poverty by the project	• Field reconnaissance • Interview survey • Gathering relevant data / information
7	Ethic Minority	Potential impact on ethnic minorities or indigenous people by the project	• Field reconnaissance • Interview survey • Gathering relevant data / information
8	Employment, sustenance and regional economy	Potential impact on employment, regional or local economy by the project	• Gathering relevant data / information • Feature or activities of project component
9	Land Use	Potential impact on land use change by the project	• Field reconnaissance • Interview survey • Gathering relevant data / information
10	Water Use / Water Right	Potential impact on water use / right by the project	• Field reconnaissance • Interview survey • Gathering relevant data / information • Feature or activities of project component
11	Existing Social Infrastructure	Potential impact on social capital and markets derived from the preferential treatment and cooperation between local individuals and groups by the project	• Field reconnaissance • Interview survey • Gathering relevant data / information • Feature or activities of project component
12	Society / Capital Market	Potential impact on social capital and markets derived from the preferential treatment and cooperation between local individuals and groups by the project	• Field reconnaissance • Interview survey
13	Unbalance of Benefit	Potential impact on unbalanced or uneven benefits by the project	• Field reconnaissance • Interview survey
14	Interests in the Region	Potential impact on possible conflicts of local interests by the project	• Field reconnaissance • Interview survey
15	Heritage	Potential existence of important cultural or historical heritage in and around the project sites	• Field reconnaissance • Interview survey • Gathering relevant data / information
16	Landscape	Potential existence of important landscape in and around the project sites and the possible impact on them by the project	• Field reconnaissance • Interview survey • Feature or activities of project component
17	Gender	Potential impact on gender issue by the project	• Field reconnaissance • Interview survey
18	Right of Children	Potential impact on right of children by the project	• Field reconnaissance • Interview survey
19	HIV / AIDS	Potential impact on infectious diseases such as HIV / AIDS by the project	• Interview survey • Gathering relevant data / information • Feature or activities of project component
20	Occupational Health and Safety	Potential impact on occupational health and safety by the construction, operation and maintenance activities of the project	• Field reconnaissance • Interview survey • Gathering relevant data / information • Feature or activities of project component
Pollution			
21	Air Pollution	Potential impact on occupational health and safety by the construction, operation and maintenance works of the project	• Field reconnaissance • Gathering relevant data / information • Feature or activities of project component
22	Water Pollution	Potential impact on water pollution of the water body of the surface and groundwater by the project	• Field reconnaissance • Gathering relevant data / information • Feature or activities of project component

No.	Environmental Component / Item	Impacts to be Assessed	Survey Method
23	Waste	Potential generation of construction debris, domestic waste and disposal manners of treated sludge by the project	• Field reconnaissance • Gathering relevant data / information • Feature or activities of project component
24	Soil Contamination	Potential occurrence of leakage or spillage of untreated sewage into soil of by the project	• Gathering relevant data / information • Feature or activities of project component
25	Noise / Vibration	Potential generation of noise or vibration by the project	• Field reconnaissance • Interview survey • Gathering relevant data / information • Feature or activities of project component
26	Subsidence	Potential generation of ground subsidence by the project	• Field reconnaissance • Gathering relevant data / information • Feature or activities of project component
27	Odor	Potential generation of offensive odor by the project	• Field reconnaissance • Interview survey • Gathering relevant data / information • Feature or activities of project component
28	Sediments	Potential generation of sediments in lakes or rivers by the project	• Field reconnaissance • Interview survey • Gathering relevant data / information • Feature or activities of project component
Others			
29	Accident	Potential occurrence of accidents by the project	• Field reconnaissance • Interview survey • Gathering relevant data / information • Feature or activities of project component
30	Climate Change	Potential impact on trans-boundary or global issues by the project	• Gathering relevant data / information • Feature or activities of project component

Source: JICA Guideline on Environmental and Social Considerations edited by JICA Survey Team

11.4.3 Anticipated Activities due to the Project

The anticipated project activities causing potential environmental and social impacts are expected for the project components of STPs, IPSs, Sewage Collection System including main/ sub main sewers in and outside Baner area and the public toilet facilities at their construction and operation/ maintenance stage. At construction stage, the possession of sites, clearing works, excavation works and concrete placing will be common to all components. At operation and maintenance stage, inspection, examination and monitoring works will be common to all components. The anticipated project activities are shown in from Table 11.4.2 to Table 11.4.5.

Table 11.4.2 Anticipated Project Activities for Construction of STPs

Component	Anticipated Project Activities
1. STPs	
1.1 Construction Stage	✓ Possession of sites ✓ Transplantation or clearing trees inside STP sites ✓ Site preparation / Leveling works ✓ Temporary works ✓ Construction of access roads ✓ Removal of existing STP structures ✓ Excavation works ✓ Placing of concrete ✓ Construction of earth retaining wall ✓ Transportation of construction vehicles ✓ Operation of heavy machines ✓ Installation of pipes, equipment and devices ✓ Backfilling ✓ Discharge, storage and disposal of construction debris and excavated soil ✓ Discharge, storage and disposal of domestic waste at construction camps
1.2 Operation and Maintenance Stage	✓ Inspection / Examination of facilities and equipment ✓ Water treatment ✓ Sludge treatment, handling, transport and disposal ✓ Cleaning works ✓ Injection of chlorine gas ✓ Effluent discharge ✓ Monitoring works

Source: JICA Survey Team

Table 11.4.3 Anticipated Project Activities for Construction of IPSs

Component	Project Activities
2. Intermediate Pump Stations (IPSs)	
2.1 Construction Stage	✓ Transplantation or clearing trees inside IPSs sites ✓ Site preparation / Leveling works ✓ Temporary works ✓ Removal of existing IPSs structures ✓ Excavation works ✓ Placing of concrete ✓ Construction of earth retaining wall ✓ Transportation of construction vehicles ✓ Operation of heavy machines ✓ Installation of pipes, equipment and devices ✓ Backfilling ✓ Discharge, storage and disposal of construction debris and excavated soil ✓ Discharge, storage and disposal of domestic waste at construction camps
2.2 Operation and Maintenance Stage	✓ Inspection / Examination of facilities and equipment ✓ Cleaning works ✓ Effluent discharge ✓ Monitoring works

Source: JICA Survey Team

Table 11.4.4 Anticipated Project Activities for Construction of Sewage Collection System

Component	Project Activities
3. Collection System and Main / sub mains	

3.1 Construction Stage	✓ Possession of ROWs (Right of Ways) ✓ Site preparation / Leveling works ✓ Temporary works ✓ Excavation works ✓ Placing of concrete ✓ Construction of earth retaining wall ✓ Transportation of construction vehicles ✓ Operation of heavy machines ✓ Installation of pipes, equipment and devices ✓ Backfilling ✓ Discharge, storage and disposal of construction debris and excavated soil ✓ Discharge, storage and disposal of domestic waste at construction camps
3.2 Operation and Maintenance Stage	✓ Inspection / Examination of manholes and sewer pipes ✓ Repairing works ✓ Cleaning works ✓ Monitoring works

Source: JICA Survey Team

Table 11.4.5 Anticipated Project Activities for Construction of Public Toilet Facilities

Component	Project Activities
4. Public Toilet Facili-ties	
4.1 Construction Stage	✓ Possession of sites ✓ Transplantation or clearing trees in the sites ✓ Site preparation / Leveling works ✓ Temporary works ✓ Excavation works ✓ Placing of concrete ✓ Transportation of construction vehicles ✓ Operation of heavy machines ✓ Installation of pipes ✓ Backfilling ✓ Construction of buildings
3.2 Operation and Maintenance Stage	✓ Inspection ✓ Effluent discharge

Source: JICA Survey Team

11.4.4 Identification of Anticipated Environmental Impacts

(1) Scoping

Considering the baseline survey on site conditions and facility planning/ designing condition, a scoping was conducted in accordance with the JICA's Guidelines for Environmental and Social Considerations (April 2010). Concretely, the scoping was carried out evaluating the project in use of the following ratings.

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)

D: No impact is expected.

The project falls in three components including 1) 11 STPs, 2) 4 IPSs, 3) Sewage Collection System and 4) Public Toilet Facilities. The scoping result for the proposed project is shown in from Table 11.4.6 to Table 11.4.9.

Table 11.4.6 Scoping Results for Development of STPs

Type	No.	Environmental Elements to be Assessed	Evaluation for		Reason for Evaluation
			Construction stage	Operation stage	
Natural Environment	1	Protected Area	D	D	The project sites and surrounding areas are not located in any national parks or natural reserves.
	2	Ecosystem	B-	D	Some negative impacts on the vegetation in the STP sites.
	3	Hydrology	D	D	Mula, Mutha and Mula-Mutha rivers are final water body which receives the treated effluent of the proposed STPs. However, currently untreated sewage is directly discharged to Nalla and above rivers finally. There will be no change of the flow regime of the rivers after the proposed STPs are developed.
	4	Geology	B-	D	Some negative impacts on geology such as ground collapse are expected due to the excavation works of the STPs at construction stage.
Social Environment	5	Resettlement	B-	D	There is no involuntary resettlement. The proposed STPs will be developed at existing STP sites basically. However, some lands for STP sites should be acquired by PMC. Currently, not all sites have been acquired by PMC and their LA (Land Acquisition) process is still in progress.
	6	Poverty	D	D	The project is not related to the issue of poverty. Tariff collection can be one of the elements which possibly affect the poor. However, the situation on tariff collection will be same as the current state.
	7	Ethic Minority	D	D	The project is not related to the issue of ethnic minority and indigenous people.
	8	Employment, sustenance and regional economy	B+	D	Positive impact is estimated by the promote employment of local residents as workers.
	9	Land Use	D	D	The project sites have already been decided as STP sites as per the land use plan of the DP (Development Plan) As for Khradi site, the site is currently a vacant land and PMC is preparing its LA process for the use as a STP.
	10	Water Use / Water Right	D	D	The project is not related to the issue of water use / water right
	11	Existing Social Infrastructure	B-	D	The vehicles for construction works may cause some impact on traffic congestion at the STP sites near the roads with heavy traffic.
	12	Society / Capital Market	D	D	No project components impact on society / capital Market.
	13	Unbalance of Benefit	D	D	The project is a public project to bring social benefit to the citizens not for partial individuals.
	14	Interests in the Region	D	D	The project is developed for public interests in the region and will bring benefit to the citizens.
	15	Heritage	D	D	Important heritage sites are not identified in the project sites and its surrounding areas.
	16	Landscape	D	D	The project sites are planned to be developed at existing STP sites or relevant facilities.

Type	No.	Environmental Elements to be Assessed	Evaluation for		Reason for Evaluation
			Construction stage	Operation stage	
					And also, there are no places with high valuable landscapes near other STP sites which are not located at existing STP sites.
	17	Gender	D	D	Project component will not affect gender issue.
	18	Right of Children	D	D	Project component will not affect right of children.
	19	HIV / AIDS	B-	D	Construction works may increase the number of workers in and outside the city and may cause infection disease including HIV / AIDS.
	20	Occupational Health and Safety	B-	B-	During Construction: The construction works may cause some negative impact on labor environment of the workers. At Operation: The operation works may cause some negative impact on the operation staffs due to the explosive / hazardous gas.
Pollution	21	Air Pollution	B-	D	Some negative impact on air is estimated due to the generation of dust by the construction equipment and trucks.
	22	Water Pollution	B-	B+/B-	During Construction: Some turbid water may be generated due to excavation works. At Operation: The sewerage system is expected to contribute to improve water quality for rivers, canals and groundwater. However, a malfunction of STPs operation may cause some negative impact on the downstream water body
	23	Waste	B-	B-	During Construction: Generation of construction debris is expected. Littering of waste is expected at construction sites. At Operation: Treated sludge will be utilized at farmer lands and it may cause negative impact on environment.
	24	Soil Contamination	D	B-	Leakage or spill of sewage may cause soil contamination. Treated sludge will be utilized at farmer lands and it may cause negative impact on soil contamination.
	25	Noise / Vibration	B-	B-	During Construction: Increase number of vehicle and construction vehicle may cause noise and vibration. At Operation: Pump equipment or blower in STPs may cause some noise.
	26	Subsidence	D	D	The project will not extract groundwater.
	27	Odor	D	B-	At Operation: No complaint for odor was identified at existing STP sites. However, the treatment process for sewage and sludge may cause odor.
	28	Sediments	D	D	No project components cause deterioration on sediments.
Others	29	Accident	B-	B-	During Construction: Construction works may cause some accidents. At Operation: Some accidents may occur due to the generation of explosive and hazardous gas at operation and maintenance works.
	30	Climate Change	D	D	The project is a not large scaled one which may cause transboundary or global issues.

Notes:

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.

Source: JICA Survey Team

Table 11.4.7 Scoping Results for Development of IPSs

Type	No.	Environmental Elements to be Assessed	Evaluation for		Reason for Evaluation
			Construction stage	Operation stage	
Natural Environment	1	Protected Area	D	D	The project sites and surrounding areas are not located in any national parks or natural reserves.
	2	Ecosystem	B-	D	Some negative impacts on the vegetation in the IPS sites.
	3	Hydrology	D	D	The IPSs only convey the sewage to STPs and may cause no change for hydrology.
	4	Geology	B-	D	Some negative impacts are expected due to the excavation works of the IPSs at construction stage.
Social Environment	5	Resettlement	D	D	The IPS will be developed at existing IPS sites and there is no involuntary resettlement and LA.
	6	Poverty	D	D	The project is not related to the issue of poverty. Tariff collection can be one of the elements which possibly affect the poor. However, the situation on tariff collection will be same as the current state.
	7	Ethic Minority	D	D	The project is not related to the issue of ethnic minority and indigenous people.
	8	Employment, sustenance and regional economy	B+	D	Positive impact is estimated by the promote employment of local residents as workers.
	9	Land Use	D	D	The projects are planned at existing IPS sites and may not change land use.
	10	Water Use / Water Right	D	D	The development of IPSs is not related with water use.
	11	Existing Social Infrastructure	B-	D	The vehicles for construction works may cause some impact on traffic congestion at the STP sites near the roads with heavy traffic.
	12	Society / Capital Market	D	D	The project may not cause impact on society / capital Market.
	13	Unbalance of Benefit	D	D	The project is a public project to bring social benefit to the citizens not for partial individuals.
	14	Interests in the Region	D	D	The project is developed for public interests in the region and will bring benefit to the citizens.
	15	Heritage	D	D	Important heritage sites are not identified in the project sites and its surrounding areas.
	16	Landscape	D	D	The project sites are developed at existing pumping stations and may cause no change of landscape.
	17	Gender	D	D	Project component will not affect gender issue.
	18	Right of Children	D	D	Project component will not affect right of children.
	19	HIV / AIDS	B-	D	Construction works may increase the number of workers in and outside the city and may cause infection disease including HIV / AIDS.
	20	Occupational Health and Safety	B-	B-	During Construction: The construction works may cause some

Type	No.	Environmental Elements to be Assessed	Evaluation for		Reason for Evaluation
			Construction stage	Operation stage	
					negative impact on labor environment of the workers. At Operation: The operation works may cause some negative impact on the operation staffs due to the explosive / hazardous gas.
Pollution	21	Air Pollution	B-	D	Some negative impact on air is estimated due to the generation of dust by the construction equipment and trucks.
	22	Water Pollution	B-	D	Some turbid water may be generated due to excavation works.
	23	Waste	B-	D	Generation of construction debris is expected. Littering of waste is expected at construction sites.
	24	Soil Contamination	D	B-	Leakage or spill of sewage may cause soil contamination.
	25	Noise / Vibration	B-	B-	During Construction: Increase number of vehicle and construction vehicle may cause noise and vibration. At Operation: Pump equipment in SIPSs may cause some noise.
	26	Subsidence	D	D	The project will not extract groundwater.
	27	Odor	D	D	The sewage which can be a main source for odor will be sealed in pipes and pumping houses.
	28	Sediments	D	D	No project components cause deterioration on sediments.
Others	29	Accident	B-	D	During Construction: Construction works may cause some accidents.
	30	Climate Change	D	D	The project is a not large scaled projects which may cause trans-boundary and global issues.

Notes:

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.

Source: JICA Survey Team

Table 11.4.8 Scoping Results for Development of Collection System and Main/Sub Mains

Type	No.	Environmental Elements to be Assessed	Evaluation for		Reason for Evaluation
			Construction stage	Operation stage	
Natural Environment	1	Protected Area	D	D	The project sites and surrounding areas are not located in any national parks or natural reserves.
	2	Ecosystem	D	D	The existing Nallas where untreated sewage is flowing are already contaminated for the habitat of aquatic organism.
	3	Hydrology	D	D	The development of Collection System and Main / sub mains may not cause the hydrological change.
	4	Geology	B-	D	Some negative impacts are expected due to the excavation works of the Collection System and Main / sub mains at construction stage.
Social Environment	5	Resettlement	B-	D	Several main / sub mains cross a existing railway line, shopping mall, public market and parts of slum areas. Fo the details on crossing of these properties, see Chapter 11.6.3.

Type	No.	Environmental Elements to be Assessed	Evaluation for		Reason for Evaluation
			Construction stage	Operation stage	
	6	Poverty	D	D	The project is not related to the issue of poverty. Tariff collection can be one of the elements which possibly affect the poor. However, the situation on tariff collection will be same as the current state.
	7	Ethic Minority	D	D	The project is not related to the issue of ethnic minority and indigenous people.
	8	Employment, sustenance and regional economy	B+	D	Positive impact is estimated by the promote employment of local residents as workers.
	9	Land Use	D	D	The projects are planned at existing Nallas and road areas and may not change the existing land use.
	10	Water Use / Water Right	D	D	The development of Collection System and Main / sub mains is not related with water use.
	11	Existing Social Infrastructure	B-	D	The construction of Collection System and Main / sub mains may affect the existing transport operation of roads and railway.
	12	Society / Capital Market	D	D	The project may not cause the impact on society / capital market.
	13	Unbalance of Benefit	D	D	The project is a public project to bring social benefit to the citizens not for partial individuals.
	14	Interests in the Region	D	D	The project is developed for public interests in the region and will bring benefit to the citizens.
	15	Heritage	D	D	Important heritage sites are not identified in the project sites and its surrounding areas.
	16	Landscape	D	D	The project sites are developed at existing nallas and road areas and may cause no change of landscape.
	17	Gender	D	D	Project component will not affect gender issue.
	18	Right of Children	D	D	Project component will not affect right of children.
	19	HIV / AIDS	B-	D	Construction works may increase the number of workers in and outside the city and may cause infection disease including HIV / AIDS.
	20	Occupational Health and Safety	B-	B-	During Construction: The construction works may cause some negative impact on labor environment of the workers. At Operation: The operation works may cause some negative impact on the operation staffs due to the explosive / hazardous gas and Anoxia.
Pollution	21	Air Pollution	B-	D	Some negative impact on air is estimated due to the generation of dust by the construction equipment and trucks.
	22	Water Pollution	B-	B-	During Construction: Some turbid water may be generated due to excavation works. At Operation: Some turbid water may be generated due to the leakage or spill-out of sewage from the Collection System and Main / sub mains
	23	Waste	B-	D	Generation of construction debris or excavated soil is expected. Littering of waste is expected at construction sites.
	24	Soil Contamination	D	B-	Leakage or spill of sewage may cause soil contamination.
	25	Noise / Vibration	B-	D	Increase number of construction vehicle and operation of heavy machines may cause noise and vibration.

Type	No.	Environmental Elements to be Assessed	Evaluation for		Reason for Evaluation
			Construction stage	Operation stage	
	26	Subsidence	D	D	The project will not extract groundwater.
	27	Odor	D	D	The sewage which can be a main source for odor will be sealed in pipes.
	28	Sediments	D	D	No project components cause deterioration on sediments.
Others	29	Accident	B-	B-	During Construction: Construction works may cause some accidents. At Operation: Some accidents may occur due to the generation of explosive and hazardous gas at operation and maintenance works.
	30	Climate Change	D	D	The project is a not large scaled projects which may cause trans-boundary and global issues.

Notes:

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.

Source: JICA Survey Team

Table 11.4.9 Scoping Results for Development of Public Toilet Facilities

Type	No.	Environmental Elements to be Assessed	Evaluation for		Reason for Evaluation
			Construction stage	Operation stage	
Natural Environment	1	Protected Area	D	D	The project sites and surrounding areas are not located in any national parks or natural reserves.
	2	Ecosystem	D	D	The existing Nallas where untreated sewage is flowing are already contaminated for the habitat of aquatic organism.
	3	Hydrology	D	D	The development of Collection System and Main / sub mains may not cause the hydrological change.
	4	Geology	D	D	The facility will be constructed at flat area of the city.
Social Environment	5	Resettlement	B-	D	The proposed sites should be identified and secured by PMC.
	6	Poverty	D	D	The project is not related to the issue of poverty. Tariff collection can be one of the elements which possibly affect the poor. However, the situation on tariff collection will be same as the current state.
	7	Ethic Minority	D	D	The project is not related to the issue of ethnic minority and indigenous people.
	8	Employment, sustenance and regional economy	B+	D	Positive impact is estimated by the promote employment of local residents as workers.
	9	Land Use	D	D	The projects are planned at existing Nallas and road areas and may not change the existing land use.
	10	Water Use / Water Right	D	D	The development of Collection System and Main / sub mains is not related with water use.
	11	Existing Social Infrastructure	B-	D	The construction of the facilities may affect the existing public facilities such as roads and water supply.
	12	Society / Capital Market	D	D	The project may not cause the impact on society / capital market.
	13	Unbalance of Benefit	D	D	The project is a public project to bring social benefit to the citizens not for partial individuals.
	14	Interests in the	D	D	The project is developed for public interests

Type	No.	Environmental Elements to be Assessed	Evaluation for		Reason for Evaluation
			Construction stage	Operation stage	
		Region			in the region and will bring benefit to the citizens.
	15	Heritage	D	D	Important heritage sites are not identified in the project sites and its surrounding areas.
	16	Landscape	D	D	The project sites are developed at existing nallas and road areas and may cause no change of landscape.
	17	Gender	D	D	Project component will not affect gender issue.
	18	Right of Children	D	D	Project component will not affect right of children.
	19	HIV / AIDS	B-	D	Construction works may increase the number of workers in and outside the city and may cause infection disease including HIV / AIDS.
	20	Occupational Health and Safety	B-	D	During Construction: The construction works may cause some negative impact on labor environment of the workers.
Pollution	21	Air Pollution	D	D	The construction work is not large.
	22	Water Pollution	D	B-	At Operation: Some turbid water may be generated due to the leakage or spill-out of sewage from the facilities.
	23	Waste	D	D	The construction work is not large.
	24	Soil Contamination	D	B-	Leakage or spill of sewage may cause soil contamination.
	25	Noise / Vibration	B-	D	Increase number of construction vehicle and operation of heavy machines may cause noise and vibration.
	26	Subsidence	D	D	The project will not extract groundwater.
	27	Odor	D	D	The sewage which can be a main source for odor will be sealed in pipes.
	28	Sediments	D	D	No project components cause deterioration on sediments.
Others	29	Accident	B-	D	During Construction: Construction works may cause some accidents.
	30	Climate Change	D	D	The project is a not large scaled projects which may cause trans-boundary and global issues.

Notes:

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.

Source: JICA Survey Team

(2) Anticipated Environmental Impacts

From the results of the scoping which is prescribed before, the anticipated environmental results are shown below.

1) Construction of STPs

a) Ecosystem

The project activities may cause a negative impact on ecosystem at the construction stage. Planted trees were identified at most of the project sites of the proposed STPs. According to the

state's regulation, tree cutting inside STP sites will require permissions by PMC or they will require transplantation to other places. Prior process will be necessary with regard to the trees inside the sites.

b) Geology

The project activities may cause a negative impact on geology on the excavation works of the STPs. The excavation works may cause the land collapse at the construction stage of the STPs.

c) Resettlement

There is no involuntary resettlement in case that the proposed STPs will be developed at existing STP sites where no residential houses were identified. However, some lands for the proposed STP sites should be acquired by PMC. Currently, not all sites have been acquired by PMC and their LA (Land Acquisition) process is still in progress. As for the details of the LA in terms of their areas, ownership, current status and expected date, refer to Chapter 11.6.3

d) Employment, sustenance and regional economy

The project activities may cause a positive impact on local economy at the construction stage of the STPs. The construction works may have an opportunity to employ construction workers in regional and local level.

e) Existing Social Infrastructure

The project activities may cause a negative impact on the traffic at the construction stage especially at the nearby roads with heavy traffics such as at Bhairoba site. In addition, in the construction of the inflow pipes connecting to main sewers at STPs, the construction works may cause some impact on underground utilities.

f) HIV/ AIDS

Construction works in and outside the city may bring the number of workers and cause the expansion of infectious diseases such as HIV/AIDS.

g) Occupational Health and Safety

<u>At Construction Phase</u>

The construction works may cause some negative impact on labor environment of the workers.

<u>At Operation Phase:</u>

The operation and maintenance works may cause some negative impact on the operation and

maintenance staffs due to the explosive gas, hazardous gas such as chlorine gas at its injection for disinfection process at the proposed STPs.

h) Air Pollution

Some negative impact on air is estimated due to the generation of dust by the operation of construction equipment and trucks.

i) Water Pollution

At Construction Phase

Some negative impact is expected because of the turbid water to be generated by the excavation works at the STP sites.

At Operation Phase:

The sewerage system is expected to contribute to improve water quality for rivers, Nallas and groundwater. However, the sewage inflow of its concentration exceeding target standards into STP and the effluent water which does not comply with the effluent standard may cause a negative impact on the downstream water environment.

j) Waste

At Construction Phase

Some negative impact is expected due to the generation of excavated soil and construction debris concerning to excavation works and construction works, respectively, during construction phase. Littering of general waste at construction camps is also another factor for causing the negative impact.

At Operation Phase:

Currently, the treated sludge from existing STPs is disposed of at farmlands as the use of manure. The future same utilization at farmlands may cause some negative impact on the environment. Appropriate manners of treatment are required.

k) Soil Contamination

The leakage of untreated sewage or sludge to be caused by the malfunction of the proposed STPs may cause some negative impact of soil contamination due to the seepage of the untreated sewage. Treated sludge will be utilized at farmer lands and it may cause negative impact on soil contamination.

l) Noise/ Vibration

At Construction Phase

Some negative impact by the generation of noise is expected by the construction vehicles and the construction machineries at the construction site of the trunk sewers and the STP site.

At Operation Phase:

No complaints on noise from the surrounding residents of existing STPs have been identified currently. However, the proposed STPs may have potential noise sources such as main pumps, vacuum pumps, compressors, blowers, backup generators and ventilation equipment, and the relay pump station also has pump equipment as its noise source, which may generate some noise problem.

m) Odor

No complaints have been identified on offensive odor from the surrounding residents of existing STPs. However, negative impact on the generation of offensive odor is expected at the sewage inflow point and the sludge treatment facility of the proposed STPs.

n) Accident

At Construction Phase

The construction works of the STPs may cause some negative impact due to occurrence of accidents on the construction workers and the surrounding environment.

At Operation Phase:

Some accidents may occur on the operation and maintenance staffs due to the generation of explosive gas (e.g. methane gas) or hazardous gas (e.g. Chlorine: Cl_2) at the STPs.

2) Development of IPSs (Intermediate Pumping Stations)

a) Ecosystem

As the development of STPs, the project activities of IPSs may cause a negative impact on ecosystem at the construction stage. Planted trees were identified in most of the project sites of the proposed IPSs.

b) Geology

The project activities may cause a negative impact on geology on the excavation works of the STPs. The excavation works may cause the land collapse at the construction stage of the STPs.

c) Employment, sustenance and regional economy

The project activities may cause a positive impact on local economy at the construction stage of the IPSs. The construction works may have an opportunity to employ construction workers in regional and local level.

d) Existing Social Infrastructure

The project activities may cause a negative impact on the traffic at the construction stage especially at the nearby roads with heavy traffics.

e) HIV / AIDS

Construction works in and outside the city may bring the number of workers and cause the expansion of infectious diseases such as HIV/AIDS.

f) Occupational Health and Safety

<u>At Construction Phase</u>

The construction works may cause some negative impact on labor environment of the workers.

<u>At Operation Phase:</u>

The operation and maintenance works may cause some negative impact on the operation and maintenance staffs due to the hazardous gas such as hydrogen sulfide (H_2S) at its operation and maintenance works.

g) Air Pollution

Some negative impact on air is estimated due to the generation of dust by the operation of construction equipment and trucks.

h) Water Pollution

Some negative impact is expected because of the turbid water to be generated by the excavation works at the IPS sites.

i) Waste

Some negative impact is expected due to the generation of excavated soil and construction debris concerning to excavation works and construction works, respectively, during construction phase. Littering of general waste at construction camps is also another factor for causing the negative impact.

j) Soil Contamination

The leakage of untreated sewage or sludge to be caused by the malfunction of the proposed IPSs may cause some negative impact of soil contamination.

k) Noise / Vibration

At Construction Phase

Some negative impact by the generation of noise is expected by the construction vehicles and the construction machineries at the construction site of the trunk sewers and the STP site.

At Operation Phase:

Traffic noise was identified as a dominant level compared to the noise generating from the existing IPSs. However, the proposed IPSs may have potential noise sources of pump equipment, which may generate some noise problem.

l) Accident

At Construction Phase

The construction works of the IPSs may cause some negative impact due to occurrence of accidents on the construction workers and the surrounding environment.

3) Development of Collection System and Main / sub mains

a) Geology

Some negative impact is expected due to the ground collapse of the embankment of Nallas at construction of sewers.

b) Resettlement

Several main / sub mains cross an existing railway line, shopping mall, public market and slum areas (main / sub mains of No. 07, 12, 18 and 21, refer to Chapter 11.6 for the details). These crossings may cause negative impact on these properties at construction phase.

c) Employment, sustenance and regional economy

The project activities may cause a positive impact on local economy at the construction stage of the sewers. The construction works may have an opportunity to employ construction workers in regional and local level.

d) Existing Social Infrastructure

The construction of the sewers which crosses the existing railway or those at existing road areas may affect the operation of the railway, underground utilities and traffic.

e) HIV / AIDS

Construction works in and outside the city may bring the number of workers and cause the expansion of infectious diseases such as HIV/AIDS.

f) Occupational Health and Safety

At Construction Phase

The construction works may cause some negative impact on labor environment of the workers.

At Operation Phase:

The operation and maintenance works may cause some negative impact on the operation and maintenance staffs due to the hazardous gas such as hydrogen sulfide (H_2S) or anoxia at its operation and maintenance works.

g) Air Pollution

Some negative impact on air is estimated due to the generation of dust by the operation of construction equipment and trucks.

h) Water Pollution

At Construction Phase

Some negative impact on water pollution is expected because of the turbid water to be generated by the excavation works at the IPS sites.

At Operation Phase:

Some negative impact on water pollution is expected because of the leakage or spill-out of the sewage from the sewers.

i) Waste

During construction stage, excavated soil and construction debris will be generated. In addition, littering on general waste will be generated at construction camps.

j) Soil Contamination

At operation and maintenance stage, leakage from the collection system and sewers may cause

potential of soil contamination.

k) Noise / Vibration

At construction stage, travelling of construction vehicles and operation of heavy machines may cause noise.

l) Accident

At construction stage, accidents will occur due to the construction works such as excavation works or sewers laying works at road areas.

At operation and maintenance stage, some negative impact is estimated due to the potential generation of hazardous or explosive gases such as H_2S and methane gases.

4) Development of Public Toilet Facilities

a) Resettlement

PMC has to identify and secure the lands for the forty (40) sites of the public toilet facilities.

b) Existing Social Infrastructure

The construction of the public toilets may affect the properties of existing public facilities such as roads and water supply.

c) HIV / AIDS

Construction works in and outside the city may bring the number of workers and cause the expansion of infectious diseases such as HIV/AIDS.

d) Occupational Health and Safety

The construction works may cause some negative impact on labor environment of the workers.

e) Water Pollution

Some negative impact on water pollution is expected because of the leakage or spill-out of the sewage from the facilities.

f) Soil Contamination

At operation and maintenance stage, leakage from the facilities may cause potential of soil contamination.

g) Noise / Vibration

At construction stage, travelling of construction vehicles and operation of heavy machines may cause noise.

h) Accidents

At construction stage, accidents will occur due to the construction works.

The summary of possible impacts from the scoping results for the construction of STPs, IPSs and sewers is shown in from Table 11.4.10 to Table 11.4.13.

Table 11.4.10 Summary of Possible Impact and Evaluation (STPs)

Type	No.	Environmental Elements	Evaluation				Reason for Evaluation
			Scoping		Assessment		
			Const.	Oper.	Const.	Oper.	
Natural Environment	1	Protected Area	D	D	N/A	N/A	
	2	Ecosystem	B-	D	B-	N/A	Some negative impacts on the vegetation in the STP sites.
	3	Hydrology	D	D	N/A	N/A	
	4	Geology	B-	D	B-	N/A	Some negative impacts on geology such as ground collapse are expected due to the excavation works of the STPs at construction stage.
Social Environment	5	Resettlement	B-	D	B-	N/A	There is no involuntary resettlement. The proposed STPs will be developed at existing STP sites basically. However, some lands for STP sites should be acquired by PMC. Currently, not all sites have been acquired by PMC and their LA (Land Acquisition) process is still in progress.
	6	Poverty	D	D	N/A	N/A	
	7	Ethic Minority	D	D	N/A	N/A	
	8	Employment, sustenance and regional economy	B+	D	N/A	N/A	
	9	Land Use	D	D	N/A	N/A	
	10	Water Use / Water Right	D	D	N/A	N/A	
	11	Existing Social Infrastructure	B-	D	B-	N/A	The vehicles for construction works may cause some impact on traffic congestion at the STP sites near the roads with heavy traffic.
	12	Society / Capital Market	D	D	N/A	N/A	
	13	Unbalance of Benefit	D	D	N/A	N/A	
	14	Interests in the Region	D	D	N/A	N/A	
	15	Heritage	D	D	N/A	N/A	

Type	No.	Environmental Elements	Evaluation				Reason for Evaluation
			Scoping		Assessment		
			Const.	Oper.	Const.	Oper.	
	16	Landscape	D	D	N/A	N/A	
	17	Gender	D	D	N/A	N/A	
	18	Right of Children	D	D	N/A	N/A	
	19	HIV / AIDS	B-	D	B-	N/A	Construction works may increase the number of workers in and outside the city and may cause infection disease including HIV / AIDS.
	20	Occupational Health and Safety	B-	B-	B-	B-	During Construction: The construction works may cause some negative impact on labor environment of the workers. At Operation: The operation works may cause some negative impact on the operation staffs due to the explosive / hazardous gas.
Pollution	21	Air Pollution	B-	D	B-	N/A	Some negative impact on air is estimated due to the generation of dust by the construction equipment and trucks.
	22	Water Pollution	B-	B+/B-	B-	B-	During Construction: Some turbid water may be generated due to excavation works. At Operation: The sewerage system is expected to contribute to improve water quality for rivers, canals and groundwater. However, some impact on water pollution is expected due to a malfunction of the STPs.
	23	Waste	B-	B-	B-	B-	During Construction: Generation of construction debris is expected. Littering of waste is expected at construction sites. At Operation: Treated sludge may have some risk on health.
	24	Soil Contamination	D	B-	N/A	B-	Leakage or spill of sewage may cause soil contamination.
	25	Noise / Vibration	B-	B-	B-	B-	During Construction: Increase number of vehicle and construction vehicle may cause noise and vibration. At Operation: Pump equipment or blower in STPs may cause some noise.
	26	Subsidence	D	D	N/A	N/A	
	27	Odor	D	B-	N/A	B-	The treatment process for sewage and sludge may cause odor.
	28	Sediments	D	D	N/A	N/A	
Others	29	Accident	B-	B-	B-	B-	During Construction: Construction works may cause some accidents. At Operation: Some accidents may occur due to the generation of explosive and hazardous gas at operation and maintenance works.
	30	Climate Change	D	D	N/A	N/A	

Notes:

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)

D: No impact is expected.

Source: JICA Survey Team

Table 11.4.11 Summary of Possible Impact and Evaluation (IPSs)

Type	No.	Environmental Elements	Evaluation				Reason for Evaluation
			Scoping		Assessment		
			Const.	Oper.	Const.	Oper.	
Natural Environment	1	Protected Area	D	D	N/A	N/A	
	2	Ecosystem	B-	D	B-	N/A	Some negative impacts on the vegetation in the IPS sites.
	3	Hydrology	D	D	N/A	N/A	
	4	Geology	B-	D	B-	N/A	Some negative impacts are expected due to the excavation works of the IPSs at construction stage.
Social Environment	5	Resettlement	D	D	N/A	N/A	The IPS will be developed at existing IPS sites and there is no involuntary resettlement and LA.
	6	Poverty	D	D	N/A	N/A	
	7	Ethic Minority	D	D	N/A	N/A	
	8	Employment, sustenance and regional economy	B+	D	N/A	N/A	
	9	Land Use	D	D	N/A	N/A	
	10	Water Use / Water Right	D	D	N/A	N/A	
	11	Existing Social Infrastructure	B-	D	B-	N/A	The vehicles for construction works may cause some impact on traffic congestion at the IPS sites near the roads with heavy traffic.
	12	Society / Capital Market	D	D	N/A	N/A	
	13	Unbalance of Benefit	D	D	N/A	N/A	
	14	Interests in the Region	D	D	N/A	N/A	
	15	Heritage	D	D	N/A	N/A	
	16	Landscape	D	D	N/A	N/A	
	17	Gender	D	D	N/A	N/A	
	18	Right of Children	D	D	N/A	N/A	
	19	HIV / AIDS	B-	D	B-	N/A	Construction works may increase the number of workers in and outside the city and may cause infection disease including HIV / AIDS.
	20	Occupational Health and Safety	B-	B-	B-	B-	<u>During Construction</u>: The construction works may cause some negative impact on labor environment of the workers. <u>At Operation</u>: The operation works may cause some negative impact on the operation staffs due to the explosive / hazardous gas.
Pollution	21	Air Pollution	B-	D	B-	N/A	Some negative impact on air is estimated due to the generation of dust by the construction equipment and trucks.
	22	Water Pollution	B-	D	B-	N/A	Some turbid water may be generated due to excavation works.
	23	Waste	B-	D	B-	N/A	Generation of construction debris is expected. Littering of waste is expected at construction sites.
	24	Soil Contamination	D	B-	N/A	B-	Leakage or spill of sewage may cause soil contamination.
	25	Noise / Vibration	B-	B-	B-	B-	<u>During Construction</u>: Increase number of vehicle and construction vehicle may cause noise and vibration. <u>At Operation</u>: Pump equipment in SIPSs may cause some noise.
	26	Subsidence	D	D	N/A	N/A	
	27	Odor	D	D	N/A	N/A	
	28	Sediments	D	D	N/A	N/A	
Others	29	Accident	B-	D	B-	N/A	<u>During Construction</u>: Construction works may cause some accidents.
	30	Climate Change	D	D	N/A	N/A	

Notes:

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.
Source: JICA Survey Team

Table 11.4.12 Summary of Possible Impact and Evaluation (Collection System and Main/sub mains)

Type	No.	Environmental Elements	Evaluation				Reason for Evaluation
			Scoping		Assessment		
			Const.	Oper.	Const.	Oper.	
Natural Environment	1	Protected Area	D	D	N/A	N/A	
	2	Ecosystem	D	D	N/A	N/A	
	3	Hydrology	D	D	N/A	N/A	
	4	Geology	B-	D	B-	N/A	Some negative impacts are expected due to the excavation works of the Collection System and Main / sub mains at construction stage.
Social Environment	5	Resettlement	B-	D	N/A	N/A	Several main / sub mains cross existing properties of railway lines, shopping mall, public market and slum areas.
	6	Poverty	D	D	N/A	N/A	
	7	Ethic Minority	D	D	N/A	N/A	
	8	Employment, sustenance and regional economy	B+	D	N/A	N/A	
	9	Land Use	D	D	N/A	N/A	
	10	Water Use / Water Right	D	D	N/A	N/A	
	11	Existing Social Infrastructure	B-	D	B-	N/A	The construction of Collection System and Main / sub mains may affect the existing transport operation of roads and railway.
	12	Society / Capital Market	D	D	N/A	N/A	
	13	Unbalance of Benefit	D	D	N/A	N/A	
	14	Interests in the Region	D	D	N/A	N/A	
	15	Heritage	D	D	N/A	N/A	
	16	Landscape	D	D	N/A	N/A	
	17	Gender	D	D	N/A	N/A	
	18	Right of Children	D	D	N/A	N/A	
	19	HIV / AIDS	B-	D	B-	N/A	Construction works may increase the number of workers in and outside the city and may cause infection disease including HIV / AIDS.
	20	Occupational Health and Safety	B-	B-	B-	B-	<u>During Construction</u>: The construction works may cause some negative impact on labor environment of the workers. <u>At Operation</u>: The operation works may cause some negative impact on the operation staffs due to the explosive / hazardous gas and Anoxia.
Pollution	21	Air Pollution	B-	D	B-	N/A	Some negative impact on air is estimated due to the generation of dust by the construction equipment and trucks.
	22	Water Pollution	B-	B-	B-	B-	<u>During Construction</u>: Some turbid water may be generated due to excavation works. <u>At Operation</u>: Some turbid water may be generated due to the leakage or spill-out of sewage from the Collection System and Main / Sub Mains
	23	Waste	B-	D	B-	N/A	Generation of construction debris or excavated soil is expected. Littering of waste is expected at construction sites.
	24	Soil Contamination	D	B-	N/A	B-	Leakage or spill of sewage may cause soil contamination.

Type	No.	Environmental Elements	Evaluation				Reason for Evaluation
			Scoping		Assessment		
			Const.	Oper.	Const.	Oper.	
	25	Noise / Vibration	B-	D	B-	N/A	Increase number of construction vehicle and operation of heavy machines may cause noise and vibration.
	26	Subsidence	D	D	N/A	N/A	
	27	Odor	D	D	N/A	N/A	
	28	Sediments	D	D	N/A	N/A	
Others	29	Accident	B-	B-	B-	B-	During Construction: Construction works may cause some accidents. At Operation: Some accidents may occur due to the generation of explosive and hazardous gas at operation and maintenance works.
	30	Climate Change	D	D	N/A	N/A	

Notes:

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)

D: No impact is expected.

Source: JICA Survey Team

Table 11.4.13 Summary of Possible Impact and Evaluation (Public Toilet Facilities)

Type	No.	Environmental Elements	Evaluation				Reason for Evaluation
			Scoping		Assessment		
			Const.	Oper.	Const.	Oper.	
Natural Environment	1	Protected Area	D	D	N/A	N/A	
	2	Ecosystem	D	D	N/A	N/A	
	3	Hydrology	D	D	N/A	N/A	
	4	Geology	D	D	N/A	N/A	Some negative impacts are expected due to the excavation works of the Collection System and Main / sub mains at construction stage.
Social Environment	5	Resettlement	B-	D	B-	N/A	The proposed sites should be identified and secured by PMC.
	6	Poverty	D	D	N/A	N/A	
	7	Ethic Minority	D	D	N/A	N/A	
	8	Employment, sustenance and regional economy	B+	D	N/A	N/A	
	9	Land Use	D	D	N/A	N/A	
	10	Water Use / Water Right	D	D	N/A	N/A	
	11	Existing Social Infrastructure	B-	D	B-	N/A	The construction of the facilities may affect the existing public facilities such as roads and water supply.
	12	Society / Capital Market	D	D	N/A	N/A	
	13	Unbalance of Benefit	D	D	N/A	N/A	
	14	Interests in the Region	D	D	N/A	N/A	
	15	Heritage	D	D	N/A	N/A	
	16	Landscape	D	D	N/A	N/A	
	17	Gender	D	D	N/A	N/A	
	18	Right of Children	D	D	N/A	N/A	
	19	HIV / AIDS	B-	D	B-	N/A	Construction works may increase the number of workers in and outside the city and may cause infection disease including HIV / AIDS.
	20	Occupational Health and Safety	B-	D	B-	N/A	The construction works may cause some negative impact on labor environment of the workers.

Type	No.	Environmental Elements	Evaluation				Reason for Evaluation
			Scoping		Assessment		
			Const.	Oper.	Const.	Oper.	
Pollution	21	Air Pollution	D	D	N/A	N/A	
	22	Water Pollution	D	B-	N/A	B-	Some turbid water may be generated due to the leakage or spill-out of sewage from the facilities.
	23	Waste	B-	D	B-	N/A	Generation of construction debris or excavated soil is expected. Littering of waste is expected at construction sites.
	24	Soil Contamination	D	B-	N/A	B-	Leakage or spill of sewage may cause soil contamination.
	25	Noise / Vibration	B-	D	B-	N/A	Increase number of construction vehicle and operation of heavy machines may cause noise and vibration.
	26	Subsidence	D	D	N/A	N/A	
	27	Odor	D	D	N/A	N/A	
	28	Sediments	D	D	N/A	N/A	
Others	29	Accident	B-	D	B-	B-	Construction works may cause some accidents.
	30	Climate Change	D	D	N/A	N/A	

Notes:
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.
Source: JICA Survey Team

11.5 Environmental Management Plan

11.5.1 Mitigation measures against Possible negative Impacts

The proposed project will take the mitigation measures as below against these negative impacts.

(1) Natural Environment

1) Ecosystem (For STPs and IPSs)

At Construction Phase:

The trees inside the project sites of STPs and IPSs will be examined by PMC (Garden Department) in terms of their cutting or replantation depending on the importance or rarity of their species based on PMC's regulation. After the examination, PMC will take actions of their cutting or replantation.

2) Geology (For STPs, IPSs, Collection System and Main / Sub Mains)

At Construction Phase:

Ground collapse is expected due to the excavation works. The proposed project will take the following measures to reduce this impact.

- Preliminary soil investigation survey is conducted prior to the excavation works
- Excavation / construction plan including earth retaining work and false work is prepared for soft ground
- Pipe jacking method which has more advantage of generation of less deformation

compared to the open-cut method will be applied for the sites at the crossing points with the existing railways

- To prevent a scouring by pumping the water during generated at excavation works

(2) Social Environment

1) Resettlement (For STPs and Sewage Collection System)

At Construction Phase:

PMC will take LA process appropriately based on Indian regulations for the sites which have not been acquired by PMC yet. As for the main / sub main sewers, which cross existing properties of railway lines, shopping mall, public market and slum areas, a construction method using pipe jacking or construction diversion routes of such main / sub main sewers will be studied at the detail design stage.

2) Existing Social Infrastructure (For STPs, IPSs, Sewage Collection System)

At Construction Phase

The proposed project will take the following measures for the impact on the traffic and the underground utilities;

- Prior notice to traffic police before the construction works
- Application of pipe jacking at the crossing points with the existing railway areas
- Placement of traffic guides at each end of construction sections for smooth inducement of traffic
- Careful examination of construction schedule (avoiding morning or evening rush hours, execution of works at weekend, or avoiding execution of works before Ramadan holidays, etc.).
- Setting detouring route if necessary.
- Sufficient information disclosure such as construction period or work section to media such as television, radio, newspapers, etc. as well as utilization of internet media
- Socialization activity to local residents including distribution of leaflet or announcement letters, or holding meetings if required.
- Preparation of appropriate allocation or dispatching plans of cars
- Implementation of underground utility survey for existing water pipes, power lines, telephone lines and gas pipes not to cause damage on these utilities

3) HIV/AIDS (For STPs and Sewage Collection System)

At Construction Phase

The proposed project will take a measure through carrying out hygiene education to mitigate this impact especially for the laborers coming in outside.

4) Occupational Health and Safety (For STPs, IPSs and Sewage Collection System)

At Construction Phase

The following measures will be taken for the impact on the labor environment of the workers at the construction stage;

- To allocate a safety supervisor
- To hold regular meetings for work safety and preparation of construction plan considering safety
- To verify the compliance with Indian relevant laws and regulations on occupational health and safety including prohibition of employment of children at the construction sites.

At Operation Phase

The following measures will be taken for the impact on the working environment of the operation and maintenance staffs at the operation stage;

- To allocate a safety supervisor
- To hold regular meetings for work safety and preparation of O & M plan considering safety
- To carry out safety trainings on occupational health and safety for the measures of prevention of symptoms of poisoning due to the hazardous gases of H2S and anoxia
- To verify the compliance with Indian relevant laws and regulations on occupational health and safety including prohibition of employment of children at the sites.

(3) Pollution

1) Air Pollution (For STPs, IPSs, Collection System and Main / Sub Mains)

At Construction Phase

The following measures will be taken for the impact on air at the construction stage;

- Precise construction planning for avoiding operation of a number of vehicles and construction machine simultaneously.
- Encouragement of idling reduction to the workers.
- Introduction of low emission vehicles or construction machines if applicable.
- Sprinkling water on the ground if large scale dust scattering is anticipated.
- Conducting regular monitoring of above measures for reduction of generation of dust

At Operation Phase:

The following measures will be taken for the impact on the air due to above travelling of vacuum trucks and the trucks transporting treated sludge;

- Precise car dispatching planning for avoiding operation of a number of vehicles such as vacuum trucks and trucks simultaneously.
- Encouragement of idling reduction for the travelling of vacuum trucks and trucks
- Sprinkling water on the ground at the access road
- Conducting regular monitoring of above measures for reduction of generation of dust

2) Water Pollution (For STPs, IPSs, Collection System and Main / Sub Mains)

At Construction Phase

The following measures will be taken for the impact of the turbid water at the construction stage;

- Execution of earthmoving works shall be refrained during rainy season or if heavy rain is forecasted.
- Sedimentation basin shall be equipped at the site prior to civil works for prevention of any high turbid water discharge if necessary.
- Visual inspection of the turbid conditions as a regular monitoring by executing agency and the contractor

At Operation Phase:

The operator will carry out regular monitoring for the examination of the compliance with the influent and effluent standards.

3) Waste (For STPs, IPSs and Sewage Collection System)

At Construction Phase

The following measures will be taken for the impact of the generation of surplus soil, construction wastes and the littering at construction stage;

- The excavated soil is used as backfill materials as much as possible
- The excavated soil is used as covering at the final disposal site of solid waste
- To follow the PMC's appropriate manners of discharge of solid waste for the littering

At Operation Phase:

For appropriate disposal of the treated sludge, the following measures will be taken;

- Monitoring of above agreement of relevant authorities and manifest of generation, transport and disposal of treated sludge
- Regular monitoring of treated sludge to avoid negative impact on farm lands

The treated sludge will be utilized as manure at the farmlands after dewatering at the STP pro-

cess. India doesn't have the regulations for utilization of the sludge, but regular monitoring for the treated sludge will be carried out for its actual uses. At the operation stage, regular monitoring will be carried out for chemical analysis of the treated sludge.

Chemical analysis for the treated sludge from the existing STPs was carried out by the JICA survey team and the results are shown in Table 11.5.1.

The concentration of the heavy metals of Cadmium, Arsenic, Nickel, Lead and Mercury are below the permissible level which are regulated in Japanese manual on handing heavy metal contained in sewage sludge for use as fertilizer or the EU council directive (86/278/EEC) for the regulated limit for the concentration of heavy metals of treated sludge for agricultural use.

Table 11.5.1 Concentration of Heavy Metals in Treated Sludge of Existing STPs

Unit in mg/kg

Parameter	STP				Japanese Standard[1)]	EU Council Directive[2)]
	Naidu	Bhairoba	Mundhwa	Tanajiwadi		
Cadmium	0.3	0.2	0.4	0.3	5	20 - 40
Arsenic	< 0.1	< 0.1	< 0.1	< 0.1	50	-
Nickel	< 10	< 10	< 10	< 10	300	300 - 400
Lead	4.07	3.0	8.39	3.01	100	750 - 1,200
Mercury	< 0.05	< 0.05	< 0.05	< 0.05	2	16 - 25
Chromium	5.19	< 5	7.98	< 5	500	-

Notes:

3) Manual for handling heavy metals contained in sewage sludge for use as fertilizer, Ministry of Agriculture, Forestry and Fishery (Japan), August, 2010
4) EU council directive (86/278/EEC) for the regulated limit for the concentration of heavy metals of treated sludge for agricultural use

4) Soil Contamination (For STPs, IPSs and Sewage Collection System)

At Operation Phase:

The following measures will be taken for the impact of the leakage of the sewage;

- Executing appropriate and thorough maintenance works of the facilities for prevention of damage.
- Early detection of occurrence of soil contamination and leakage of sewage through thorough cleaning and tidiness of the facility.
- Visual and odor inspection as regular monitoring
- Quick response to the local residents' information relating to occurrence of odor and strive early detection of leakage of sewage.
- Close cooperation with relevant authorities such as SPCB who conducts river and groundwater monitoring and sharing environmental information.
- Compliance with relevant guidelines or standards for the reuse of treated sludge if the

reuse of treated sludge is planned

5) Noise / Vibration (For STPs, IPSs and Sewage Collection System)

At Construction Phase

The following measures will be taken for the impacts on the noise at the construction stage;

- Utilization of low-noise type construction machineries if applicable.
- Temporary enclosure of the site during the construction works if necessary
- Instructing the contractors to examine low noise/vibration construction methods.
- Encouragement of idling reduction to the workers.
- To avoid works at night and early morning at the sites close to residential areas, schools and hospitals
- Monitoring of noise level

At Operation Phase:

The following measures will be taken for the impacts for the impact on the noise;

- Sound absorption materials will be encouraged to use for walls and roofs.
- Materials with high sound absorption and insulation effects will be progressively utilized for building construction.
- Monitoring of noise level at the facility boundaries of the STPs and IPSs
- Acceptance of complaints from the residents and quick response to take measures

6) Offensive Odor (for STPs)

At Operation Phase:

The following measures will be taken for the mitigation of the impact of the offensive odor;

- Monitoring of odor level at the facility boundaries of the STP sites
- Acceptance of complaints from the residents and quick response to take measures

The detailed measures will be decided at the detail design stage.

7) Accident (For STPs, IPSs and Sewage Collection System)

At Construction Phase

The following measures will be taken for the impacts for the impact of the potential generation of accidents at the construction stage;

- To impose contractor for the workers to wear working suits such as helmet, safety belt and safety shoes for the construction works
- Formulation of safety management plan and allotment of safety supervisor
- Periodic safety meeting.

- Frequent and periodic inspection of construction equipment and construction vehicle

At Operation Phase:

The following measures will be taken for the impacts of the potential generation of accidents at the facilities;

- Formulation of safety management plan and allotment of safety supervisor
- Periodic safety meeting.
- Frequent and periodic inspection of relevant facilities and equipment and repairing if necessary
- To keep continuous operation of the STPs and IPSs by using backup generator

(4) Others (Climate Change)

The following measures will be taken for the impact on the potential generation of GHGs;

- Effective utilization through recycling the GHGs (e.g. methane gas) generated at the digestion process for biogas generation
- Elaboration of operation management such as optimization of ventilation volume and additive amount of flocculation agent

11.5.2 Environmental Management Plan

(1) Potential Impacts and Management Plan

The potential adverse impacts and the environmental management plan for mitigation these impacts are shown in Table 11.5.2.

Table 11.5.2 Potential Adverse Impacts and Environmental Management Plan

At Construction Phase

No.	Environmental Items	Potential Source	Management to be Taken	Actors of Environmental Management
1.	Geology (Ground collapse)	• Excavation work at STPs, IPSs and Collection System and Main / Sub Mains	• Geological survey at detail design (D/D) • Stability check of retaining wall at D/D • Construction plan prepared by Contractor • Regular inspection of excavation works • Emergency response plan for the incident of ground collapse	• Contractor
2	Existing Social Infrastructure	Work lots close to: • Traffic • Underground utilities • Railway	• Adoption of construction method at D/D minimizing adverse impacts on traffic • Implementation of underground utilities survey at D/D • Preparation of construction plan covering minimization of adverse impacts on traffic and railways	• Contractor

No.	Environmental Items	Potential Source	Management to be Taken	Actors of Environmental Management
			• Placement of traffic guide at construction work lots	
3	HIV / AIDS (Infectious diseases)	Employment of foreign workers for construction works	• Hygiene education for construction workers • Regular medical check	• Contractor
4	Occupational Health and Safety	Construction works	• Contractor's proposal on occupational health and safety plan • Allocation of health and safety supervisors • Regular meetings on occupational health and safety • Preparation of organization structure on occupational health and safety	• Contractor
5	Air Pollution	Construction works: • Travelling of construction vehicles and equipment • Idling of construction vehicles	• Contractor's construction plan on air pollution prevention such as water sprinkling for dust • Regular inspection on Contractor's work practice toward air pollution	• Contractor
6	Water Pollution	Construction work	• Contractor's construction plan on prevention of water pollution such as sedimentation • Regular inspection on Contractor's work practice toward water pollution	• Contractor
7	Waste	• Generation of excavated soil, construction debris • Generation of general waste	• Contractor's construction plan on handling or recycling of excavated soil or construction debris • Preparation of manifest system of general waste • Regular inspection on Contractor's work practice toward handling on excavated soil or construction debris	• Contractor
8	Noise / Vibration	Construction machineries	• Contractor's construction plan for minimizing noise generation • Regular inspection on Contractor's work practice toward minimization of noise generation • Environmental monitoring	• Contractor
9	Accident	Contractor's construction practice	• Contractor's proposal on safety management • Regular inspection on Contractor's safety management • Formulation of organization structure for emergency response • Regular inspection on Contractor's practice on safety management	• Contractor • Contractor • Contractor • Consultant / Contractor

Source: JICA Survey Team

At Operation Phase

No.	Potential Impacts	Potential Source	Management to be taken	Actors for Environmental Management
1	Occupational Health and Safety	Operator's operation & maintenance practice	• Preparation of Operation & Maintenance manual by a Contractor at commissioning • Training on occupational health and safety at commissioning • Preparation of emergency response plan • Regular meetings on occupational health and safety	• PMC
2	Air pollution	• Travelling of dump truck conveying treated sludge	• Manifest system of treated sludge	• PMC
3	Water pollution	• Influent flow • Treated effluent	• Environmental monitoring of influent flow and treated effluent • Compliance with relevant guidelines and regulations if the treated effluent is reused	• PMC
4	Waste	Treated sludge	• Manifest system of treated sludge • Compliance with relevant guidelines and regulations if the treated sludge is reused	• PMC
5	Soil Contamination	• Leakage of sewage at STPs, IPSs and main / Sub Mains	• Regular maintenance works through visual and odor inspection • Handling of local residents' information on occurrence of leakage or odor • Close cooperation with relevant authorities of monitoring rivers and groundwater	• PMC
6	Noise / Vibration	• STPs • IPSs	• Sound proof design at D/D • Environmental monitoring	• Contractor • PMC
7	Offensive odor	• STPs	• Environmental monitoring of odor level at facility boundaries • Handling of residents' complaints toward odor	• Contractor • PMC
8	Accidents	• Operation & maintenance of trunk sewers, relay pumping station and WTTP	• Preparation of Operation & Maintenance manual by a Contractor at commissioning • Training on occupational health and safety at commissioning • Preparation of emergency response plan • Regular meetings on occupational health and safety	• Contractor • PMC
9	Climate Change	Generation of GHG • STPs •	• Designing of STPs and IPSs for energy reduction at D/D • Preparation of O&M manual toward energy reduction • Regular operation toward energy reduction	• Contractor • Contractor • PMC

Source: JICA Survey Team

(2) Complaints Handling

1) Setup of Contact System

Relevant concerned parties at construction and operation phase should take appropriate response for the residents' complaints on pollution related matters such as noise, offensive odor, dust and traffic. The contact departments will be officially announced with the names of the departments, addresses, telephone number and e-mail addresses through newspapers, television, radio and internets. The schematic diagram of the proposed contact system for complaints handling is shown in Figure 11.5.1.

The contact points of each actors are shown below;

- Project proponent: Sewerage department of PMC
- Inspection of environmental management: Environmental department of PMC or Regional office / Technical Wing of SPCB (Maharashtra State Pollution Control Board)
- Contractor: A set up of a contact point for complaints handling for the contractors will be provided in the tender documents or construction contract documents.

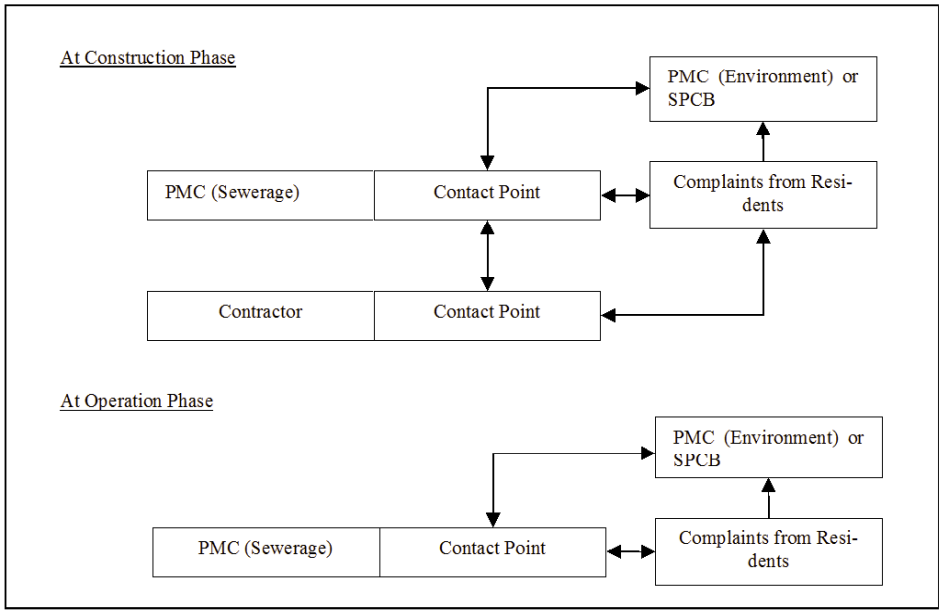


Figure 11.5.1 Contact System for Complaints Handling

2) Complaints Response Process

All complaints received shall be recorded.

The following data shall be recorded;

- Data, time and place of the complaints
- Method how the complaint was received (e.g. telephone, e-mail)?
- Details of the complaint

Actions to be taken by the site

11.5.3 Emergency Response Plan

Emergency Response Plan (ERP) of the proposed project will be carried out through 1) identifying hazard, 2) decision making toward appropriate action based on a risk management manual according to the type of hazard, level and potential frequency of its occurrence and 3) taking an action for mitigation measures. During normal operation, regular trainings will be carried out to take appropriate actions promptly by assuming the actual events of hazard.

(1) Type of Hazard

The estimated hazards in case of sewerage system are classified by the types of natural and human-induced hazards and the lists of resulting events covered in the hazard. Earthquake and meteorological phenomenon are major hazards in natural hazard, while accidents, incidents, terrorism and troubles in administrative work are major hazards in human-induced hazards. The estimated hazard in sewerage system is shown in Table 11.5.3.

Table 11.5.3 Estimated Hazards in Sewerage System by Type

Type of Hazards	Event
(1) Natural Hazard	
Earthquake	• Failure, deterioration of function • Floating of manholes and cave-in in a road • Shortage of toilets
Meteorological phenomenon	• Inflow of water with a discharge over planned discharge • Floating of manholes and scattering • Submergence of construction sites • Sedimentation of earth and sands in main / Sub Mains
Others	• Power blackout due to thunder and tornado
(2) Human-induced hazard	
Accidents	• Cave-in a road due to deteriorated damage • Malfunction of equipment • Occurrence of troubles during operation • Accidents at construction works • Degradation of effluent quality • Inflow of hazardous or noxious sewage into sewers (e.g. hazardous chemicals, oil, dangerous substances and radioactive materials) • Fire disasters of facilities
Incidents	• Outbreak of dangerous creature and vectors of transmitted diseases at sewers • Inflow of virus into sewer pipes due to occurrence of infectious diseases
Terrorism	• Occurrence of terrorism
Trouble in administrative work	• Leaking personal information • Lack of knowledge and violation of legal requirements • Destruction of computer system by computer virus

Source: JICA Survey Team

(2) Preparation of Contingency Management Manual

A preparation of a contingency management plan is necessary to take specific actions for the unexpected events of hazards.

The following contents will be covered in the manual.

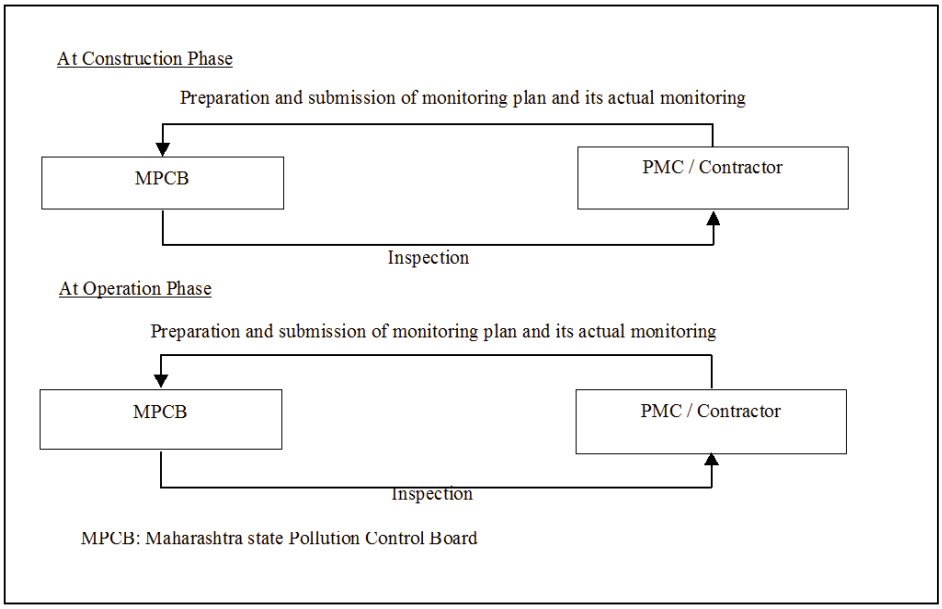
- Preparation of response measure by type of hazards
- Actions in three (3) stages of 1) at normal operation: preparation of a contingency manual through identification hazards and estimation of their events, 2) at actual occurrence of hazards: taking an action for the hazard which was estimated at the stage of 1) and 3) at recovery stage after occurrence of hazards: the emergency event terminates and the hazard is under control.
- Organization of response measures: Decision of response structure

Compilation of actions in a manual: Organization structure of response measures, way of a creation of response structure, power / authorities in the structure, place and facilities for the response structure, transmission of information inside and outside of the sewerage department, concept on publication to residents / mass media

11.5.4 Environmental Monitoring Plan

(1) Monitoring Framework

The monitoring framework should be formulated for the construction and operation phases. Each main actor of the monitoring is the contractor and PMC, respectively at the construction and operation phases and they will have to report and obtain relevant approval from MPCB (Maharashtra Pollution Control Board). The monitoring framework is shown in Figure 11.5.2.



Source: JICA Survey Team

Figure 11.5.2 Monitoring Framework

(2) Environmental Monitoring Plan

Environmental monitoring will be carried out to examine the mitigation measures for the predicted adverse impacts. The environmental monitoring plan is shown in Table 11.5.4

Table 11.5.4 Environmental Monitoring Plan

At Construction Phase

Impacts to be Assessed	Methods and Monitoring Parameter	Frequency	Actor of Monitoring
Existing Social Infrastructure and Social Service	• Prior contact and approval from relevant authorities • Socialization activity and close communication with society • Announcement through TV, Radio, Newspaper, Internet media, etc. • Implementation of the survey of underground utilities / pipes	Occasionally	Contractor
Infection Diseases such as HIV/AIDS	• Allotment of safety supervisor and safety officer • Conduction of safety and hygiene education at employment of construction workers	Every 2 or 3 month	Contractor
Occupational health and safety	• Appointment of safety supervisor and safety officer • Holding safety meeting	Every week	Contractor
Air pollution	• Visual inspection of dust • Performance of mitigation measures for generation of dust	• Daily	Contractor
Water pollution	• Visual inspection of turbid water • Performance of mitigation measures for turbid	• Daily	Contractor

Impacts to be Assessed	Methods and Monitoring Parameter	Frequency	Actor of Monitoring
	water		
Waste	• Inspection of contractor's practice on treating excavated soil including its backfill • Management through manifest on the transport route and amount of excavated soil • Contractor's monthly report on construction	• Daily • Daily • Monthly	Contractor
Noise / Vibration	• Sound level survey at site boundaries of construction sites • Acceptance of complaints from residents	• Monthly • Occasionally	Contractor
Accident	• Contractor's practice of safety measures of using helmet, safety belt and safety shoes • Contractor's practice of safety training • Contractor's preparation and submission of monthly report including safety meeting	• Daily • Monthly • Monthly	Contractor

Source: JICA Survey Team

At Operation

Impacts to be Assessed	Methods and Monitoring Parameter	Frequency	Actor of Monitoring
Occupational health and safety	• Performance of preparation of organization structure and training program • Compliance with relevant regulation • Performance of holding periodical meetings	• Occasionally 3 months after operation • Monthly • Monthly	PMC
Air pollution	• Preparation of appropriate allocation / dispatching plans of cars • Visual inspection of operator's practice of mitigation measures of idling reduction and water sprinkling	• Monthly • Monthly	PMC
Water pollution	• Water quality measurement 1[*1] for 11 STPs • Water quality measurement 2[*2] for public water bodies (Mula river, Mutha river, nallas)	• Monthly • Monthly	PMC
Waste	• Operator's performance of management system by manifest	• Monthly	PMC
Soil Contamination	• Acceptance of complaints from resident • Sewage inflow volume monitoring • Regular monitoring through visual inspection or smelling at the STPs, main / submain and intermediate pump stations • Chemical analysis of treated sludge[*3]	• Monthly • Daily • Daily • Monthly	PMC
Noise / Vibration	• Acceptance of complaints from residents and quick response to it • Noise level survey at the site boundaries of STPs and intermediate pump stations	• Occasionally • Occasionally 3 months after operation	PMC
Offensive Odor	• Odor level monitoring (ammonia, methyl mercaptan, hydrogen sulfide, methyl sulfide, styrene) at the facility boundary of the STPs • Acceptance of complaints from resident and its quick response	• Occasionally 3 months after operation • Occasionally	PMC
Accident	• Operator's practice on holding safety meetings	• Monthly	PMC

	• Training through OJT • Initial training by contractor at the test operation	• Occasionally • Once at test operation	
Others (Climate Change)	• Monthly report of operator's operation including mitigation of energy consumption and recycling of digestion gas (e.g. methane gas)	• Monthly	PMC

Notes;

*1, *2: Compliance with Indian standards for the parameters of Water Temperature, pH value (H^+), Dissolved Oxygen (DO) , "Biochemical Oxygen Demand (BOD_3), "Chemical Oxygen Demand (COD)", Total Suspended Solids (TSS)", Ammonia (NH_3), Total Nitrogen (T-N), Total Kjeldahl Nitrogen, Nitrates (NO_3-N), Nitrites (NO_2-N), Total Phosphorus (T-P), Coliforms, Air Temperature

*3: Parameters: Cadmium (Cd), Arsenic (As), Nickel (Ni), Lead (Pb), Mercury (Hg), Chromium (Cr), Copper (Cu), Cyanogen (CN)

Source: JICA Survey Team

11.6 Land Acquisition and Resettlement

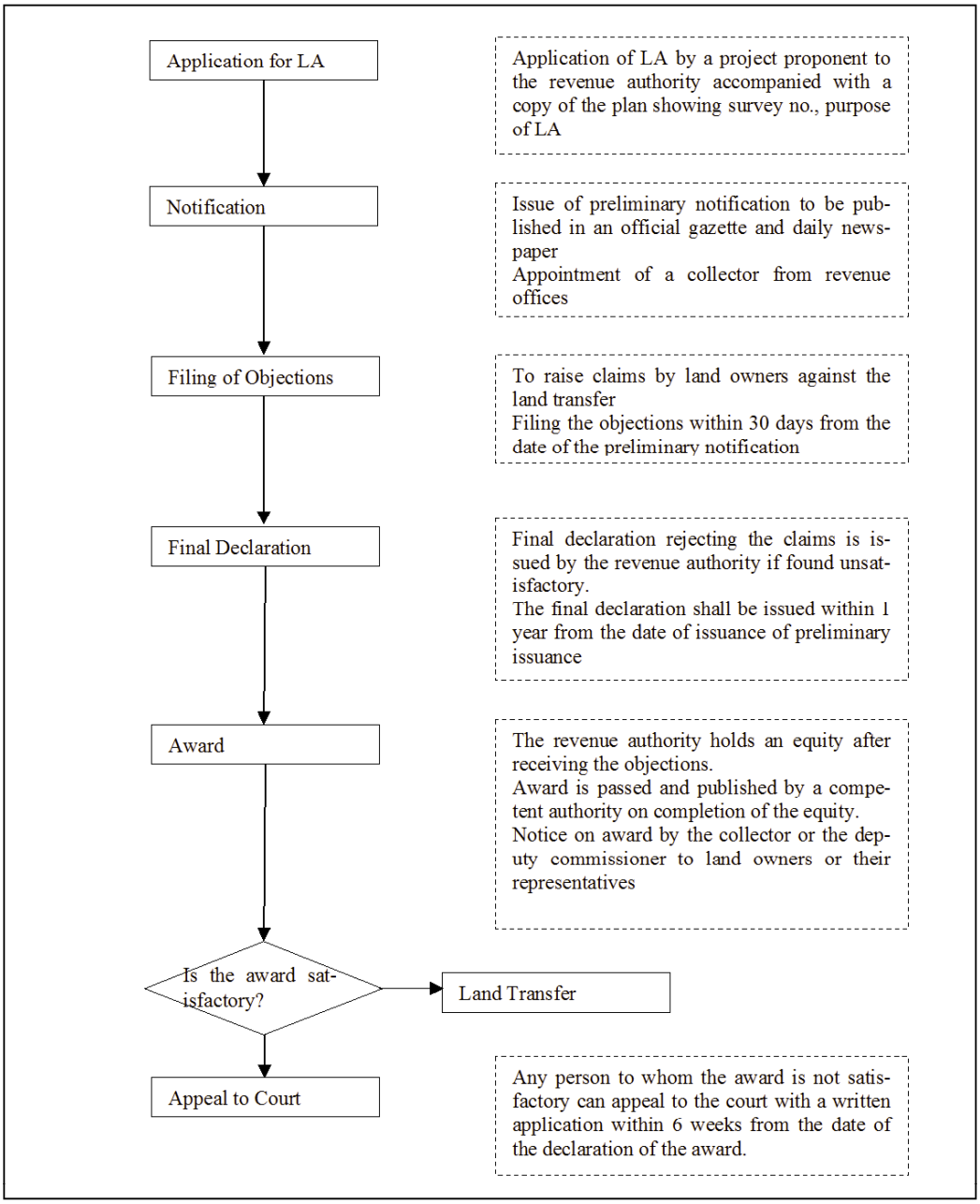
11.6.1 Laws and Regulations on Land Acquisition

(1) Laws and Regulations

As the legal basis for the LA (land acquisition) of the project sites, the old act on LA (1984) and the new act ("The Right to fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013") which came into force from 1 January 2014 can be included. The LA of the project sites of the proposed project has been proceeded in the DP which PMC has formulated for the land use plan for public purpose including sewerage systems so far based on the old LA act (1894) as its legal basis. According to PMC, for the LA for the project sites of the STPs which currently belongs to private land owners, the new act was applied for the payment of the compensation to the land owners. Therefore, the new acts are applied in combination with the old act for the land acquisition of the proposed project.

The process of LA based of the old LA act is shown in Figure 11.6.1.

It is stipulated that 'Compensation cost has a 30% surcharge over market value' under the old LA act (1894). However, there is no provision on the benefit of an alternate site or livelihood security to PAP (Project Affected People). There are problems with land acquisition in public works. Constructing facilities for the public is easy for residents to understand and share relatively; also some of the PAPs were guaranteed to be given priority regarding employment in the public sector. After 1991, the situation was changed because of economic deregulation and the low percentage of employment promotion in the public sector. As a result, there were many reports that land acquisition did not go smoothly. In response to above background, the amendment of the Act has been discussed and a new land acquisition act "The Right to fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013" came into force.



Source: Preparatory Survey on the Urban Railway Project, Final Report in PMC

Figure 11.6.1 Process of Land Acquisition based on old LA Act (1894)

(2) LA Process in PMC

There are two methods to acquire the land of PMC. One is to follow The Maharashtra Regional and Town Planning Act, 1966 and the other is to follow the Land Acquisition Act, 1894.

The Maharashtra Regional and Town Planning Act, 1966:

Land under DP reservation or DP Road – PMC will issue a request letter under MRTP (The Maharashtra Regional and Town Planning Act, 1966) section 126 (Compensation section) to the concerned owner. If the owner agrees to hand over the land, it is taken by PMC with a conditional receipt, which mentions the method for compensation (FSI / TDR / cash) in the form. It'll take 3 or 4 months to acquire the land by following this Act.

Land Acquisition Act, 1894

Another way for land Acquisition is to follow the Land Acquisition Act (1894). It'll take 3 or 4 years to acquire the land by following this Act.

Compensation Cost of PMC

There are 3 type of compensation of land acquisition in case of projects are developed in PMC.

- Cash Compensation – This will be made as per the market value of the property. This procedure will take about 2 years.
- Compensation (Alternative) Land – Alternative land as compensation under PMC is to be given to the land owner for which it may take 3-4 months by mutual understanding between the two bodies
- FSI (Floor Space Index) and TDR (Transferable Development Right) – This is possible only when the project is owned or planned by PMC.

TDR is a PMC's administrative means to implement a DP (Development Plan). TDR is a notion which utilizes the potential of land for a particular location. A right to develop of a land is taken away from one land parcel and an incentive is given to another land parcel where there is a high demand for development space. The receiver of the development right pays money to the donor of the development right depending on the market value of the TDR. The concept of TDR was brought in by an amendment to the MRTP (Maharashtra Regional and Town Planning) Act in the year of 1993. This tool allows transfer of development potential of a piece of land that is reserved for some purpose to another designated area. TDR is linked to (FSI) Floor Space Index, which is the ratio of total floor area of construction to the total area of the plot. The landowner of a reserved plot or land surrendered for road widening will be entitled to FSI in the form of a Development Rights Certificate (DRC) which he may use or sell to any other person.

According to PMC, the compensation is planned to be paid to the private land owners of the Warje and Vadgaon STP sites in accordance with the new land act.

Section 27 of the new act defines the compensation method by which the market value of the land shall be computed. Schedule I regulates the proposed minimum compensation based on a multiple of market value. Schedule II defines the resettlement and rehabilitation entitlements to land owners and livelihood losers.

The detail of the compensation money is shown as below;

Compensation = 1) the highest value of the lands which is calculated based on ready reckoner, or, 2) Market value of the lands + Solatium which is 100 % of the market value of the lands + the Interest of 9 % for the 1st year + the Interest of 15 % for more than 1st year.

Therefore, a compensation money twice as the market price of the land is to be paid to the owners as a minimum in case of application of the new land act.

11.6.2 Comparison of Indian Legislative System with the World Bank Operational Policy

A comparison of the main items and survey items that are listed in the old LA act (1894) and the World Bank policies was carried out. The socio-economic survey to establish the eligibility of PAP (Project Affected people by the resettlement), the requirement of social infrastructures such as housing and public facilities and handling mechanism on complaints are not regulated in the act. The Act states that “compensation cost is market value plus 30%”, there is no provision concerning "guarantees of alternative land" or "guarantee for provision of basic needs". Above comparison is shown in Table 11.6.1.

Table 11.6.1 Comparison between WB Operational Policy and Old LA Act (1894)

No.	The World Bank's Environmental and Social Safeguard Policies	Land Acquisition Act in India(1894)
1	Socio-economic survey related to the resettlement (including population census, asset inventory, etc.) shall be conducted and their results shall be conducted to establish the eligibility of the project affected people (PAP)	Not regulated.
2	Definition and eligibility requirements of compensation and support of transfers	With the implementation of the project, houses, offices and land that exist in project sites are subject for project affected people (PAP). Public announcement is given for the negotiations for land acquisition.
3	Method of compensating and calculating loss amount of the asset of the PAPs	After the public announcement, asset assessment is carried out for each PAP, the calculation of loss and the method of compensation is determined based on the survey results. The Land Acquisition Act (1894) states that “compensation cost is market value plus 30%”, there is no provision concerning "guarantees of alternative land" or "guarantee for provision of basic needs". It prescribes a "compensation premium of 30% of market price" in the current law (1894 statute), however, there is no provision for livelihood security or guarantee of an alternate site.
4	Specific details of compensation and support	Compensation can be in the form of alternative land or compensation in money. Some options are proposed additionally.
5	Housing, infrastructure, public facilities are to be provided in the area of relocation site	Not regulated.
6	Participation in the process by resettlement residents and the community	Explanatory meeting is held for the PAPs, there’s no meeting with the community.
7	Handling mechanism for complaints	Not regulated.
8	Implementation Schedule	After public announcement, the period for negotiations

		of land acquisition is defined as within one year as a rule. Normally it takes 3 and 4 years to deliver the project sites.
9	Cost estimates and Budget planning	Overall cost estimates and budget plan are considered based on the results as shown in No. 3 and 4 above .
10	Overview of the monitoring and ex-post evaluation	Not regulated.

Source: Preparatory Survey on the Urban Railway Project, Final Report in PMC City

The new land act, on one hand, defines the following basic provisions to correspond to the requirements of the WB operational Policy.

- Fair rehabilitation of land owners and those directly affected from loss of livelihoods
- Information disclosure
- Transparent process

11.6.3 Survey Results on Land Acquisition and Resettlement by Project Site

(1) Basic Condition of the Survey

Basically, LA (Land Acquisition) will not be required for the project sites of the proposed main / Sub Main sewers, sewage collection system in Baner district and the IPSs, since main/ sub main sewers will be constructed along existing nalla, sewage collection system will be constructed at public road areas and the IPSs will be constructed at existing facility areas. The survey on the land acquisition was conducted at the STP sites. In addition to the LA status, the status if the main/ sub mains may disturb the ROW of railways and other private assets was also examined.
In addition to the sites of proposed STPs, LA for planned 40 public toilets (40 number x 80 m^2 = 3,200 m^2 to be required for Public Toilets: 80 m^2 required for 1 public toilet with 10 seats) also should be carried out by PMC.

(2) Results of LA Status on STP Sites

The project sites of Naidu, Bhairoba and Mundhawa have already been acquired by PMC and no LA process is required for these sites, since these sites are located at existing STP facility areas. As for the STP sites of Matsya Beij Kendra, Tanajiwadi, Dhanori and Baner, their LA is currently under process and it will take several months to acquire their lands. LA of other remaing sites of Botanical Garden, Warje, Vadgaon and Khradi are under process currently.
The details on the LA status as November 2014 for the proposed STP sites is shown in Table 11.6.2 and those of Botanical Garden, Warje, Vadgaon and Kharadi are described below.

- Botanical Garden STP: the site belongs to the Rahuri Agricultural University, which is operated under the Ministry of Agriculture of State of Maharashtra. PMC has initiated the LA process, and the discussions at state level are required as the permission from Ministry of

Agriculture will be sought by Rahuri University to transfer the land to PMC. The state-level discussions are expected with the recently elected State Government who takes charge and appoints the bureaucrats to various state departments. Some progress can be expected by February 2015.

- Warje STP: The site is owned privately consisting of 36 land owners. The project site has been reserved for the STP in the PMC's City Development Plan, and once the Plan is approved by the State Government, the process will be accelerated because the land use of the DP will be authorized. A joint measurement by PMC, land owners and collector was planned on 30th October 2014, but when the officers reached the site, the land owners did not allow the procedure to be completed because the LA process has not been completed yet. During the meeting on 19th November, 2014 with PMC which was chaired by the Municipal Commissioner, the City Engineer stated that the land for Warje site will be acquired within 3 months. PMC will apply Section 6 of the old land act (Declaration of LA) within 1 month to expedite the process.

- Vadagaon STP: The site is a private land consisting of about 33 land owners. The site has been reserved for the STP in the PMC's City Development Plan, and once the Plan is approved by the State Government, the process will be accelerated because the land use of the DP will be authorized. A joint measurement by PMC, land owners and collector has been completed and submitted to Land Acquisition office. PMC's land acquisition officer called the land owners for negotiation in October 2014, and only 2 owners attended the negotiation. During the meeting on 19th November, 2014 with PMC which was chaired by the Municipal Commissioner, the City Engineer stated that the land for Vadgaon site will be acquired within 3 months. PMC will apply Section 6 of the old land act (Declaration of LA) within 1 month to expedite the process.

- Kharadi STP: The site is composed of 1.05 ha of State Government land, 0.25 ha of PMC, and 0.50 ha of Private land. The land use for proposed STP in these sites has been already approved by PMC with City Development Plan, and the STP construction plan will be developed in accordance with City Development Plan.
  As discussed the meeting with Municipal Commissioner during on 19th November, 2014, the City Engineer stated that the land for Kharadi site will be acquired within 6 months.

Table 11.6.2 Current Status on Land Acquisition for Proposed STP Sites

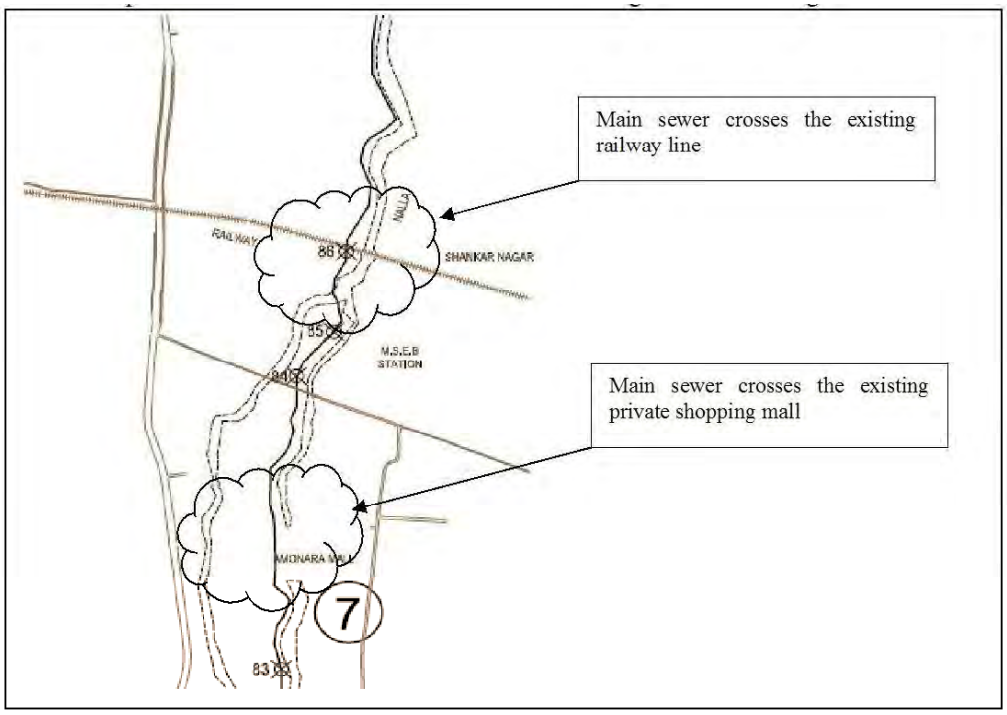
No.	Site	Area required in Ha	Land already acquired by PMC in Ha	Land to be acquired	Remarks by PMC	Status of LA (Land Acquisition) by Survey Team	Issues Identified by Survey Team	Future schedule on LA
1	Naidu	4.75	4.75	None	None	LA is not required. (Existing STP area)	• Existing structures to be demolished. (Generate demolished waste.) • Trees: To Obtain permission for cutting or transplantation.	NA
2	Bhairoba	2.7	2.7	None	None	LA is not required. (Existing pumping facility of PMC)	• Traffic: Heavy • Existing structures to be demolished (generate demolished waste.) • Trees: To Obtain a permission for cutting or transplantation.	NA
3	Mundhawa	1.17	1.17	None	None	LA is not required. (Existing STP area)	• Traffic: Heavy • Trees: To Obtain a permission for cutting or transplantation.	NA
4	Matsya Beej Kendra	0.3	Nil	0.3	Land belongs to private owner	LA is under process	Trees: To Obtain a permission for cutting or transplantation.	The LA process is in progress. The topographical and geotechnical survey have been completed.
5	Botanical Garden	1.6	0.25	1.35	Land belongs to State Government (Rahuri Agricultural University)	LA is under process	Trees: To Obtain a permission for cutting or transplantation.	As per the meeting held on 19th November with the Municipal Commissioner, the land will be made available within 3 months.
6	Tanajiwadi	0.58	0.3	0.28	School playground to be acquired; land from green belt to be acquired	LA is under process	• Residential area close to the site • Access: Existing road is narrow	NA
7	Dhanori	1.0	0.34	0.66	LA process is almost completed. The land owner has accepted the 25% TDR.	LA is in a final process	• The construction debris has been dumped at proposed STP site.	Approximately require 2 to 3 months as per PMC officers
8	Warje*	1.07	Nil	1.07	Currently private land, but reserved for STP in the ap-	LA is under process	• Trees: To Obtain a permission for cutting or transplantation. • Access: Future road can be uti-	As per the meeting held on 19th November with the Municipal Commissioner, the land will be

No.	Site	Area required in Ha	Land already acquired by PMC in Ha	Land to be acquired	Remarks by PMC	Status of LA (Land Acquisition) by Survey Team	Issues Identified by Survey Team	Future schedule on LA
					proved Development Plan;		lized (Road project along river side is planned as a Greenbelt plan)	made available within 3 months.
9	Vadgaon*	2.75	Nil	2.75	2.37 Ha reserved land in approved Development Plan; partly with state government and partly with private parties;	LA is under process	• Cattle shed identified • Trees: To Obtain a permission for cutting or transplantation. • Access: Future road can be utilized (Road project along river side is planned as a Greenbelt plan) • Temporary huts identified	As per the meeting held on 19th November with the Municipal Commissioner, the land will be made available within 3 months.
10	Baner	0.95	Nil	0.95	Land belongs to private owner. 2.5 Ha land has been reserved in DP by PMC.	LA is under process	• Land filling is done at the proposed STP site.	Approximately require 6months to 1 year as per PMC officers
11	Kharadi *	1.55 (0.50 of Private)	Nil	1.55 (0.50 of Private)	The land is belonged to state government and private owner will be acquired within 6 month.	LA is under preparation	• The land is a vacant land • There are small shrubs and bushes only and no big trees.	As per the meeting held on 19th November with the Municipal Commissioner, the land will be made available within 6 months.

Notes;
*: Land acquisition cost was taken in account for this site.
Source: JICA Survey Team

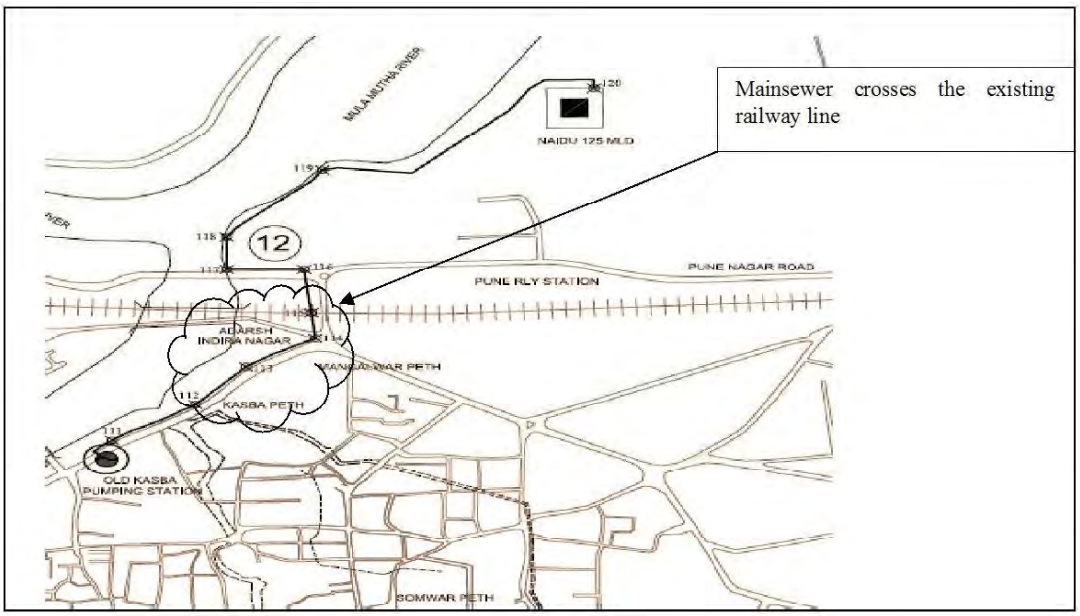
(3) Crossing by Main/ Sub Main sewers through Public and Private Facilities

The main sewer of No.07, 12 and 18 cross the existing railway and the No.21 main sewer crosses the public market area. The details are shown in Figure 11.6.2 to Figure 11.6.5.



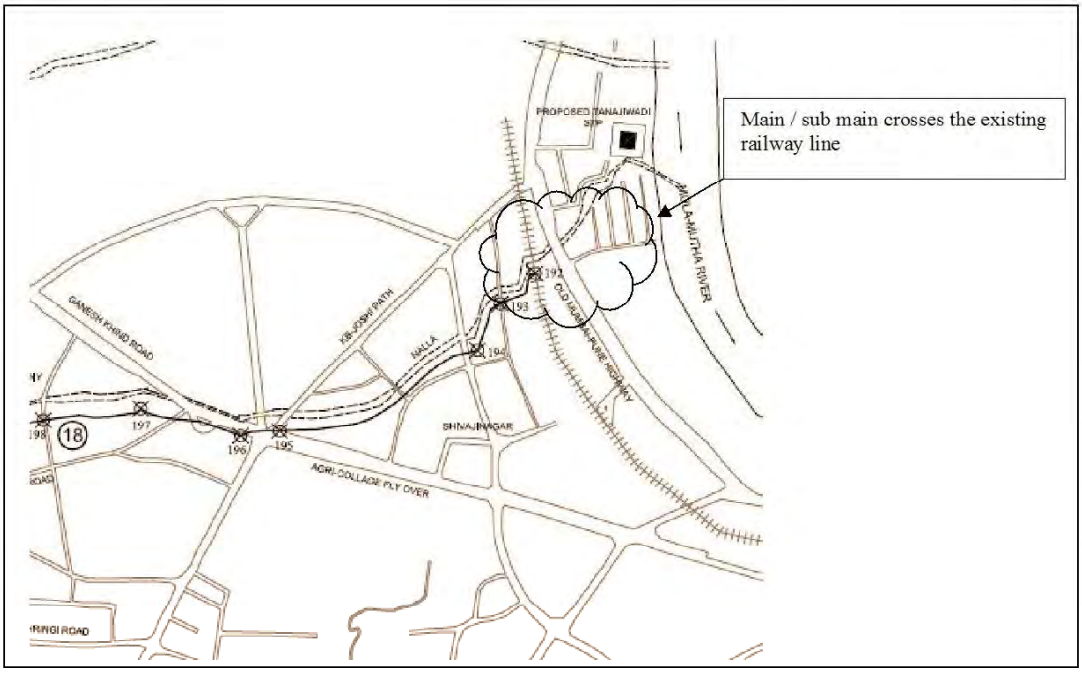
Source: JICA Survey Team

Figure 11.6.2 Crossing by Main sewer through Railway and Shopping Mall (No. 07)



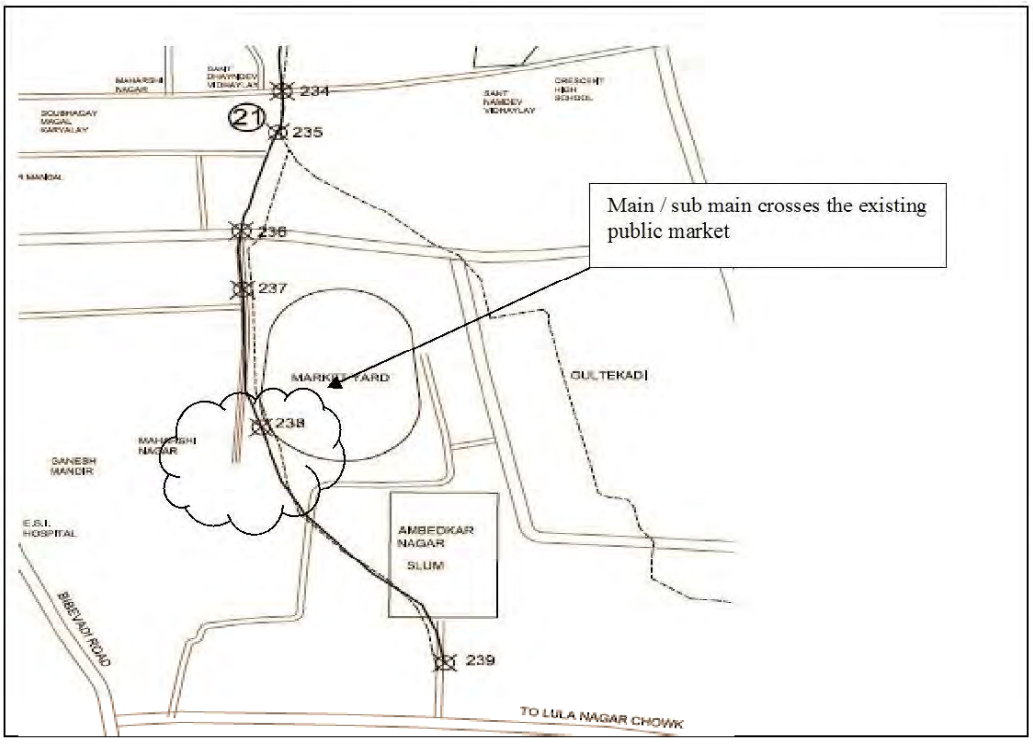
Source: JICA Survey Team

Figure 11.6.3 Crossing of Main / Sub Main with Existing Railway Line (No. 12)



Source: JICA Survey Team

Figure 11.6.4 Crossing of Main / Sub Main with Existing Railway Line (No. 18)



Source: JICA Survey Team

Figure 11.6.5 Crossing of Main / Sub Main with Existing Public Market Area (No. 21)

11.7 Environmental Checklist

The environmental checklist in JICA form for the proposed project is shown in Table 11.7.1 The project does not require EIA. The stakeholder meetings relating to the project was carried out by PMC to gather public opinion as the information disclosure of the DP which covers the land use plan of the proposed sewerage project.

Table 11.7.1 Environmental Checklist in JICA Form

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	a) N b) N c) N d) N	a) As per the Ministry of Environment and Forest (MoEF) Notification dated 14-09-2006, EIA reports are not required for infrastructure projects like Sewerage and Sewage Treatment Plants undertaken by PMC within its city limits. b) Not applicable for the Project c) Not applicable for the Project d) All the necessary Environment related approvals are issued by MoEF or their agencies. The project is categorized as B2 in the EIA notification and Form B1 is required to be submitted prior to the tendering process which will be carried out by the PMC. As for other clearances prior to the construction works, the permission for tree cutting or replantation, permission for construction at railway or road areas and Nallas are required from relevant authorities.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	a) Y b) Y	a) Extensive public hearings have been held as a part of formulation of the Development Plan which included the notified locations of the STPs. Objections of the stakeholders were received and responded to by the PMC. b) See response to a) above.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	Y	Currently, sewerage coverage exceeds 90 % in PMC with existing operation of STPs (Sewage Treatment Plants) and a drastic change of facility allocation will not be realistic taking the existing situation into consideration. However, a study on technical options of STP treatment process was examined in DPR and will be reviewed in the JICA Preliminary Survey.
2 Pollution Control	(1) Water Quality	(a) Do pollutants, such as SS, BOD, COD, pH contained in treated effluent from a sewage treatment plant comply with the country's effluent standards? (b) Does untreated water contain heavy metals?	a) Y b) N	a) Yes these pollutants like S.S, BOD, COD. pH are within the limits specified by Maharashtra State Pollution Control Board (MPCB), which operates under the MoEF (national ministry). b) Due to absence of heavy or chemical industries in the PMC / project area, the wastewater is of domestic nature only, and therefore it would not contain heavy metals. However, under the Preparatory Survey, the sludge from the existing STPs will be analyzed for heavy metals, and examination for their concentrations against the standards.
	(2) Wastes	(a) Are wastes, such as sludge generated by the facility operations properly treated and disposed of in accordance with the country's standards?	a) Y	a) There are no national guidelines for disposal of sludge from treatment plants. Currently, the dewatered sludge is utilized for soil amendment at farmlands as manure. According to the results of the chemical analysis for the treated sludge from existing STPs by the JICA survey team, all the samples were below the permissible level of heavy metals for use of fertilizer which is regulated in the handling manual by Ministry of Agriculture, Forestry and Fisheries (Japan).

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(3) Soil Contamination	(a) If wastes, such as sludge are suspected to contain heavy metals, are adequate measures taken to prevent contamination of soil and groundwater by leachates from the wastes?	a) Y	a) The proposed STPs receive the sludge only therefore the treated sludge will not do contain heavy metals however the survey team will carry out the laboratory analysis including the heavy metals for treated sludge of existing STPs to examine this issue. According to the results of the chemical analysis for the treated sludge from existing STPs by the JICA survey team, all the samples were below the permissible level of heavy metals for use of fertilizer which is regulated in the handling manual by Ministry of Agriculture, Forestry and Fisheries (Japan).
	(4) Noise and Vibration	(a) Do noise and vibrations generated from the facilities, such as sludge treatment facilities and pumping stations comply with the country's standards?	a) Y	a) Basically there are no complains identified from the neighboring residents on noise from existing STPs or IPS (Intermediate Treatment Pumps). The traffic noise is dominant compared to the noise from STPs and at the facility boundaries. However environmental monitoring will be carried out to examine their compliance with environmental standards.
	(5) Odor	(a) Are adequate control measures taken for odor sources, such as sludge treatment facilities?	a) N	a) Basically there are no complains identified from the neighboring residents on odor from existing STPs or IPS. Some measures on odor control will be taken such as the facility design and environmental monitoring also will be considered.
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	a) N	a) The project sites are not located in protected areas.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that the project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	a) N b) N c) N d) N	a) There is no forest, rainforest or ecological valuable habitat near by the project. However, for the trees growing inside the project sites, their cutting or replantation will be carried out at the inspection of PMC's tree authority based on the State's regulation. b) The project site does not encompass any protected habitats. c) No significant negative ecological impacts are anticipated d) There will not be any adverse effect the project on the aquatic environment. It will help in improving the water quality of the river & the environment.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Is the compensations going to be paid prior to the resettlement? (e) Is the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	a) N b) Y c) NA d) Y e) N f) NA g)Y h) Y i) NA j) Y	a) There is no involuntary resettlement to be caused by the project. The project sites to be acquired by PMC has been under progress. b) There is no involuntary resettlement with regard to the project. However , The project sites to be acquired by PMC has been under progress. PMC has already received consent from the land owners including compensation. c) See response to b) above. d) Yes. e)Yes. f) Not applicable. g) See response to b) above. h) There is a separate officer / section within PMC that undertakes land acquisition and resettlement process. i) There are no resettlements necessary, only purchase of land from private owners. j) The grievance redress process was completed during the preparation and approval of the City Development Plan.
	(2) Living and Livelihood	(a) Is there a possibility that changes in land uses and water uses due to the project will adversely affect the living conditions of inhabitants? (b) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	a) N b) NA	a) The Project will improve the living standard & hygienic conditions of the residents. b) The Project will improve the living conditions of the inhabitants.
4 Social Environment	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	a) N	a) There are no archeological, historical or heritage sites at or nearby the proposed project sites.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	a) N	a) There is no such impact on the landscape as most of the STPs are being upgraded or being constructed within the land next to the existing STPs.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to lands and resources respected?	a) N b) N	a) The proposed project is not related to any ethnic minority people or indigenous people. b) same as above

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	a) Y b) Y c) Y d) Y	a) The proponent will not be violating any rule, laws associated with the working conditions. b), c) & d) The Contractors will make arrangements towards safety of people working like (wearing helmet, safety shoes, & safety belts) etc. at the time of execution. A safety management policy will be carried out and there will be a periodical check for health & safety measures provided to the workers.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? (d) If the construction activities might cause traffic congestion, are adequate measures considered to reduce such impacts?	a) Y b) Y c) Y d) Y	a) The mitigation measures will be carried out at the time of construction. b) The project will not affect the ecosystem. c) The project will not affect the ecosystem. d) The construction activities will be planned and techniques adopted after discussion with residents.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	a) Y b) Y c) Y d) Y	a) Proponent will adhere to the monitoring requirements prescribed by the Maharashtra Pollution Control Board. b) The items of the monitoring program for the STP will be flow and water quality. Some of these parameters will be monitored continuously through on-line instruments and some in the laboratory. c) The construction contractor will monitor the assets for five years, during which time engineers from the PMC will monitor the performance of the contractor. d) These will be as prescribed by the Maharashtra Pollution Control Board.

Category	Environ-mental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
6 Note	Note on Using Environ-mental Checklist	(a) If necessary, the impacts to trans-boundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as trans-boundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) Energy saving and reduction in greenhouse gas will be achieved through production and recovery of methane gas (biogas)for power generation.

Notes;

1) Regarding the term “Country’s Standards” mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made.
In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).

2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which the project is located.

11.8 Assessment on the Mitigation of CO_2 Emission by Biogas Power Plant

11.8.1 Basic Approach

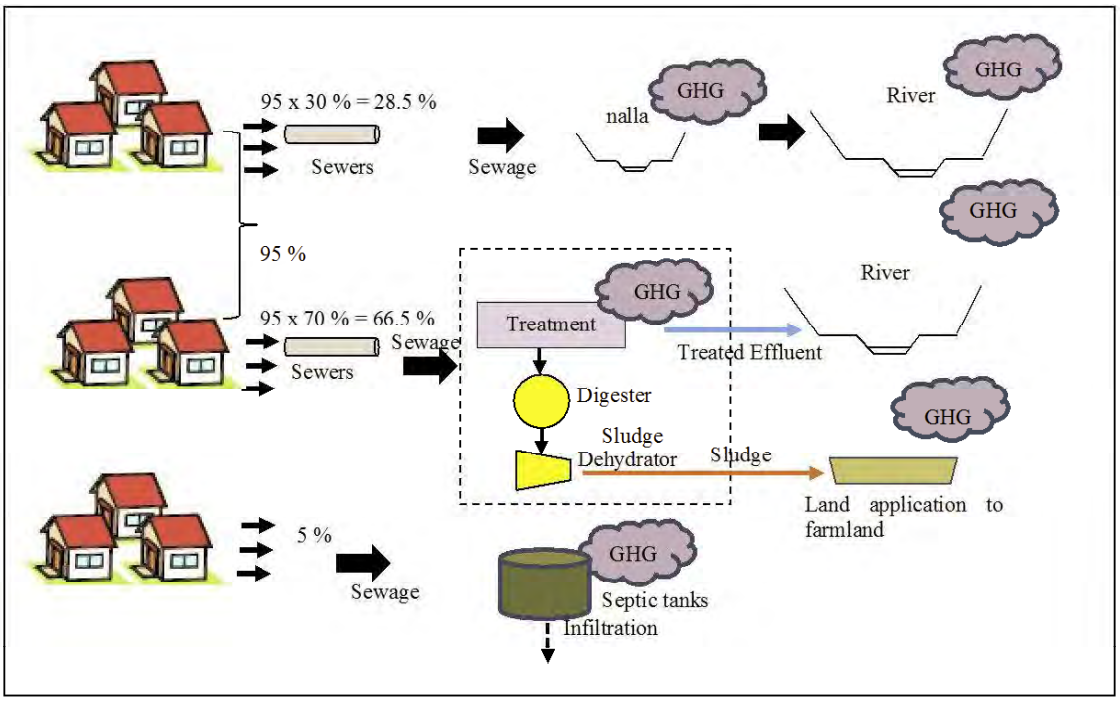
The proposed project includes the construction of two biogas power generation plants each at Naidu STP and Bhairoba STP. Possible reduction of GHGs (Green House Gases) amount was estimated for the proposed project equipped with biogas generation comparing with the case without the project. The estimation of GHGs reduction amount was studied using following methodology.

1) Data gathering of necessary data and information
   To gather necessary data and information relating to current situation on sewerage system and basic mechanism on GHGs generation for setting a baseline scenario
2) To set up a basic policy on estimation of GHGs
   To examine application of "Approved Methodology (hereinafter referred to as "AM")", "Approved Consolidated Methodology (hereinafter referred to as "ACM")" and "Approved Small-scale Methodology (hereinafter referred to as "AMS")", following the approved baseline and monitoring methodology in principle in order to estimate the potential of GHGs reduction
3) To set a project scenario to estimate the reduction of GHGs emission amount from the baseline scenario by taking the GHGs recovery of the biogas power generation into consideration
4) In addition, technical options to reduce additional reduction of GHGs compared to project scenario were studied on the viewpoint for not only physical aspect such as development of facilities or equipment but also operation and management aspect.

11.8.2 Current Situation on GHGs Emission associated with Existing Sewerage System

According to DPR, most of the sewage generated (95%) is connected to existing sewage collection system except Banner district and 70 % of the connected sewage source is treated by existing STPs and the remaining (30%) is directly discharged into drainage channel (Nalla) and rivers without treatment at STPs. In Baner district, however, its sewage source is stored at septic tanks and the sewage is infiltrated into underground because collection system has not been in service in the area. The sludge is dehydrated at existing STPs and delivered to farm lands for their land application.

The current mechanism of GHGs emission based on above situation is illustrated in Figure 11.8.1.



Source: JICA Survey Team

Figure 11.8.1 Current Mechanism on GHGs Emission due to Domestic Sewage

11.8.3 Basic Policy on Estimation of GHGs Reduction Amount

11.8.3.1 Estimation of GHGs Reduction Potential

(1) Project Boundary

According to the methodology for the mitigation of GHGs emissions with treatment of wastewater (AM0080) approved by UNFCCC (United Nations Framework Convention on Climate Change), the spatial extent of the project boundary includes:

- The site and facilities where the wastewater and sludge are treated in both the baseline and the project scenario;
- Any on-site power plants that supply electricity to the wastewater and sludge treatment systems;
- Any on-site facilities that generate heat used by the wastewater and sludge treatment systems;
- If applicable, the anaerobic digester, the power and/or heat generation equipment and/or the flare installed under the project activity;
- If grid electricity is displaced from electricity generation with biogas from an aerobic digester, the power plants connected to the grid, with the geographical boundary as specified in the latest approved version of the emission factor for an electricity system

The GHGs emission for the treatment of wastewater to be covered in the project boundary which was approved by CDM-Executive board of UNFCC is shown in Table 11.8.1.

Table 11.8.1 Emission Sources to be covered in Project Boundary approved by UNFCC

Stage	Emission Source	Type of GHGs	Direction for Use	Justification / Explanation
Baseline	Wastewater and sludge treatment	CH_4	Included	Major source of emissions in the baseline
		N_2O	Excluded	Excluded for simplification. This is conservative
		CO_2	Excluded	CO_2 emissions from the decomposition of organic waste are not accounted for.
	Electricity and thermal energy generation	CO_2	Included	Emissions from electricity/thermal energy generation in the baseline scenario arise from: (i) Electricity/thermal energy used for the operation of the baseline wastewater/sludge treatment systems; (ii) Electricity/thermal energy displaced by biogas based electricity/thermal energy generated in the project activity, if any.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Transportation of sludge	CO_2	Included	Emissions from transportation of sludge may be included.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
Project	Wastewater and sludge treatment	CH_4	Included	Major source of emissions in the baseline.
		CO_2	Excluded	CO_2 emissions from the decomposition of organic waste are not accounted for.
		N_2O	Included	In case of projects that involve land application of sludge this is an important emission source.
	On-site use of electricity and fossil fuels	CO_2	Included	May be an important emission source.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Transportation of sludge	CO_2	Included	Emissions from transportation of sludge may be included.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.

Source: Approved baseline and monitoring methodology AM0080, CDM-Executive Board, UNFCCC

(2) Setting of Emission Source in Baseline and Project Scenario

The GHGs generated as a baseline scenario is composed of those of originating in 1) untreated sewage directly flowing into rivers, 2) water treatment process in the existing STPs, 3) consumption of the electricity power in the existing STPs, 4) treated effluent in the existing STPs which discharges into rivers, 5) transportation of treated sludge, 6) land application of the treated sludge at farm lands and 7) septic tank in Baner district which is infiltrated into the underground.

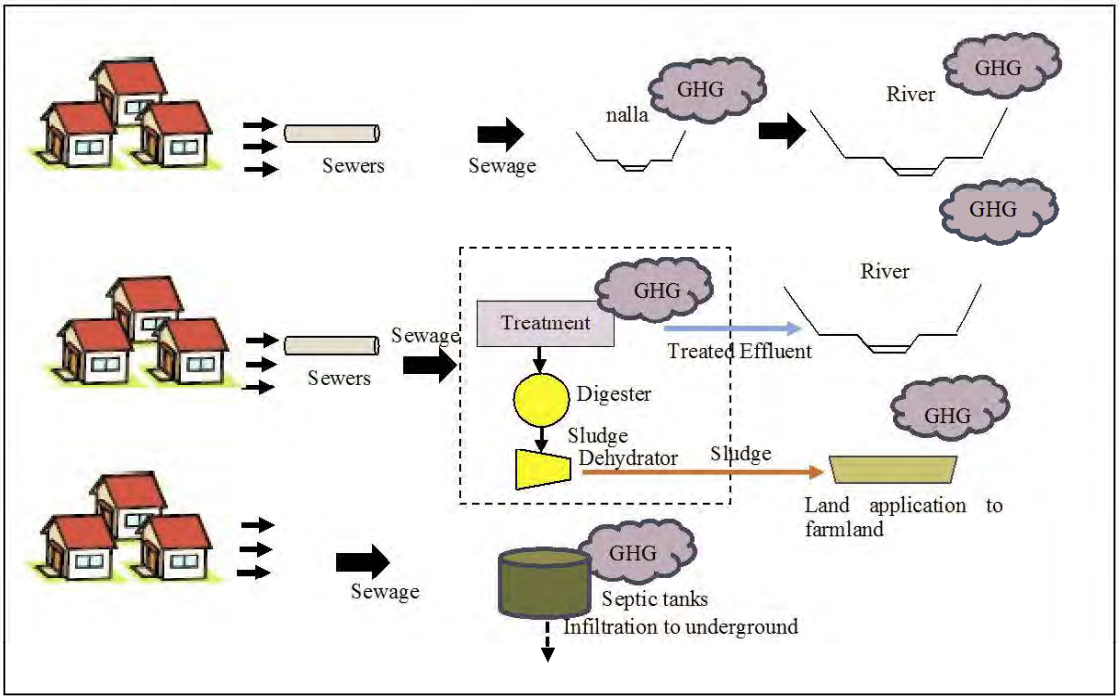
The project boundary is that all the generated sewage is treated at all STPs added with the proposed 11STPs with the bio gas power generation in Naidu and Bhairoba STPs to existing STPs at the target year of 2027 and the treated sludge is delivered to the farm lands for their land application. Therefore, the GHGs as a project scenario is composed of those of 1) water treatment process in all STPs added with the proposed STPs to existing STPs, 2) consumption of the electricity power in all STPs added with the proposed STPs to existing STPs, 3) treated effluent in all STPs which discharges into rivers,

4) transportation of treated sludge, 5) land application of the treated sludge at farm lands and the reduced GHGs at the STPs of Naidu and Bhairoba through their GHGs recovery at the biogas power generation. The estimation of GHGs associated with the use of fuel and chemicals was not included since almost no fuel consumption is practiced at existing STPs and no data on chemicals was available from existing STPs. The summary on the emission sources for the study for the baseline and project scenario is shown in Table 11.8.2 and their schematic diagrams are shown in Figure 11.8.2 and Figure 11.8.3.

Table 11.8.2 Emission Sources for Estimation of GHGs Amount for Baseline and Project Scenario

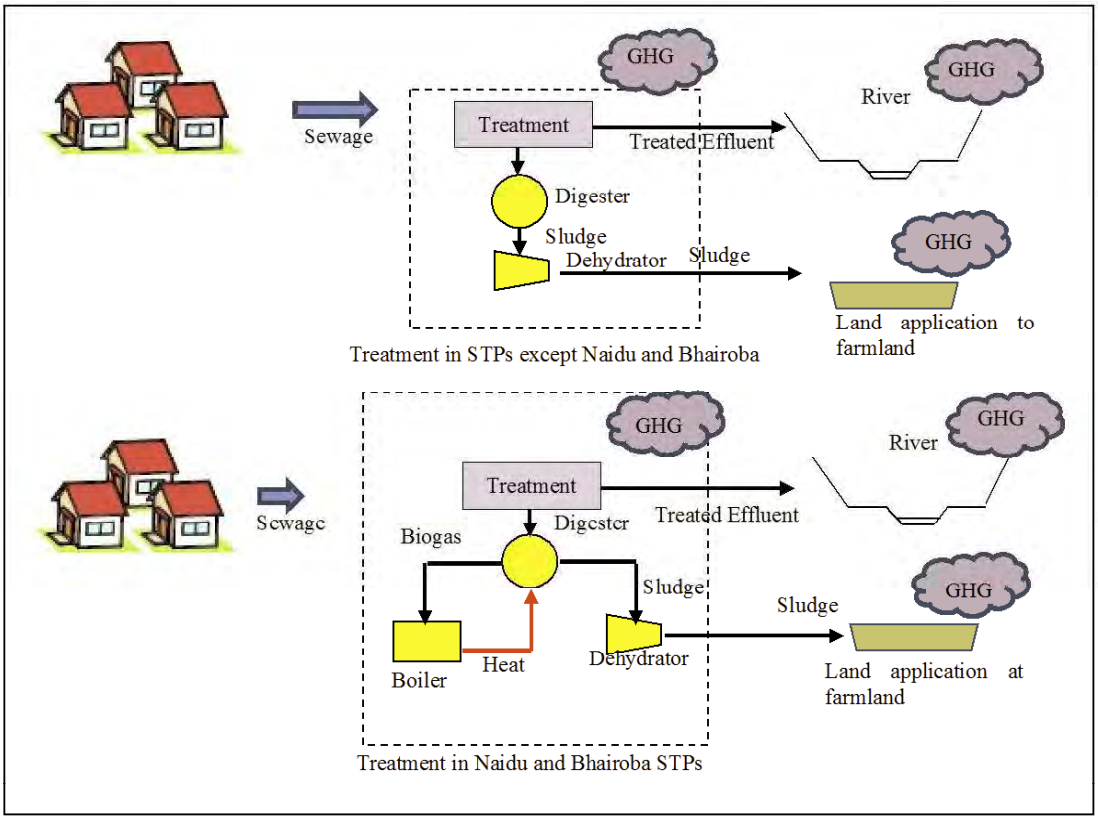
Project Boundary	Emission Source of GHGs
Baseline Scenario	✓ Untreated sewage directly flowing into rivers ✓ Water treatment process at existing STPs ✓ Electricity power consumption at existing STPs ✓ Treated effluent which discharges into rivers from existing STPs ✓ Transportation of treated sludge ✓ Land application of the treated sludge at farmlands ✓ Swage storage at septic tanks in Banner district which is infiltrated into the underground
Project Scenario	✓ Water treatment process at all STPs added with the proposed STPs ✓ Electricity power consumption at existing STPs added with the proposed STPs ✓ Treated effluent which discharges into rivers from all STPs added with the proposed STPs ✓ Transportation of treated sludge ✓ Land application of the treated sludge at farmlands ✓ Recovery of GHGs at Naidu and Bhairoba STPs

Source: JICA Survey Team



Source: JICA Survey Team

Figure 11.8.2 Mechanism on GHGs Emission as Baseline Scenario



Source: JICA Survey Team

Figure 11.8.3 Mechanism on GHGs Emission as Project Scenario

11.8.3.2 Estimation of Reduction of GHGs Emission

(1) Basic Condition for Estimation of GHGs Emission Amount

1) Basic Equation for Estimation of GHGs Emission as Baseline Scenario

The emission amount of the GHGs as the baseline scenario is calculated based on the equation below;

$$BE_y = BE_{WW,y} + BE_{WT,y} + BE_{EC,y} + BE_{TE,y} + BE_{TR,y} + BE_{LA,y} + BE_{SE,y}$$

Where,

- BE_y : GHGs total emission as a baseline in year y
- $BE_{WW,y}$: GHGs emission associated with untreated sewage discharge into rivers in year y
- $BE_{WT,y}$: GHGs emission associated with water treatment process at existing STPs in year y
- $BE_{EC,y}$: GHGs emission associated with electricity consumption at existing STPs in year y
- $BE_{TE,y}$: GHGs emission associated with the discharge of the treated effluent from STPs in year y
- $BE_{TR,y}$: GHGs emission associated with transport of treated sludge in year y
- $BE_{LA,y}$: GHGs emission associated with land application of sludge at farmlands in year y
- $BE_{SE,y}$: GHGs emission associated with sewage in septic tanks in Baner district in year y

2) Basic Equation for Estimation of GHGs Emission as Project Scenario

The emission amount of the GHGs as the project scenario is calculated based on the equation below;

$$PE_y = BE_{WT,y} + BE_{WT,y} + BE_{EC,y} + BE_{TE,y} + BE_{TR,y} + BE_{LA,y} - PE_{ELC,y}$$

Where,

- PEy : GHGs total emission in year y
- $PE_{WT,y}$: GHGs emission associated with water treatment process at aa STPs in year y
- $PE_{EC,y}$: GHGs emission associated with electricity consumption at all STPs in year y
- $PE_{TE,y}$: GHGs emission associated with the discharge of the treated effluent from STPs in year y
- $PE_{TR,y}$: GHGs emission associated with transport of treated sludge in year y
- $PE_{LA,y}$: GHGs emission associated with land application of sludge at farmlands in year y
- $PE_{ELC,y}$: GHGs reduced emission associated with biogas recovery at Naidu and Bhairoba STPs

3) Assumption of Basic Data for Estimation of GHGs Emission

The basic data for the estimation of GHGs emission for the baseline and project scenario is shown in Table 11.8.3.

Table 11.8.3 Assumption of Basic Data for Estimation of GHGs Amount

Item	Baseline Scenario	Project Scenario
Target Year	2027	2027
Population	5,745,560	5,745,560
Sewage generation volume (m^3/day)	873,000	873,000
Sewage volume treated by STPs (m^3/day)	477,000	873,000
Untreated sewage (m^3/day)	341,000	0
Sewage infiltrated to underground at Baner district	55,000	0

Source: JICA Survey Team

(2) Estimation Results of GHGs Emission Amount

1) Estimated GHGs Generation as Baseline Scenario

The GHGs emission at 2027 as the baseline scenario is given as below.

$$BE_{2027} = BE_{WW,2027} + BE_{WT,2027} + BE_{EC,2027} + BE_{TE,2027} + BE_{TR,2027} + BE_{LA,2027} + BE_{SE,2027}$$

$$= 53,764 + 11,853 + 67,752 + 92 + 19,178 + 428 + 6,324$$

$$= 159,391 \text{ t-}CO_2$$

The detail of the calculation results is shown in Table 11.8.4.

Table 11.8.4 Calculation Results of GHGs Amount at 2027 as Baseline Scenario

No.	Symbol	Equation	Unit	GHGs Amount
(1)	**$BE_{WW,2027}$**	GHGs Emission associated with natural decomposition of un-treated sewage discharge into rivers	t-CO_2/year	**53,764**
	where	$BE_{WW} = BE_{WWCH4} + BE_{WWN2O}$		
		BE_{WWCH4} = ((TOW - OC) x EF - R) x V = TOW: Organic component in BOD in untreated sewage（= 250 mg/l）, OC: Organic component extracted as sludge (=0), EF: Emission factor of CH_4 due to natural decomposition of un-	t-CO_2/year	39,206

No.	Symbol	Equation	Unit	GHGs Amount
		treated sewage (EF = B_0 x MCF) , B_0: CH_4 producing capacity for sewage (= 0.6 kg-CH_4/kg-BOD), MCF: Methane correction factor for sewage (= 0.1), R: CH_4 recovered (= 0 kg-CH_4/year) (Source: 2006 IPCC guideline), V: Untreated sewage volume, GWP: Global Warming Potential of conversion from CH_4 to CO_2 (=21)		
		BE_{WWN2O} = P x EF x A =	t-CO_2/year	14,558
		P: Population (= 5,745,560 x 0.95 x 0.3), EF: Emission factor for N_2O emissions from untreated sewage (kg-N_2O-N/kg N), N: Emission factor of N_2O from domestic wastewater as a default value indicated by IPCC 2006 Guideline (= 0.005 kg N_2O-N/kg-N), A: Nitrogen effluent per capita per day (= 10 g/person/day: T-N x Effluent Per Capita = 40 mg/L x 200 L/day = 8 g/person·day→10 g/person/day)		
		BE_{WW} = BE_{WWCH4} + BE_{WWN2O}	t-CO_2/year	53,764
(2)	**$BE_{WT, 2027}$**	GHGs Emission associated with natural decomposition of treated effluent into rivers	t-CO_2/year	**11,853**
	where	BE_{WT} = BE_{WTCH4} + BE_{WTN2O} = (EF_{WTCH4} + EF_{WTN2O}) x V		
		BE_{WTCH4} = GWP x EF_{WTCH4} x V =	t-CO_2/year	3,217
		GHGs emission originating BOD in treated wastewater: GWP: Global Warming Potential from CH_4 to CO_2 (=21), EF_{WTCH4}: Emission factor of CH4 due to natural decomposition of treated effluent = 0.00000088 t-CH_4/m^3·year, Source: JSWA (Japan Sewage Works Association), V: Sewage volume treated by STPs (= 477,000 x 365 m^3/year)		
		BE_{WTN2O} = EF_{WTN2O} x V =	t-CO_2/year	8,636
		EF_{WTN2O} (= 0.00000016 kg-N_2O/m^3): Emission factor of N2O associated with water treatment in STPs, Source: JSWA (Japan Sewage Works Association), V: Sewage treated by STPs		
		BE_{WT} = BE_{WTCH4} + BE_{WTN2O} =	t-CO_2/year	11,853
(3)	**$BE_{EC, 2027}$**	GHGs Emission associated with electric power consumption at STPs	t-CO_2/year	**67,752**
	where	BE_{EC} = EF x EC x V		
		EF: Emission factor for power generation	t-CO_2/MWh	0.895
		EF=0.895 was used for grid CO_2 emission factors in India, source: Appendix, March 2014, JICA Climate-FIT Version 2.0		
		EC: Electricity power consumption for STPs per treated sewage volume (m^3), source: JSWA (Japan Sewage Works Association)	kWh/m^3	0.4348
		BE_{EC} = EF x EC x V	t-CO_2/year	67,752
(4)	**$BE_{TR,2027}$**	GHGs emission associated with transport of treated sludge	t-CO_2/year	**92**
	where	BE_{TR} = $N_{BL,y}$ x $D_{BL,i}$ x $F_{BL,i}$ x $NCV_{BL,j}$ x $EF_{BL,j}$ x 44 / 12		
		$N_{BL,y}$: Trip number of trucks for transport of sludge (= $Q_{BL, sl,y}$ / $q_{BL, i}$)		
		$Q_{BL, sl,y}$: Sludge generation	ton/day	109.6
		$q_{BL, i}$ = Sludge amount per trip	ton/trip	4
		$N_{BL,y}$: Trip number	trip/day	27
		$BE_{TR,sl}$ = $N_{BL,y}$ x $D_{BL,i}$ x $F_{BL,i}$ x $NCV_{BL,j}$ x $EF_{BL,j}$ x 44 / 12	t-CO_2/day	0.253
		$BE_{TR,sl}$ =	t-CO_2/year	92
(5)	**$BE_{TE, 2027}$**	GHG Volume associated with Treated Effluent into Rivers	t-CO_2/year	**19,178**
		BE_{WWT} = BE_{WWTCH4} + BE_{WWTN2O}		
		BE_{WWTCH4} = ((TOW - OC) x EF – R) x V	t-CO_2/year	2,194
		TOW: Organic component in BOD in treated effluent（= 10 mg/l）, OC: Organic component extracted as sludge (=0), EF: Emission factor of CH_4 due to natural decomposition in sewage (EF=B_0 x MCF) , B_0: CH_4 producing capacity for sewage (= 0.6 kg-CH4/kg-BOD), MCF: Methane correction factor for sewage (= 0.1), R: CH_4 recovered (= 0 kg-CH_4/year), V: Sewage treated		
		BE_{WWTN2O} = P x EF x A x 50 % x V		16,984

No.	Symbol	Equation	Unit	GHGs Amount
		P: Population (= 5,745,560 x 0.95 x 0.3), EF: Emission factor for N_2O emissions from treated effluent (kg-N_2O-N/kg N), N: Emission factor of N_2O from domestic wastewater as a default value indicated by IPCC 2006 Guideline (= 0.005 kg N_2O-N/kg-N), A: Nitrogen effluent per capita per day (= 10 g/person/day: T-N x Effluent Per Capita = 40 mg/L x 200 L/day = 8 g/person·day→10 g/person/day), 50 %: Removal of N in percentage, V: Sewage treated	t-CO_2/year	
		$BE_{WWT} = BE_{WWTCH4} + BE_{WWTN2O}$	t-CO_2/year	19,178
(6)	**$BE_{LA, 2027}$**	GHG Generation associated with land application at farm lands	t-CO_2/year	**428**
		Ws: Sludge generated	t/year	39,853
		BE_{LA} = Sludge Amount x Emission Factor of N_2O x GWP (= 310)	t-CO_2/year	427.7
		Emission factor of N_2O in case of land application of liquid sludge per sludge: 0.0294 kg/ton, source: Assessing GHG emission from Sludge treatment and disposal routes - The method behind gestaboues tool, Pradel M., Reverdy, A.L., 2012		
(7)	**BE_{SE}**	BE_{SE} associated with sewage storage at septic tanks	t-CO_2/year	**6,324**
	BE_{SE}	BE_{SE} = EF x BOD = B_0 x MCF x Sewage volume at Septic tanks	t-CO_2/year	6,324
		BE_{2027} Total (= (1) + (2) +(3) +(4) +(5) +(6) + (7))		**159,391**

Source: JICA Survey Team

2) Estimated GHGs Generation as Project Scenario

The GHGs emission at 2027 as the project scenario is given as below.

$$PE_{2027} = PE_{WT, 2027} + PE_{EC, 2027} + PE_{TE, 2027} + PE_{TR, 2027} + PE_{LA, 2027} - PE_{ELC, 2027}$$

$$= 21,693 + 123,999 + 12,188 + 482 + 2,201 - 19,287$$

$$= 141,276 \text{ t-}CO_2$$

The detail of the calculation results is shown in Table 11.8.5.

Table 11.8.5 Calculation Results of GHGs Amount at 2027 as Project Scenario

No.	Symbol	Equation	Unit	GHGs Amount
(1)	***$PE_{WT, 2027}$***	GHGs Emission associated with natural decomposition of treated effluent into rivers	t-CO_2/year	**21,693**
	where	$PE_{WT} = PE_{WTCH4} + PE_{WTN2O} = (EF_{WTCH4} + EF_{WTN2O}) \times V$		
		$PE_{WTCH4} = EF_{WTCH4} \times V$	t-CO_2/year	5,889
		GWP: Global Warming Potential of the conservation from CH_4 to CO_2 (=21), EF_{WTCH4}: Emission factor of CH4 due to natural decomposition of treated effluent = 0.00000088 t-CH_4/m^3·year, Source: JSWA (Japan Sewage Works Association), V: Sewage volume to be treated by STPs (= 873,000 x 365 m^3/year)		
		$PE_{WTN2O} = EF_{WTN2O} \times V$	t-CO_2/year	15,805
		EF_{WTN2O} (= 0.00000016 kg-N_2O/m^3): Emission factor of N_2O associated with water treatment in STPs, Source: JSWA (Japan Sewage Works Association), V: Sewage treated by STPs		
(2)	***$PE_{EC, 2027}$***	GHGs Emission associated with electric power consumption at STPs	t-CO_2/year	**123,999**
	where	$PE_{EC} = EF \times EC \times V$		
		EF=0.895 was used for grid CO_2 emission factors in India, source: Appendix, March 2014, JICA Climate-FIT Version 2.0,		
		EC: Electricity power consumption for STPs per treated sewage volume (=0.4348 kWh/m^3), source: JSWA (Japan Sewage Works Association)		
		$BE_{EC} = EF \times EC \times V$	t-CO_2/year	123,999
(3)	**$PE_{TE, 2027}$**	GHGs Emission associated with Treated Effluent into Rivers	t-CO_2/year	**12,188**
	where	$PE_{WWT} = PE_{WWTCH4} + PE_{WWTN2O}$		

No.	Symbol	Equation	Unit	GHGs Amount
		PE_{WWTCH4} = ((TOW - OC) x EF – R) x V = ((TOW - OC) x B_0 x MCF – R) x V Same as Baseline scenario except Treated Volume (= 873,000 m^3/day)		4,015
		PE_{WWTN2O} = P x EF x A x 84% Same as Baseline scenario except Treated Volume (= 873,000 m^3/day) and N removal of 84 %	kg-N_2O	8,173
		PE_{WWT} = PE_{WWTCH4} + PE_{WWTN2O}	t-CO_2/year	12,188
(4)	***$PE_{TR,2027}$***	GHGs emission associated with transport of treated sludge: $PE_{TR,sl}$ = $NP_{L,y}$ x DPL,i x FPL,i x NCVPL,j x EFPL,j x 44 / 12 – Same as Base-line Scenario	t-CO_2/year	**482**
	where	$N_{BL,y}$ = $Q_{BL, sl,y}$ / $q_{BL, i}$		
		$Q_{BL, sl,y}$ =		562.0
		$q_{BL, I}$ =		4
		$N_{BL,y}$ =		141
		$PE_{TR,sl}$ =	t-CO_2/year	482
(4)	**$PE_{TE, 2027}$**	GHGs Emission associated with Treated Effluent into Rivers	t-CO_2/year	**12,188**
	where	PE_{WWT} = PE_{WWTCH4} + PE_{WWTN2O}		
		PE_{WWTCH4} = ((TOW - OC) x EF – R) x V = ((TOW - OC) x B_0 x MCF – R) x V Same as Baseline scenario except Treated Volume (= 873,000 m^3/day)		4,015
		PE_{WWTN2O} = P x EF x A x 84% Same as Baseline scenario except Treated Volume (= 873,000 m^3/day) and N removal of 84 %	kg-N_2O	8,173
		PE_{WWT} = PE_{WWTCH4} + PE_{WWTN2O}	t-CO_2/year	12,188
(5)	**$PE_{LA, 2027}$**	GHG Generation associated with land application at farm land	t-CO_2/year	**2,201**
	where	Ws: Sludge generated in dry base	t/year	205,130
		PE_{LA} = Sludge Amount x Emission Factor of N_2O x GWP (310)	t-CO2/year	2,201
(6)	**$PE_{ELC,2027}$**	GHGs emission reduction associated with biogas recovery for power generation in Naidu and Bhairoba STPs	t-CO_2/year	**19,287**
	where	Annual power generation Naidu: 770 kW x 2 units, Bhairoba: 460 kW x 2 units: (770 x 2 +460 x 2) x 24 x 365 / 1,000 MWh/year	MWh/year	21,550
		Converted amount into CO_2 EF=0.895 was used for grid CO_2 emission factors in India, source: Appendix, March 2014, JICA Climate-FIT Version 2.0	t-CO_2/year	19,287
		PE_{2027} Total = (1) + (2) +(3) +(4) +(5) – (6)		**141,276**

Source: JICA Survey Team

3) Estimated Reduction of GHGs Generation by Project

The estimated reduction amount of GHGs by the implementation of the project is given as below;

$$PE_{2027} - BE_{2027} = \mathbf{141,276} - \mathbf{159,391}\ t\text{-}CO_2$$

$$= \mathbf{18,115}\ t\text{-}CO_2$$

11.8.4 Possible Approach toward GHGs Emission Reduction other than Biogas Generation in Proposed Project

The possible approach toward GHGs emission reduction other than the biogas power generation in the proposed STP is carried out by taking the following situation into consideration.

- Limited area of project sites of the proposed STPs
- Current equipment or technology which has already been used in existing STPs

- Local condition of procurement of energy saving equipment
- Local meteorological condition

The GHGs emission reduction can be carried out by the energy saving as shown in Table 11.8.6.

Table 11.8.6 List of Possible Approach toward Energy Saving other than Biogas Generation

Process		Possible Approach (General)	Possible Approach (Specific)
Grit Chamber	Main Pump	Introduction of equipment with high efficiency	Introduction of electric motor with higher energy saving
Water Treatment	Blower	Improvement of operation	Optimization of blower volume
Sludge Treatment	Dehydration of sludge	Improvement of operation method	✓ Shortening of operation time associated with switching ✓ Control of injection of chemicals ✓ Proportional control of solids at injection of flocculation agent
		Introduction of equipment with high efficiency for dehydration	✓ Introduction of dehydrator with high efficiency capable of lowering water content of sludge ✓ Introduction of mechanical dehydrator with high efficiency capable of more power reduction
Others	Lightening	Introduction of energy saving equipment	Introduction of LED
Utilization of other energy sources	Utilization of natural energy	Introduction of solar panel	Introduction of solar panel for utilization of its energy in the facility

CHAPTER 12 Implementation Plan and Construction Cost Estimates

12.1 General

Implementation plan for the improvement of sewerage systems in PMC was prepared in this chapter covering construction/ rehabilitation of sewerage facilities and consulting services to ensure successful project implementation. Issues and problems experienced in India and recommended countermeasures for timely completion of the projects from bidding to construction stages are refereed to for preparation of the plan. Preliminary cost was estimated based on preliminary design of sewerage facilities. The costs include the requirements as a project assisted by Japanese ODA loan.

12.2 Conditions and Assumptions for Preparation of Implementation Plan

The implementation Plan for the Project shall be established referring to the lessons from the similar projects in India, as summarized below, and particular conditions and assumptions to be considered for the Project.

(1) Needs for the improvement in the project implementation based on the experiences on the similar projects in India

1) Change of Scope of the Project

a) Site conditions in terms of topography and geotechnical conditions shall be confirmed before commencement of construction work (D/D stage and prior to construction by the contractor)

2) Delay in land acquisition and statutory permissions

a) Agreement on the land use shall be exchanged between PMC and land owner/s before Loan Agreement.
b) If there is a need of relocation in the planed facility site, required action shall be started in early stage together with legislative countermeasures.

3) Procedural delays in obtaining concurrence

a) Selection of Consultants: NRCD shall prepare to complete selection procedure in shortest period by procurement specialist. In this regard, the approval process for the selection of the Consultants shall be simplified in the GoI.
b) Selection of Contractors: Conditions on the qualifications and experience of the bidders shall be stricter with a requirement to submit comprehensive and complete documents to show clearly evidence of experience of procurement of larger diameter pipes and equipment to be imported. The required qualifications shall include certificate from the clients

on the experienced projects. On-the-job training by the Consultants specialist shall be provided for the procurement specialist of PMC before and during bidding stage for the selection of contractors.

b) Reduction in the duration of approval process in PMC shall be studied to find a short cut way in the approval process for the procurement.
c) Reduction in the duration of approval process in PMC shall be sought to find a short cut way in the approval process for the procurement. The following shall be considered.

- Establishment of approval committee to simplify approval process
- Utilization of simplified format in documentation by different purpose of required approval (technical, administrative and accounting
- Training of procurement specialist of PMC upon commencement of Consulting services by general consultants

4) Poor responsiveness to biddings

a) Potential contractors for undertaking the Project shall be studied both in PMC and nationwide markets in consideration of scope of work.
b) For the bidding announcement various kind of media shall be used.

5) PQ conditions on the company's experience and quality and experience of Project manager (P/M) and engineers for construction work

a) Eligibility of bidders: The prime contractor shall be selected through International Competitive Bidding (ICB) excepting for the construction of Community Toilet Facility. However, local sub-contractors may be used for civil/architectural work.
b) The bidders for construction of STPs shall have experiences on big-size projects with a construction cost of more than 3 billion yen to ensure quality of the construction work. The bidders shall also have the experience on O&M of STPs.
c) Quality and experience of staff: Conditions on the qualifications and experience of the P/M and engineers of the bidders shall include communication capability in English. The PQ and bid documents shall request bidders to submit comprehensive and complete documents including pictures at the project sites on experienced similar projects and certificates of completed project by the clients in the similar scope of work of this Project, in order to show clearly the evidence of the capability of the P/M and engineers, as well as experience of the bidder on similar project(s) in Asian countries.

(2) Special conditions to be considered for the Project

a) Weather conditions in PMC shall be considered to assume working period/months, espe-

cially for the construction of sewers.

b) Following present procurement practices used in India, manner of bidding shall be determined by sewerage facility (sewer, IPS and STP).

12.3 Scope of Work for the Project

The scope of work for the Project is tabulated in Table 12.3.1 including Consulting Services.

Table 12.3.1 Project Components for Water Pollution Abatement of Mula-Mutha River in Pune

Category	Component	Details (Specifications)
A. Sewer	1. Construction of Main/Sub-main and Branch sewers in Baner area	43.0 Km
	2. Construction of Main sewers in the left bank area of Mutha River and Mula-Mutha River and Central area of PMC	33 Km: Sewer No. 1, 2, 6, 8a, 8b, 9, 10, 12, 13a, 13b, 14a, 14b, 15, 16, 17, 18, 19, 23
	3. Construction of Main sewers in the right bank area of Mutha River and Mula-Mutha River	37.6 Km: Sewer No. 3, 4, 5, 7, 20, 21, 22; Sewer No 5 is arranged to include in this group, though located in item 2
B. Intermediate Pump Station (IPS)	4. Rehabilitation of Kalyani Nagar IPS	
	5. Rehabilitation of New Kasba IPS	
	6. Rehabilitation of Old Kasba IPS	
	7. Rehabilitation of Topkhana IPS	
C. Sewage Treatment Plant (STP)	8. Construction of STP at Mastya Beij Kendra	Treatment capacity: 7 MLD, SBR
	9. Construction of STP at Mundhwa	Treatment capacity: 20 MLD; SBR
	10. Construction of STP at Bhairoba Nallah including Bio-gas power generation plant	Treatment capacity: 75 MLD; A_2O
	11. Construction of STP at Naidu including Bio-gas power generation plant	Treatment capacity: 127 MLD; A_2O
	12. Construction of STP at Vadgaon Bk	Treatment capacity: 26 MLD; EA
	13. Construction of STP at Warje	Treatment capacity: 28 MLD; EA
	14. Construction of STP at Botanical Garden	Treatment capacity: 10 MLD; EA
	15. Construction of STP at Tanajiwadi	Treatment capacity: 15 MLD; EA
	16. Construction of STP at Dhanori	Treatment capacity: 33 MLD; EA
	17. Construction of STP at Baner	Treatment capacity: 25 MLD; SBR

	18. Construction of STP at Kharadi	Treatment capacity:30 MLD; SBR
	19. Installation of Central SCADA System	Located at Naidu STP site
D. Community Toilet Facility	20. Construction of Community Toilet Facilities in the slum areas and fringe villages	24 units
E. GIS & MIS	Capacity Development for PMC in application of GIS and MIS for sewers and STPs/ISPs	
F. Public participation, Institutional Capacity & Environmental management	Strengthening in Public awareness/participation and institutional capacity, and facilitation of implementation of Environmental Management Plan (EMP), and Environmental Monitoring Plan (EMoP)	
G. Consulting Services	(1) Detailed Design, Bidding and construction for Sewers (2) Design Built: Basic Design, Bidding and Construction Supervision for IPS and STPs, Community Toilet Facility, and Central SCADA System	(1) Sewers: Detailed design, assistance for Bidding and construction supervision (2) IPSs & STPs, Community Toilet facilities and Central SCADA: Basic Design, assistance for Bidding and Construction Supervision (3) GIS& MIS and Public Part., Institutional Capacity & Environment: Supervise Contractors

Note: Sewer Numbers in item "A is refereed to those in sewerage DPR

12.4 Alternative Study on Implementation Plan

12.4.1 Packaging for Project Component

The major components of the Project are (1) Sewers, (2) Intermediate Pump Stations, (3) STPs including Central SCADA System, (4) Community Toilet facilities and (5) Consulting Services. The packaging of the Project for the major components was made in consideration of the following conditions by component.

A. Sewer

There are two types of sewer construction work for this project. These are:

1) Construction of sewer networks in Baner with estimated length of 43 Km and

2) Construction of main/sub-main sewers planned in the entire PMC area with a total length of 70.6 Km.

For sewer construction, a total of 3 packages are recommended dividing the requirements for 2) construction of main/ sub-main sewers into two packages, aside from one package for item 1) sewer network construction. Namely a total of 70.6 Km is divided into two parts; one for 33 Km located in the left bank area of Mutha River and Mula-Mutha River (17.8 Km), and central area of PMC (15.2 Km); and the other 37.6 Km located in the right bank rea of Mutha River and Mula-Mutha River.

B. Intermediate Pump Station (IPS)

The IPS and STP, which are constructed within the same sewerage system shall have close relationship in the operation of the sewerage system. Taking this into consideration, rehabilitation work for the IPS is included in the construction work for the specific STP which belong to the same sewerage system of the concerned IPS.

C. Sewage Treatment Plant (STP) including Central SCADA System

A total of six packages are recommended for the construction of STPs considering the following conditions.

1) An average treatment capacity per package for package grouping purpose is assumed to be about 70,000 m^3/d.
2) Planned two STPs with power generation plant using bio-gas are separated in packaging.
3) Maximum number of the STPs to be included in a package is assumed to be three based on the experience in other JICA assisted projects in India. It was found in the Bangalore project that there is a limitation in the number of STPs to be constructed simultaneously with a maximum of 3 STPs in order to maintain the quality of the construction work and for schedule control.

Installation of the central SCADA system is planned at a large STP and the work is manageable by one contractor. Thus, one package for this work is recommended.

D. Community Toilet Facility

For a limited number of facility units (3 % of existing community toilets in slum areas) applying a uniform type of building with plumbing facilities (a total of ten-sitters per toilet facility connected either to sewer or septic tank), one package is recommended. As of December, 2014, PMC identified

land availability for 24 sites for the construction of community Toilet facilities.

E. Capacity Development for PMC in application of GIS and MIS for sewers and STPs/ISPs

F. Strengthening in Public awareness/participation and institutional capacity, and facilitation of implementation of Environmental Management Plan (EMP), and Environmental Monitoring Plan (EMoP)

G. Consulting Services

Consulting services will be employed for the two kinds of construction components of the Project; design-bid-construction for sewers; and design-built for IPSs and STPs, Central SCADA System and Community Toilet Facilities. In addition, two components for supporting requirements (GIS & MIS, and people's participation, institutional development and environmental management) are included covering TOR preparation for selection of the contractors, bidding assistance and supervision of the contractors.

The following are the required packages by component for the Project

(1) Package 1: Construction of Main/Sub-main and Branch sewers in Baner area including the crossings of rivers/bridges and others using pipe-jacking method
(2) Package 2: Construction of Main sewers in the left bank area of Mutha River and Mula-Mutha River, and Central area of the PMC including the crossings of rivers/bridges and others using pipe-jacking method
(3) Package 3: Construction of Main sewers in the right bank of Mutha River and Mula-Mutha River including the crossings of rivers/bridges and others using pipe-jacking method
(4) Package 4: Construction of 2 STPs at Mastya Beij Kendra and Mundhwa with respective treatment capacities of 7 MLD and 20 MLD
(5) Package 5: Construction of STP at Bhairoba with the treatment capacity of 75 MLD including Bio-gas generation facilities and rehabilitation of Kalyani Nagar IPS
(6) Package 6: Construction of STP at Naidu with the treatment capacity of 127 MLD including Bio-gas generation facilities and New Kasba, Old Kasba and Topkhana IPSs
(7) Package 7: Construction of 2 STPs at Vadgaon and Warje with respective treatment capacities of 26 MLD and 28 MLD
(8) Package 8: Construction of 2 STPs at Tanajiwadi and Dhanori with respective treatment capaci-

ties of 15 MLD and 33 MLD

(9) Package 9: Construction of 3 STPs at Botanical Garden, Baner and Kharadi with respective treatment capacities of 10 MLD, 25 MLD and 30 MLD

(10) Package 10 Construction of Community toilet Facility in Slum areas and fringe villages

(11) Package 11 Installation of the Central SCADA system

(12) Package 12 Capacity Development for PMC in application of GIS and MIS for sewers and STPs/IPSs

(13) Package 13 Strengthening in Public awareness/participation and institutional capacity, and facilitation of implementation of Environmental Management Plan (EMP), and Environmental Monitoring Plan (EMoP)

(14) Package 12 Consulting Services

The contractors' work for Packages 4 to 9 and Package 11 will include O&M of STPs for five years after construction/installation of the facilities.

12.4.2 Procurement Method for the Implementation of the Project

(1) Manner of Contract for the construction of sewerage facilities

All packages may be implemented by application of the method used for normal loan projects. However, for the construction/rehabilitation work for STPs and IPSs, and community toilet facilities, design-Built method is recommended following current practices in the similar projects in India. While for the construction of sewers, Design-Bid-Construction method shall be adopted, since this work needs to adjust/arrange right of way for pipe laying and house connections with beneficiaries.

(2) Possibility of Local Bidding

With regard to the manner of bidding for construction work, generally, Local Competitive Bidding (LCB) is more advantageous than International Competitive Bidding (ICB) in terms of the time required from the start of bidding to contract award. However, it seems to be difficult to adopt LCB for the Project excepting for community toilet facilities, because of the technical expertise required for the construction of sewers and STPs as well as limited experience on larger scale sewerage projects by local contractors. Therefore, excepting for the construction of community toilet facilities, ICB shall be used for all packages to maintain the quality of the required facilities and timely completion of construction works, although local Contractors may be employed as sub-contractors. On the other hand, supporting components of the Project for Capacity Development for PMC in application of GIS and MIS, and Strengthening in Public awareness/participation and institutional capacity, and facilitation of implementation of Environmental Management Plan, LCB is recommended.

(3) Procurement Methods

In application of ICB, normal procurement procedure is recommended for all packages based on the discussions in the above sub-sections.

Table 12.4.1 summarizes the procurement methods both for Consultants and Contractors.

Table 12.4.1 Procurement Method

Procurement	Scope of Work	Manner of Procurement with required process/ events
Consultants	One consultancy package: D/D, Assistance for Bidding and C/S for sewer packages of work and Basic Design, Assistance for Bidding and C/S for IPSs & STPs, Community Toilet Facilities and SCADA System	ICB (Short list, QCBS)
Contractor	Construction of sewers: Design-Bid-Construction	ICB (PQ, Single stage with two envelope)
Contractor	Construction of Community Toilet Facilities: Design-Built	LCB (PQ, Bid, Approval)
Contractor	Construction/rehabilitation of IPSs and STPs, and Central SCADA System: Design-Built	ICB (PQ, Single stage with two envelope)
Contractor	Capacity Development for PMC in application of GIS and MIS, and Strengthening in Public awareness/participation and institutional capacity, and facilitation of implementation of EMP and EMoP	LCB (PQ, Bid, Approval)

There are sufficient number of potential contractors for the implementation of the Project. Table 12.4.2 shows potential contractors for the implementation of sewerage projects in India through ICB. For the implementation of IPSs and STPs, they have experience on the similar ODA projects in India as well as financially sound with annual income of more than 500 million INR at present. For sewer construction, they (Indian contractors) have experiences including the construction of more than 10 Km sewers as well as financial soundness (more than 500 million annual income).

12.4.3 Implementation Schedule by Major Component /Procurement Case

(1) Conditions of Implementation Schedule

Appraisal of the Project and Exchange of the Note between GoI and GOJ and Loan agreement are assumed to be completed in March 2015, as shown in Table 12.4.3.

Table 12.4.3 Loan Agreement Schedule

Detailed Fact Finding of the Project	January, 2015
Pledge of JICA Loan	February 2015
Exchange of Note between GOB and GOJ	March 2015
Signing of Loan Agreement	March 2015

Table 12.4.4 shows the required months for the implementation of the Project under the following site conditions and assumptions.

- Rainy season from July to September and a series of national holidays usually affect the civil works in the PMC area. In this regard, annual working months are assumed to be 9 months in consideration of non-working months.

Table 12.4.4 Package and Construction Periods

Item	Date	Remarks
Loan Agreement	March, 2015	
Selection of Consultant	12 months, April, 2015 to March, 2016	
Detailed Design of Sewers	18 months, April, 2016 to September, 2017	
Basic Design of IPS & STP	6 months April, 2016 to September 2016	
Detailed Design of Community Toilet	10 months April, 2016 to January 2017	
Selection of Contractor		
Package 1	October, 2017 to September, 2018	PQ: May, 2016 to July, 2016
Packages 2, 3	May, 2017 to April, 2018	ditto
Packages 5, 6 &11	October, 2016 to September, 2017	ditto

Item	Date	Remarks
Packages 4, 7, 8 & 9	ditto	
Package 10	February, 2017 to January, 2018	
Package 12	April, 2016 to September, 2016	
Package 13	ditto	
Construction stage		
Package 1	31 months October, 2018 to April, 2021	
Packages 2, 3	36 months May, 2018 to April, 2021	
Packages 5, 6 &11	48 months October, 2017 to April, 2021	
Packages 4, 7, 8 & 9	42 months October, 2017 to October, 2020	
Package 10	12 months February, 2018 to January, 2019	
Package 12	October, 2016 to September, 2018	
Package 13	October, 2016 to September, 2017	
O&M stage for IPS & STP		
Packages 4 to 9 &11	May, 2021 to April, 2026	
Completion of Project including defects liability period	July, 2022	

- Construction period of the Project is assumed at 48 months including rainy season.
- Shop inspection for procurement of materials/equipment is included in the construction period.

Figure 12.4.1 shows the Work-flow of bidding procedure to select contractors (Two-Envelope Bidding under JICA Procedure) and required time by major work is summarized below.

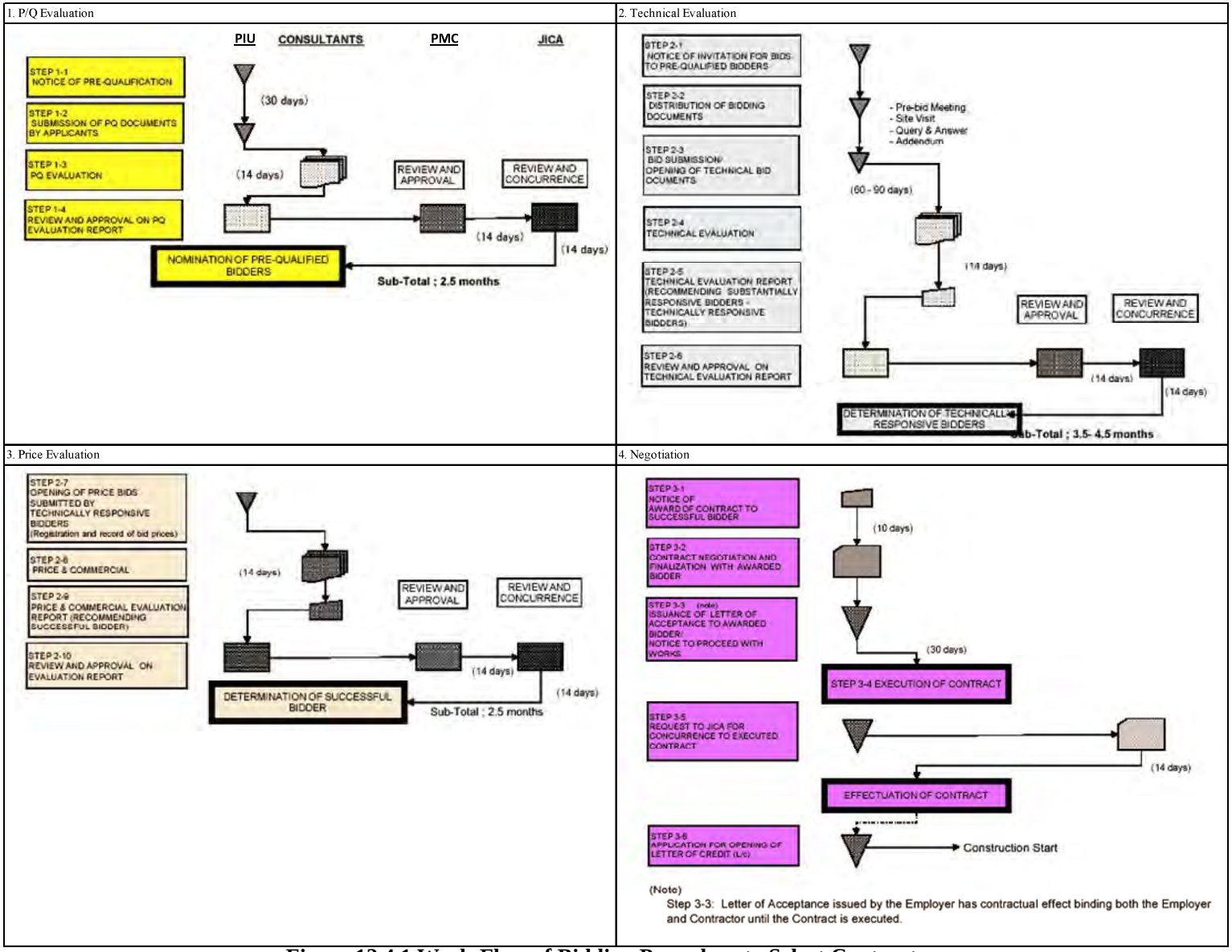


Figure 12.4.1 Work-Flow of Bidding Procedure to Select Contractors

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12.5 Project Implementing Unit

12.5.1 Present Institutional Arrangements for the Relevant Sectors

Concerned sectors are Water Supply and Sewerage sectors in PMC. The following are present arrangements in the sectors.

12.5.1.1 Sewerage sector

Sewerage facilities managed by PMC include 2200 km of sewer networks, 10 STPs, and 6 IPSs.
The following are practiced for sewerage sector management.

Planning, construction supervision and O&M of sewerage facilities (STPs and PSs): Under the supervision of Superintending Engineer (Projects & Coordination), the team of Executive Engineer (1), Deputy Engineers (4) and Junior Engineers (8) carry out all works related to project planning, supervising construction and later monitoring the O&M. Planning work for sewer network is also undertaken by the same staff. Task delegation is random and there are no separate units for planning, construction and O&M requirements.

PMC took a policy decision to outsource the O&M of its STPs and PSs to private contractors in the year 2005. Presently, out of the 10 STPs, and 6 PSs, PMC has outsourced O&M of 9 STPs and 6 PSs to private contractors. The details relating to the private agency carrying out the O&M of each STP and the associated PS are presented in the Table 12.5.1.

Table 12.5.1 Outsourcing Status on STP and PS

S. No	Name of STP	Capacity MLD	Name of IPS	Name of O&M Company
1	Bhairoba	130	Kalaninagar, Mental Hospital	M/s Mahabal Emviro Engineering.
2	Enandavane	50		M/s Vetech Wabag,.
3	Tanajiwdi	17		M/s Vetech Wabag,
4	Bopodi	18	Botanical Garden	M/s Dharpure.
5	Mundhwa	45		M/s. Chaudhari Ltd.
6	Vitthalwadi	32		M/s Ramky Infrastructure Ltd
7	Naidu (New)	115	Topkhana, Kasba (New) Kasba (Old)	M/s Enviro Control
8	Baner	30		M/s Gondwana
9	Kharadi	40		M/s Enviro Control

Each of the above mentioned contractors has entered into five years contract with PMC. O&M cost agreed between the company and PMC is paid on monthly basis. Electricity consumption charges are paid directly by PMC to Maharashtra State Electricity Board. Staff and all consumable material, other than chlorine, is procured directly by the contractors. PMC is supplying chlorine to each STP, because of government restrictions on sale of chlorine to private persons.

Daily 'flow data' from all STPs is collected by Junior Engineers and recorded at the office of Executive Engineer. Consolidated weekly 'flow data' report is checked by SE and sent to the City Engineer. Junior Engineers make weekly visit to each STPs and IPSs by rotation. Executive Engineer conducts monthly meetings with each of the companies, individually, based on a predefined time schedule.
The O&M contractors prepare the following monthly reports and submit to Executive Engineer of PMC.

- Log Sheet of Test Result (Daily Analysis Report).
- Flow data.
- Daily MSEB Reading.
- MPCB Sample Testing report.
- Mechanical maintenance statement.
- Electrical maintenance statement
- Chemical Consumption statement.
- Oil & Grease Schedule.
- Electrical maintenance panel report.
- Polyelectrolyte Consumption record.
- Chlorine Consumption record.
- Employees Attendance statement.
- Monthly Employee Provident Fund & Employees' State Insurance Scheme of India Challan
- Material Purchase bills

The following are specific arrangements for the existing sewerage facilities.

- ✓ O&M of old STP at Naidu Hospital and IPS at Kasba: As mentioned above, out of the 10 STPs and 6 IPSs, PMC has outsourced O&M of 9 STPs and 6 IPSs to private contractors. However, O&M of 1 STP (Naidu Hospital) and 1 IPS (at Kasba) is carried out by in-house team headed by Superintending Engineer (Electrical), supported by Executive Engineer (1), Deputy Engineer (1) and Junior Engineers (3).
- ✓ Construction of the Sewer network: Superintending Engineer (Sewerage) is responsible for con-

struction of sewer network, supported by a dedicated team of 11 engineers comprising of Executive Engineer (1), Deputy Engineers (3) and Junior Engineers (7). Their key function is to carry out works valued above INR 2.5 million and sewer lines with diameter of 450 mm or above.

- ✓ O&M of Sewer Network: For managing the sewer network, the city area is divided into four zones, each under a Zonal Commissioner assisted by an Executive Engineer. Each zone is further sub-divided into 15 wards (these are not related to the 152 Administrative Wards), each having one Deputy Engineer and one Junior Engineer to oversee O&M of sewer line, chambers etc. Accordingly, there are 4 Zonal Commissioners, supported by Executive Engineers (4), Deputy Engineers (15) and Junior Engineers (15).
- ✓ Zonal Commissioners, Executive Engineers, Deputy Engineers and Junior Engineers have their offices in the field. Superintending Engineers upwards in the hierarchy have their offices at PMC Headquarters.

The Sewerage sector organization structure described above is summarized in the Figure 12.5.1.

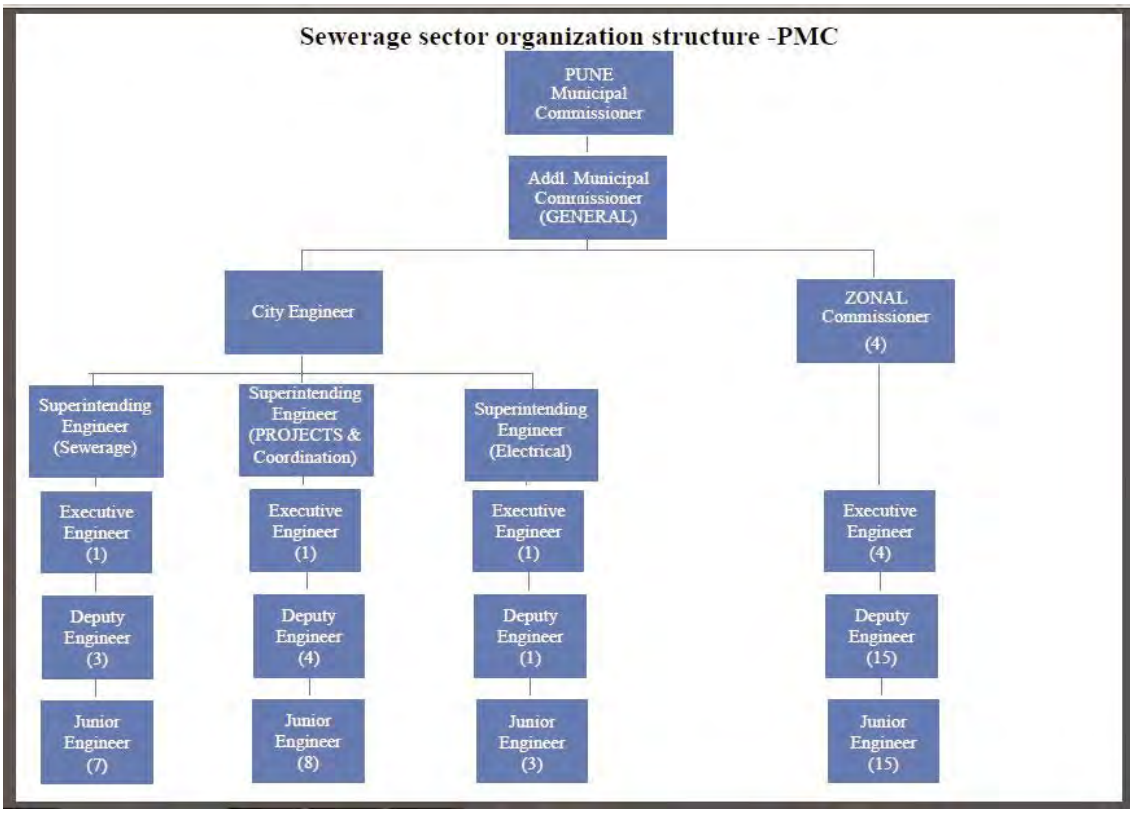


Figure 12.5.1 Sewerage Sector Organization Structure

12.5.1.2 Water supply sector

Hierarchy in the Water Supply Sector follows a similar pattern to the organization structure of Sewerage Sector till the City Engineer level as shown in the Figure 12.5.2.

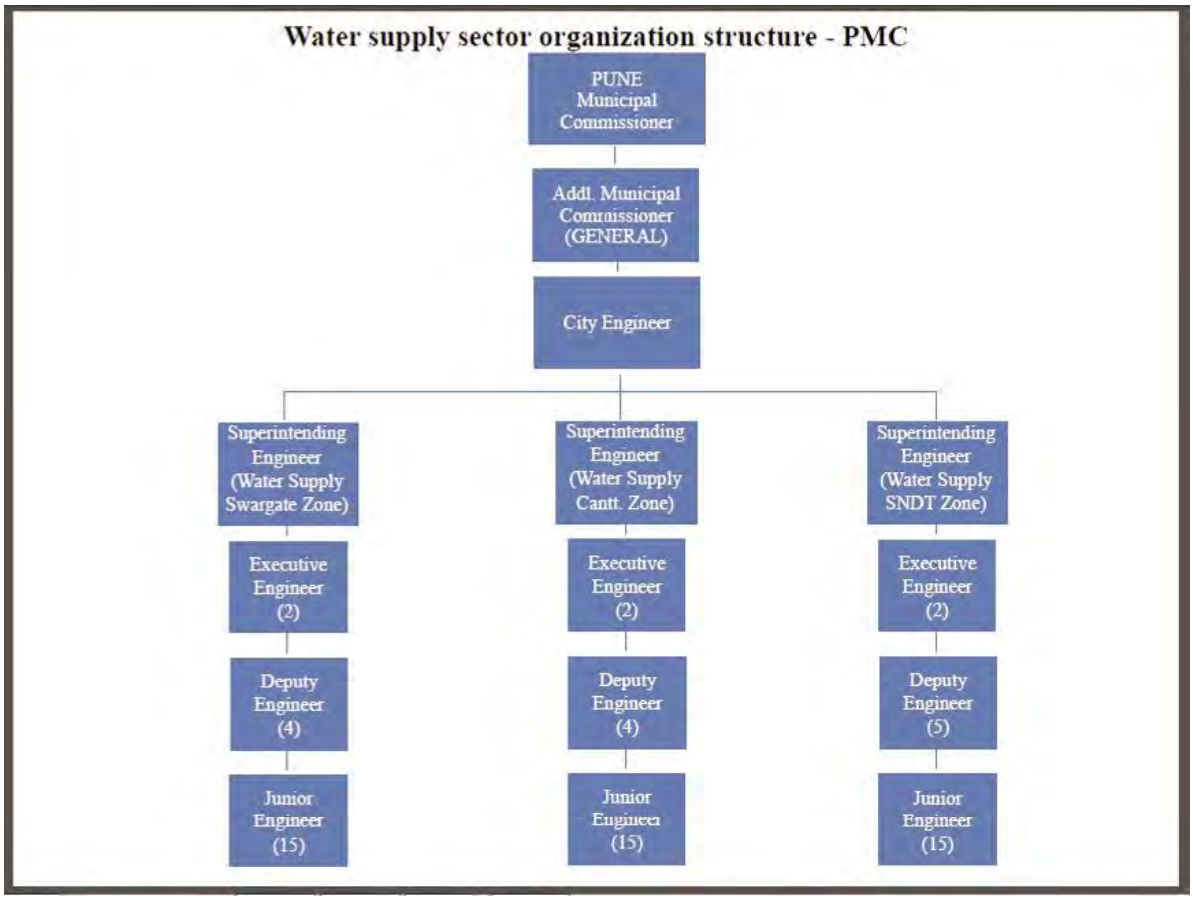


Figure 12.5.2 Water Supply Sector

For managing the water supply, Pune city area has been divided into three zones viz. Swargate zone, Cantonment zone, and SNDT zone. These are field offices of PMC. Each Zone is headed by a Superintending Engineer who manage the water supply in their respective zones. A total team of 64 engineers [Executive Engineers (6), Deputy Engineers (13) and Junior Engineers (45)] undertake the assigned work to run the system from 6 offices (2 per zone). The engineering team is involved with planning, construction of the water supply network and O&M of the network, 6 WTPs and 20 WPSs. Similar to sewerage, here too task delegation is random and there are no separate units for planning, construction and O&M functions; the same team would be planning the project, supervising the construction and later managing the O&M.

It is worth highlighting that the construction of the WTP and WSP is not carried out by the above staff.

Task of planning and construction supervision of WTP and WSP is entrusted to Superintending Engineer (Projects & Coordination) and his staff (mentioned under Sewerage sector above). After project completion, the WTP and WSP are handed over to the respective Zonal Superintending Engineer for O&M works.

12.5.1.3 Project approval and sanctioning process:

Before project implementation can commence all expenditure for works carried out by PMC require three sanctions, namely

- Budget sanction
- Technical sanction and
- Financial sanction.

The 'Budget' and the 'Financial' sanctions are awarded by the 'Standing Committee' of PMC, and the technical sanction is awarded by the 'Estimates Committee'. Standing Committee comprises 17 Councilors, elected from among the 152 Ward Councilors. These 17 Councilors, in-turn select a Chairman from amongst them. Municipal Commissioner is also a member of the Committee.

Budget sanction: All 'capital' as well as 'O&M' schemes/ projects are conceptualized by the 'Project and Coordination Division'. A tentative cost figure is calculated and allocated to the project. The 'docket' with all proposals is discussed and consent taken from the City Engineer who forwards the same to the Municipal Commissioner for presentation to the 'Standing Committee' for Budget approval. This activity is carried out annually during the months of January to March and approval is awarded before the start of next financial year i.e. April 01.

Technical sanction: Once the project budget approval has been obtained, engineers from the 'Project and Coordination Division' prepare detailed estimates, either in-house or by outsourcing the preparation to local agencies. Detailed Project Report is put up for Technical sanction to the 'Estimates Committee', which meets twice each month. This Committee is headed by Additional Municipal Commissioner (General) and has City Engineer plus all Heads of Departments (HoD) as members.

Financial sanction: Tendering process is initiated after the projects are awarded 'Technical sanction'. The stipulated bid selection process is carried out to select the agency. All details related to the project are presented by the Municipal Commissioner to the 'Standing Committee' for obtaining the 'Financial Sanction'. Municipal Commissioner is assisted in the process by City Engineer and the concerned HoD. To facilitate this process, the 'Standing Committee' meets each Tuesday of the week.

The above process is followed for all works costing INR 2.5 million and above. To make the sanctioning process faster for works below this limit of INR 2.5 million, the proposals are put up to Prabhag Samiti's (Mini Standing Committees) who operate out of the 15 Ward Offices of PMC and have a similar composition as at PMC's main office.

12.5.1.4 Project construction process:

Project management functions, based on discretionary allocation of task, are assigned to specific team of engineers for construction monitoring by the respective HoD. Here it is worth mentioning that during execution of the project, any variation /deviation related to quantity, cost, policy or legal provisions, has to follow the following process of approval:

A detailed note pertaining to the variation /deviation is prepared by the Deputy Engineer, scrutinized by Executive engineer and the Superintending Engineer. The Superintending Engineer has to get approval of the Internal Auditor's office and Vigilance office before it is put up for Additional Municipal Commissioner (General) and Municipal Commissioner to consider. The Municipal Commissioner then presents the detailed note pertaining to the variation /deviation to the Standing Committee for approval.

12.5.1.5 Challenges

Pune urban water supply and sanitation infrastructure coverage is yet to improve; the quality of water and sanitation services is not commensurate either with the scale of public investments or the economic growth of Pune.

In the current institutional structure of PMC the functions of policy making, and service provision are not clearly delineated, and lead to conflicting objectives, political interference and lack of incentives and accountability. There is lack of clarity on institutional arrangements, particularly with regard to functions such as planning, financing, regulation, and management, etc. To commence with any improvement and for creating a related development plan, it is essential to understand the prevailing situation in PMC. During this first preparatory study, interactions with key PMC staff at various levels, and observations have resulted in a compilation of organizational challenges faced by PMC management and staff. These "areas for improvement/issues" are enumerated below:

(1) Strategic issues

Multiple authorities (Administrative, Executive and Legislative - three chains of instructions) and multiple responsibilities of field staff have led to reduced productivity; the staff is frequently faced with the question whether to follow the Ward Councilor's directive or Executive Engineer's instruc-

tions.

Lack of Quality policy leading to project time over run leading to loss of economic benefits (70 % of projects experience time over run).

Poor cadre management and inadequate recruitment planning has led to shortage of appropriate staff. (though it is informed that plans are in place to induct 500 Engineers into PMC by the end of this year).

(2) Processes and system issues

No 'Job Description Document' exists in PMC, resulting in discretionary allocation of tasks based on ad hoc assignment of functions depending on the urgency and staff availability at that given time.

Systematic review mechanism to monitor plans and regulations is not followed. Procedures, though laid down, are not followed due to paucity of time which is further attributed to insufficient staff.

SOPs have been prepared for the STPs and SPSs but there is no documented standard procedure available to guide the O&M of the network.

Currently, 'expenditure incurred' is considered as indicator of the extent of completion of work. For example, once the budget is fully utilized for the construction of a building, it is accepted as 'work completed'. However, quality of construction, such as water seepages in the building within six months, does not receive due attention.

(3) Structural issues

- Functional units like planning and cost control, asset management are missing; Asset management with the objective of defining and describing the key elements of movable and immovable infrastructure, more specifically water supply, sewerage and drainage networks, pumping, storage, and treatment facilities. It is important to have appropriate management information on asset condition, infrastructure costs and performance, and the consolidated requirements for repairs and maintenance, as well as appropriate maintenance standards.
- Lack of functional specialization, specialized 'sector management' units which is required for water supply and sewerage sector

(4) People - HRM issues

- Lack of effective human resource management & development policy (performance management, manpower planning, need based training, transfer policy not linked with workload);
- Work load analysis required to match geographical spread, manpower and other resources - rightsizing of all units for "adequate" and "appropriate" human resources
- Shortage of full time operational staff in PMC's water supply and sewerage team who can be

trained, retained and incentivized to perform well. This has affected the management of services, as well as works supervision.

- Feeling of 'ownership' missing among PMC staff – cause is attributed to nepotism, practices;
- Lack of structured Training policy for induction training, in-service training and exposure visits for updating technical skills as well as for learning new skills such as contract management, construction management, and overall project management.

12.5.2 Project Implementation Unit Plan

To manage the project efficiently, a well-defined management structure has to be in place well before the first activity can begin. This management structure will comprise of 1) Project Steering Committee (PSC) and 2) Project Implementation Unit (PIU).

12.5.2.1 Project Steering Committee – Objectives, Role and Composition

This committee will be formed to monitor and guide the performance of PIU consisting of the representatives from NRCD and PMC. The objective served by this committee will be to:

- periodically review project performance
- decide on major issues, such as fund flow, manpower resources
- remove implementation bottlenecks,
- resolve land acquisition issues,
- award permission for special procurements,
- carry out policy reforms, where needed, etc.

The Committee will comprise of the following members:

- Advisor NATIONAL RIVER CONSERVATION DIRECTORATE (NRCD)
- Commissioner, Pune Municipal Corporation (PMC)
- Director NRCD (MoEF)
- Deputy Director NRCD (MoEF)
- City Engineer, PMC
- Deputy Project Director, as Member Secretary

The committee members will meet every three (3) months for the total duration of the project. Meetings will be held at Pune and Delhi, alternatively. Participation of Project Consultant (Design Supervision and Management) in the meetings will be by invitation, as required. The institutional arrangement is depicted in Figure 12.5.3.

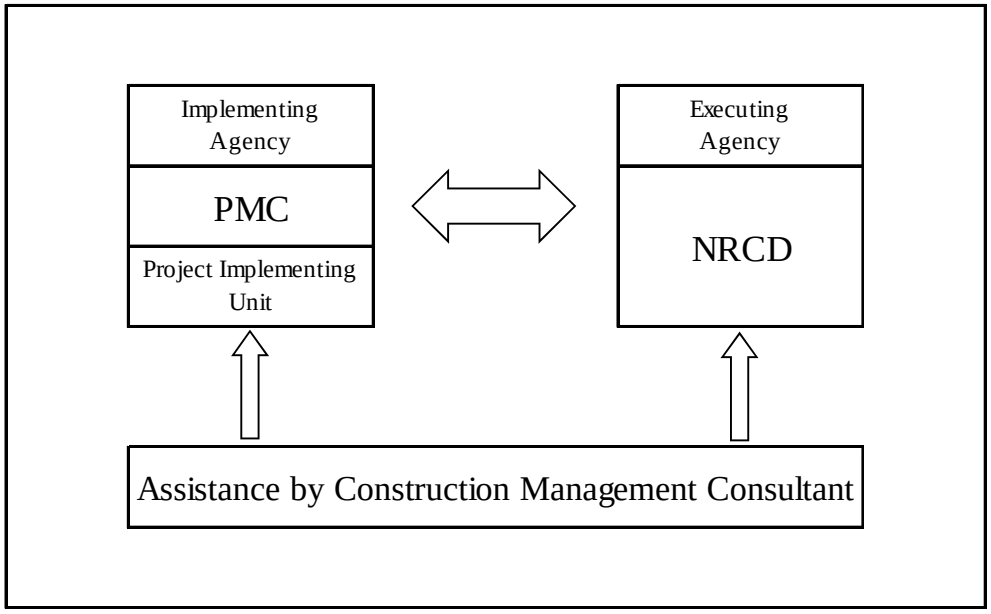


Figure 12.5.3 Institutional Arrangement for Project Implementation

For the proper implementation of the project and optimizing the maximum benefit from the construction and other related activities, it is recommended that following Project Implementation Unit (PIU) would be required. As stated earlier, the construction of sewers shall be done through conventional design-bid-build approach (item rate contract), while the STPs and ISPs in addition to Community Toilet facilities and Central SCADA System would be constructed/installed under a design-build approach and it is anticipated that the same Contractor shall be required to operate and maintain the STPs/ISPs.

PMC has to ensure that the PIU is in place before the start of the project.

1) Role of PIU

The key aims and objectives of the PIU will be to:

- Ensure that 11 Sewerage Treatment plants, 113.5 km of sewer pipe (main and sub-main), 4 sewerage pumping stations, 40 Community Toilet facilities and Centralized SCADA needed for Pune city are constructed as per prescribed design parameters.
- Manage the funds, and coordinate with NRCD (MoEF&CC) and JICA.
- Engage Design, Construction Supervision and Management Consultant for the purpose of planning, design and execution of the above, 13 packages.
- Facilitate the procurement procedure, based on JICA procurement guidelines, for the 13 Packages to select contractors.
- Supervise execution of the projects, managing the day-to-day activities.

- Monitor progress of projects under execution, receive implementation reports and issue such directions as may be necessary for securing satisfactory implementation and execution of the projects.
- Monitor and release funds to all such executing agencies (contractors) who would be engaged for implementing or executing the projects.
- Engage the services of experts, as and when needed, for advice on specific issues that may arise during the execution of the projects.
- Initiate and implement structural and institutional changes in PMC.

2) Staffing of Project Implementation Unit (PIU)

The PIU consist of central and local offices. The staff of the central office shall reserve specialist/engineer team, which can contribute to not only project component works, but also commonly to overall water sector of PMC; while staff assigned to local office work for specific packages of the Project. The staffing requirements are summarized in Table 12.5.2 by central and local office.

Table 12.5.2 Project Implementation Unit in Central Office

Specialist/Engineer	No of Specialist/Eng.	Assignment
Civil Eng. Civil Eng.	3 2	(3) 6 packages for STP & IPS (4) 3 packages for Sewer + 1 package for Community Toilet
Mechanical Eng.	3	(1) 6 packages for STP &IPS
Electrical Eng.	3	(1) 6 packages for STP &IPS
GIS Spec.	2	(1) 11 packages for construction components of the Project
MIS Spec.	2	-do-
SCADA Spec.	2	-do-
Environmental Spec.	2	(1) 6 packages for STP & IPS and 3 packages for Sewer + 1 package for Community Toilet
Community Development Spec.	2	(1) 11 packages for construction components of the Project
Procurement Spec.	3	(1) 11 packages for construction components of the Project
Project Accountant	6	(1) 11 packages for construction components of the Project

Local offices comprise 4 kinds of offices broken down into “Sewer”, “STP and IPS”, “Community Toilet Facility” and “Central SCADA System”. Each one Project Engineer shall be assigned to the total of 11 packages. The project Engineers shall be supported by Junior Engineers. Table 12.5.3 shows composition of staff members by component.

Table 12.5.3 Project Implementation Unit in Local Office

Component Work	Assignment	No. of Spec./Eng.
Sewer	Each one Project Eng. for 3 packages 2 each Jr. Civil Eng. for 3 packages	PE: 1 Eng. x 3 Packages = 3 Eng. Jr. CE: 2 Jr. CE x 3 packages = 6 Jr. CE
STP & IPS	Each one Project Eng. For 6 packages 2 each Jr. Civil Eng. for 6 Packages	PE: 1 Eng. x 6 packages = 6 Eng. Jr. CE: 2 Jr. CE x 6 packages =12 Jr. CE
Community Toilet Facility	One Project Eng. 2 Jr. CE	PE: 1 Eng. Jr. CE: 2 Jr. CE
Central SCADA System	One Project Eng. One Jr. Electrical Eng.	PE: 1 Eng. Jr. CE: 1 Jr. CE

Table 12.5.4 presents required quality and experience for the staff of the PIU.

Table 12.5.4 Required Qualification and Experience of the Staff of PIU

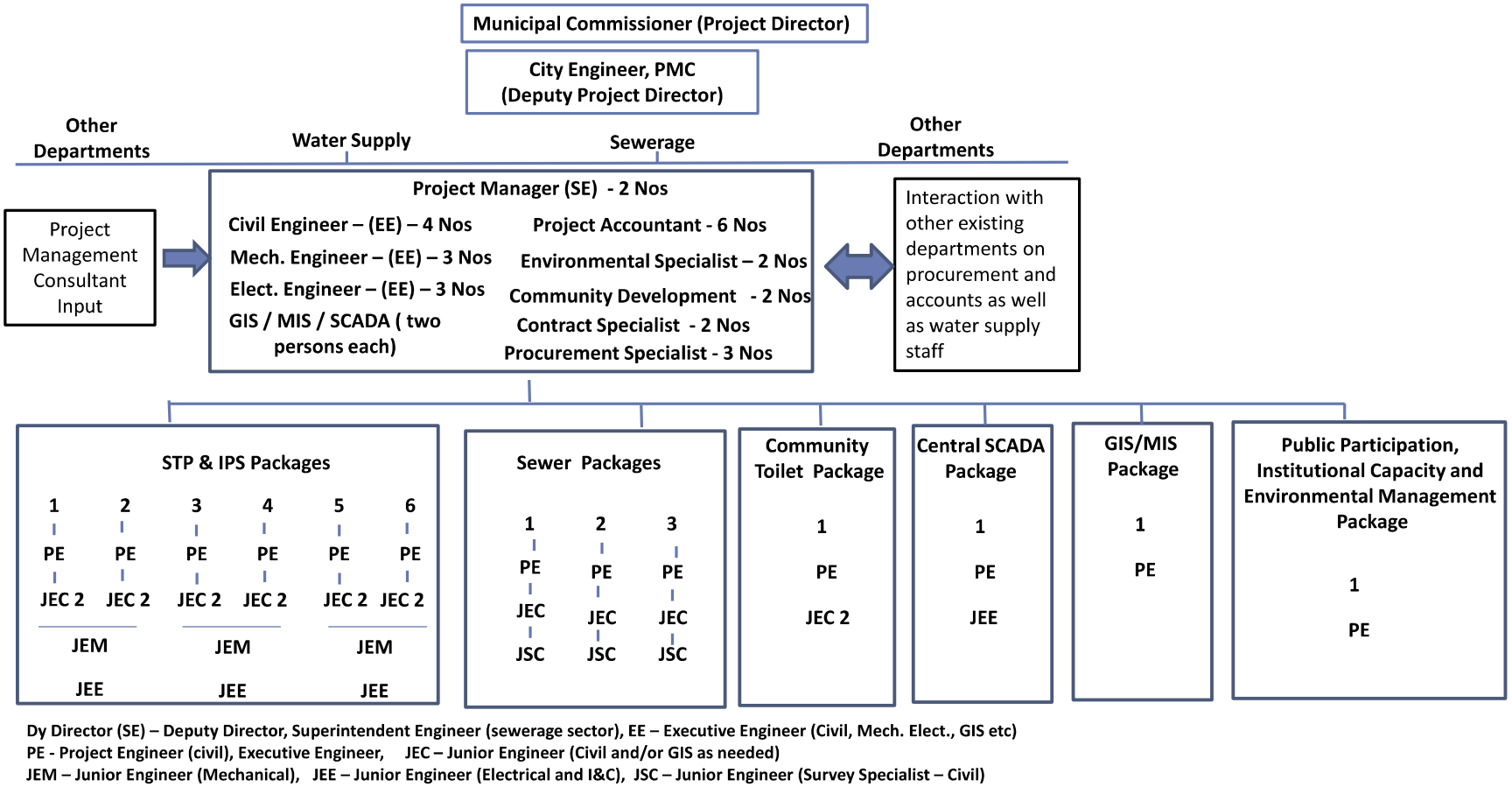
No.	**Position**	**Numbers** (approx.)	**Remarks**
1	Project Director	1	equivalent to Municipal Commissioner (MC), experience 25 yrs.
2	Senior Project Manager (Dy. Directors)	2	equivalent to City Engineer (CE), experience 20 yrs min.
3	Senior Accounts Manager	1	equivalent to Chief Accounts Officer (CAO), experience 20 yrs min.
4	Project Manager (STP & IPS)	3	equivalent to Executive Engineer (EE) -Civil, experience 15 yrs min.
5	Project Manager (Sewers)	3	equivalent to EE, experience 15 yrs min
6	Project Manager (STP & IPS)	3 / 3	equivalent to EE- Electrical /Mechanical, exp-15 yrs min
	Project Manager (PM) (CTC/Trg./PPA/M&E)	1	equivalent to EE, experience 15 yrs min; Community Toilets, Public Participation & Awareness Program, Training coordination, Monitoring and Evaluation.
7	Project Engineers (Sewers)	3	equivalent to Deputy Engineer (Dy.Engr), experience 10 yrs min
8	Project Engineers (STP & IPS)	6	equivalent to Dy Engr, experience 10 yrs min

No.	Position	Numbers (approx.)	Remarks
9	Project Engineers (Elec./Mech.) (STP & IPS)	3 / 3	equivalent to Dy Engr (Elec/Mec), experience 10 yr min
10	Project Engineers (Instrumentation) (STP & IPS)	1	equivalent to Dy ER (Instru.), experience 10 yrs min
11	Project Engineers (CTC/Trg./PPA/M&E)	1	equivalent to Dy ER, experience 10 yrs min
12	Field Engineers (Sewers)	6	equivalent to Junior Engineer(JE),experience 5 yr min
13	Field Engineers (STP & Pumping Stations) including Civil, Mech and Elect	18	equivalent to JE, experience 5 yrs min
14	Field Engineers (Instrumentation) (STP & IPS)	2	equivalent to JE, experience 5 yrs min
15	Field Engineers (CTC/Trg./PPA/M&E)	2	equivalent to JE, experience 5 yrs min

Support Team

16	Environmental Engineer (Env. Er)	2	experience 15 yrs min; for Env. impact monitoring
17	Community Development Officers (CDO)	2	experience 12 yrs min
18	Management Information System Officer (MIS)	1	experience 10 yrs min
19	Accounts Officers (AO)	1	experience 12 yrs min
20	Assistant Accounts Officers (AAO)	6	experience 8 yrs min
21	Data Entry Operators (DEO)	5	Graduate / Diploma in Computer Applications, exp-3 yrs

In accordance with the above discussions, the Municipal Commissioner, who would be the Project Director (PD) for the proposed project. The Project Director is supported by Deputy Project Director. Under the Deputy Project Director, there would be a specialist team with sufficient quality and experiences in the water sector projects. Figure 12.5.4 illustrated organization of the PIU.



Dy Director (SE) – Deputy Director, Superintendent Engineer (sewerage sector), EE – Executive Engineer (Civil, Mech. Elect., GIS etc)
PE - Project Engineer (civil), Executive Engineer, JEC – Junior Engineer (Civil and/or GIS as needed)
JEM – Junior Engineer (Mechanical), JEE – Junior Engineer (Electrical and I&C), JSC – Junior Engineer (Survey Specialist – Civil)

Figure 12.5.4 Organizational Structure for Project Implementing Unit

3) ‘Job Description’ of PIU

The general tasks of the team will include, but not limited to, the following:

a. Participate in developing bidding documents, including bill of quantities and specifications following JICA guidelines and assist in evaluation of bids;
b. Day-to-day implementation of contracts and project activities under the 11 packages;
c. Coordinate planning, control, and management of the work of a multidisciplinary team;
d. Develop implementation schedules and resource requirements;
e. Monitor progress, evaluate results, and identify and resolve constraints;
f. Identify appropriate technologies and the need for standardization of equipment and materials;
g. Participate in carrying out detailed investigation and engineering surveys (geotechnical, topographical, etc.), wherever necessary;
h. Participate in and understand designing of sewers and STP;
i. Ensure ‘Third Party design review’
j. Present the designs to all stakeholders (including local government and communities), addressing their concerns where necessary;
k. Update costs, economic and financial information, when needed;
l. Prepare and update implementation schedule and resource requirements (in ‘MS Project’ software);
m. Establish a contract tracking system, including implementation schedules and achievable milestones;
n. Supervise all construction activities under the project, including liaison with the other teams under the project;
o. Define quality control mechanisms and parameters for all components;
p. Develop and implement a quality assurance program for all works, securing compliance with design and standards;
q. Develop a coordinating mechanism with PMC and the contractor/NGO and prepare public communication products
r. Develop O&M manuals for future maintenance;
s. Issue contracts, completion certificates, settlement of contractor’s claims;
t. Prepare and present progress report during project review missions;
u. Facilitate preparation of training programs for effective implementation and O&M including training module, training plans. Organize and conduct training through consultant’s staff and other training delivery institutions.

12.6 Consulting Services

12.6.1 Terms of Reference

NRCD will procure consulting services through ICB for the construction/installation of sewers, STPs and IPS, Community Toilet Facilities and Central SCADA System. The consultants' team shall consist of international and local professional and supporting staff. Consultants will be selected through a short list method to avoid lowering of quality and in accordance with the "Guidelines for the Employment of Consultants under Japanese ODA Loans".

The scope of work in the Terms of Reference (TOR) for the consulting services includes the requirements under different manner of biddings for the sewerage facilities; one for design-bid-construction and the other design–built method.

For the former method, detailed design will be conducted including preparation of tender documents for the four packages for the construction of sewers (sewer network in Baner area and Main/sub-main sewers in entire PMC). For the latter method, basic design of STPs and IPSs, Community Toilet Facilities, and Central SCADA System is included as well as bidding assistance and construction supervision.

The TOR is prepared considering requirements discussed in the previous sub-sections and included in Supporting Report 12.6.1.

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12.8 Study on the Reduction of Construction Cost in ODA

The following are considered in the preliminary design of sewerage facilities for the reduction of construction cost.

(1) Adoption of simple facilities and equipment through the investigations on local specifications and practices for the reduction of construction cost and the saving of O&M cost

Details are enumerated below.

- No application of facilities for ventilation and deodorization providing open air space at IPSs and sludge treatment buildings
- No consideration of generator set in provision of express feeder
- Reduction of the cost for construction of grid chamber being installed at shallow elevation after pumping up at the STP
- Reduction of excavation cost installing buildings/facilities on the ground
- No thickening of sludge in application of local practices

(2) Reduction f O&M cost in use of bio-gas

- Utilization of electricity generated by bio-gas power generation at large-size two STPs

(3) Reduction of construction cost in effective use of existing facilities

- Renewal of equipment at the four IPSs to cope with the increase of sewage volume
- Utilization of existing facilities at the two IPSs

(4) Reduction of labor cost and improvement of services to the customers through effective O&M

- Effective O&M using SCADA System, GIS system and MIS system

12.9 Project Effectiveness

The performance indicators are studied for monitoring of inputs, outputs, outcomes, and impacts of a project. They are monitored during project implementation to assess project progress toward project objectives, and for evaluation of project accomplishments after project implementation.

Construction works for the Project will be completed in March, 2021. The projected indicators by target year are shown in Table 12.9.1. Service coverage will increase from 65% in 2011 to 100% in 2027. Although increasing percentage is 35%, but population to be served in 2027 against present population is about 2.6 times (5,746,000/3,425,000 x 0.65). This project's indicators are shown in Table 12.9.1.

Table 12.9.1 Operation and effect indicators

Indicator	2014	2027
Treated sewage amount（m^3/day） average of the year	561,000	948,800
Serviced population（person）and service coverage (%)	2,226,000 (65 %)	5,746,000 (100%)
Inflow BOD_5 concentration（mg/L） to STP	144	250
Effluent BOD_5 concentration（mg/L）	10	10
Inflow SS concentration（mg/L） to STP	184	350
Effluent SS concentration（mg/L）	13	10
Operating rate of facility (%)	80	100
Water quality of Mula-Mutha River; BOD (mg/L）	15-80	Less than 10
Water quality of Mula-Mutha River; DO (mg/L）	0.1-3.6	Minimum 5

Note:

(1) Treated sewage amount: in 2014; existing joint STP capacity 477,000 + individual STP 84,000 = 561,000 m^3/d, in 2027; existing STPs 477,000 + Planned STPs 396,000 + individual STP (90%) 75,800 = 948,800 m^3/d

(2) Service Population: in 2011 service coverage (treated 476,000/generated 728,000 m^3/day) = 65%, Population the Project area 3,425,000 x 0.65 = 2,226,000

(3) Influent BOD and SS: overall average at existing STPs in 2011, design figures in 2027

(4) Effluent BOD and SS: overall average at existing STPs in 2011, design figures in 2027

(5) Operation rate of existing STPs: overall average of existing STPs

(6) Water quality of Mula-Mutha River: ranges of average quality from 2009 to 2013 for year 2011, projected figures for year 2027

CHAPTER 13 Financial and Economic Considerations

13.1 Stakeholder's Financial Capability of Water Supply and Sewerage Sector

It is assumed that the capital cost required for the project will be shared between NRDC and PMC with 85% and 15%, respectively. The on-going similar projects funded by NRCD receive similar Grant Conditions. On the other hand, PMC is fully responsible for O&M of the sewerage facilities. In this regard, financial capability of PMC was studied.

13.1.1 Pune Municipal Corporation (PMC)

(1) Tax collection system

Table 13.1.1 shows type of property taxes which are collected by PMC at present. Taxes of Group A and B in Table 13.1.1; Octroi, Consolidated Property Tax, Special Conservancy Tax and Street Tax are mainly used for the capital budget. Taxes of Group C, Water Benefit Tax and Sewerage Benefit Tax are mainly used for operational budget of Water Supply and Sewerage System, though adjustment is made between capital and operational budget.

Table 13.1.1 Types of Taxes

	Type of Budget
A	General Tax
B	Special Tax mainly use for Capital Budget
	Octroi
	Consolidated Property Tax
	Street Tax
	Conservancy Tax
	Special Conservancy Tax
	Fire Tax
	Eductation Tax
C	Special Purpose Tax mainly use for Operational Budget
	Water Tax
	Water Benefit Tax
	Sewerage Tax
	Sewerage Benefit Tax
D	Others (penality, arreas, etc.)

Source: PMC

These taxes are decided based on ARV (Annual Retainable Value) of the property. ARV is determined by value of property and other economic parameters. The special purpose taxes including water benefit tax and sewerage benefit tax are based on certain percentages of ARV. The tax payers are then charged by a combination of the property tax and the special purpose taxes. Water benefit tax is 3% and sewerage benefit tax is 6% of the property ARV. Every property holder, whether connect to the water supply and sewerage network or not, are charged with these two taxes. The water tax, however, is presently a flat rate based on the location of the property. The sewerage tax is about half of the water tax.

*1)

Table 13.1.2 Percentage to ARV

Nature of Tax	% of ARV
General Tax	14 to 38
Fire Tax	1.25
Tree Tax	1
Conservancy Tax	16
Water Benefit Tax	3
Sewerage Benefit Tax	6
Street Tax	8.5
Eductation Tax	1

Source: DPR

Note: The rates of water benefit tax and sewerage benefit tax are confirmed with PMC Property Tax Collection Department in November 2014.

Based on the taxation method, PMC calculates tax amount (billing amount) to tax payers. However, some tax payers do not pay by the due dates. Therefore, there is a discrepancy between the billing amount and actual collection amount. Uncollected tax is counted as arrears and is charged with penalty in next year. Table 13.1.3 shows the billing and collection amounts from 2010 to 2014. Collection of the arrears and penalty is shown as "others" in the table. Billing amount of sewerage tax and sewerage benefit tax is 2,054 million INR in 2014, while collection amount of the year is 1,738 million INR. Average collection efficiency of the water supply and sewerage related taxes in the last five years was 85%.

Table 13.1.3 Billing and Collection Amount for Water Supply and Sewerage System

(unit: million INR)

	2010		2011		2012		2013		2014	
	Billing	Collection	Billing	Collection	Billing	Collection	Billing	Collection	Billing	Collection
Water Tax	690	610	749	666	805	686	849	745	913	885
Water Bebfit Tax	94	83	159	129	201	159	218	192	307	255
Sub total	784	693	907	794	1,006	845	1,066	937	1,220	1,140
Sewerage Tax	611	545	843	700	1,058	854	1,146	1,028	1,439	1,230
Sewerage Benefit Tax	187	164	317	256	402	315	435	383	614	508
Sub total	798	709	1,160	956	1,460	1,169	1,582	1,411	2,054	1,738
Others	2,292	2,128	3,632	2,439	4,389	3,142	5,682	3,854	6,822	4,531
Total	3,873	3,530	5,699	4,189	6,855	5,155	8,331	6,202	10,096	7,408

Source: Report from PMC Property Tax Collection Department, November 2014

(2) Budget and expenditure of the PMC's Water Supply and Sewerage Divisions

It should be firstly noted that the revenue from sewerage and sewerage benefit taxes is not fully allocated to the operational cost of the Sewerage Division. The revenue is used for storm water drainage and conservancy as well. Table 13.1.4 and Table 13.1.5 show budget and expenditures of the PMC's Water Supply Division and Sewerage Division in the last 5 years after adjustment for storm water drainage and conservancy usage. As seen in the tables, not always the full amount of the assigned budget has been utilized.

Table 13.1.4 Budget and Expenses of Water Supply Division

(unit: Crores INR)

I. Water Supply System	2010		2011		2012		2013		2014	
Capital Budget and Expenditure	Budget	Expense	Budget	Expense	Budget	Expense	Budget	Expense	Budget	Expense
1) From Water Supply Funds	73.7	100.6	80.9	78.0	74.8	69.9	150.4	40.7	188.2	103.2
2) From Water Supply Project Funds	120.5	130.5	63.2	49.0	86.2	78.5	56.5	52.0	65.4	66.6
A) total of Capital budget and expenses	194.2	231.1	144.1	127.0	161.0	148.4	206.9	92.7	253.6	169.8

Operational budget and expenditure	Budget	Expense	Budget	Expense	Budget	Expense	Budget	Expense	Budget	Expense
1) Expenses for staff	33.3	31.5	42.7	49.5	48.3	59.7	67.9	65.5	80.5	28.3
2) Electrical expenses & repairs	90.0	68.2	70.5	56.9	65.9	70.2	72.8	73.5	88.7	82.6
3) Water expenses	35.3	35.0	24.9	30.5	32.5	30.0	33.4	25.2	28.4	27.3
4) Petrol & Diesel	0.7	0.5	0.7	0.7	0.7	0.3	1.2	1.2	1.5	0.0
5) Operation & maintenance	0.2	0.1	0.4	0.2	0.1	0.1	0.1	0.0	0.1	0.0
6) Works to be done by ward offices	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7) Depreciation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8) Others	24.4	20.9	22.1	22.0	23.8	23.0	32.8	33.7	38.7	28.2
sub total	183.9	156.2	161.2	159.8	171.2	183.4	208.2	199.1	237.8	166.4
9) Loan refund & interest	44.4	0.2	16.8	5.8	14.4	5.8	22.8	6.4	23.4	0.0
B) Total of operational budget and expenses	228.3	156.4	178.0	165.5	185.7	189.1	231.0	205.6	261.2	166.4
C) A)+B)	422.5	387.5	322.1	292.6	346.7	337.5	437.8	298.3	514.9	336.2

Source: Accounting Report of Water Supply Division, 2014

Operational expenditure of Water Supply Division in 2013 is 205.6 million INR and 166.4 million INR in 2014, and Sewerage Division in 2013 is 51.4 million INR and 26.7 million INR in 2014. Budget and expenses were both increasing until 2013, but in 2014, expenditure cut rapidly on salaries. Power cost is constantly increasing. Sewerage Division did not get any subsidiary from central government and state government during 2010 to 2014.

Table 13.1.5 Budget and Expenses of Sewerage Division

(unit: Crores INR)

II. Sewerage System	2010		2011		2012		2013		2014	
Capital Budget and Expenditure	Budget	Expense	Budget	Expense	Budget	Expense	Budget	Expense	Budget	Expense
1) From Sewerage Funds	65.2	91.6	53.3	44.5	58.9	61.3	61.4	39.0	68.0	32.6
2) From Sewerage Project Funds	45.0	86.5	51.4	49.7	49.6	47.2	48.7	40.2	65.2	34.8
A) total of Capital budget and expenses	110.2	178.0	104.6	94.2	108.4	108.5	110.0	79.2	133.1	67.4

Operational Budget and Expenditure	Budget	Expense	Budget	Expense	Budget	Expense	Budget	Expense	Budget	Expense
1) Expenses for staff	13.8	12.0	17.8	16.8	18.0	21.2	24.2	22.8	30.2	8.2
2) Electrical charges & repairs	19.0	13.4	17.0	15.4	15.7	13.2	19.2	16.6	19.1	18.4
3) Petrol & Diesel	0.3	0.2	0.3	0.3	0.5	0.4	0.8	0.8	1.0	0.0
4) Works to be done by ward offices	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5) Others	6.8	4.8	6.7	4.7	6.6	4.6	6.9	4.8	15.5	0.1
sub total	39.8	30.4	41.7	37.1	40.8	39.3	51.1	45.0	65.8	26.7
6) Loan refund & interest	0.2	0.1	25.9	5.8	14.4	5.8	22.8	6.4	23.4	0.0
B) Total of operational budget and expenses	40.0	30.5	67.6	43.0	55.3	45.1	73.9	51.4	89.2	26.7
C) A)+B)	150.3	208.6	172.2	137.1	163.7	153.6	183.9	130.6	222.3	94.1

Source: Accounting Report of Sewerage Division, 2014

(3) Cost recovery on capital investment

Some portion of the capital cost is granted by the national Government and/or the Maharashtra State Government. PMC shoulders remained portion. Revenue from property tax and some of special purpose tax (such as Octoroi (LBT), consolidated property tax, street tax, conservancy tax and special conservancy tax) are primary allocates for Capital Budget. Table 13.1.5 shows the capital budget of the Sewerage Division in the past five years.

(4) Cost recovery to operational activity

Sewerage tax and sewerage benefit tax are primary allocated to the operational budget of the Division. The revenue from these two taxes is also allocated as budget for storm water drainage and conservancy. When the budget is in shortage, the budget firstly would be adjusted with category C (operational budget), then it could be adjusted between Category A (capital budget) and C (operational budget). The cost recovery of water supply is arranged in the same manner.

(5) Financial capability of the Sewerage Division

Financial capability was analyzed using projected cash flow. If they can maintain positive cash balance, it is assumed to be financially capable. If cash balance becomes to be negative, then negative amount is considered to adjust within revenue. If the negative amount is limited to observe in the total revenue, it is regarded as financially capable. However, if negative amount exceeds total revenue, there is a need of a basic countermeasure.

1) Capital cost

Table 13.1.6 summarizes the capital cost demand for this Project and Table 13.1.7 shows schedule of disbursement under cost sharing by NRCD and PMC.

Table 13.1.6 Project Budget and Cost Sharing

(unit: million INR)

Total Cost		11,812
Share of NRCD	85%	10,040
Share of PMC	15%	1,772

Table 13.1.7 Project Budget Disbursement Schedule

(unit: million INR)

year	amount	NRCD	PMC
2014	0	0	0
2015	916	778	137
2016	291	248	44
2017	2,014	1,712	302
2018	2,819	2,396	423
2019	2,959	2,515	444
2020	2,582	2,195	387
2021	201	171	30
2022	30	25	4
Total	11,812	10,040	1,772

Cost requirements for rehabilitation of existing and planned sewerage facilities are estimated as shown in Table 13.1.8 and Table 13.1.9, respectively in assumption of longevity of electrical and mechanical equipment. The following are assumptions and conditions for the estimation of required cost.

i) Rehabilitation of existing STP

- Mechanical and electrical facilities: Mechanical and electrical cost is assumed at 40% (ASP and EA methods) or 70% (SBR method). Overall construction cost of a STP is assumed to be 1.0 Crore/MLD.
- Rehabilitation cost for mechanical and electrical facilities: renewal cost is assumed at 60% of mechanical and electrical cost and renewal year is assumed after 15 years from construction completion year

ii) Rehabilitation of proposed STP

- Rehabilitation cost: 60% of estimated cost for mechanical and electrical facilities and renewal after 15 years from construction completion year.

Table 13.1.8 Rehabilitation Schedule of Existing Facilities

(unit: Crores INR)

STP	2018	2019	2025	2026	2027	2033	2034	2040	2042	2048	2049
Mundhawa			18.90					18.90			
Bhairoba	31.20					31.20				31.20	
Naidu				27.60				27.60			
Vithalwadi			7.68					7.68			
Eradwane		12.00					4.08				12.00
Tanajiwadi		4.080					4.08				4.08
Bopodi	4.32					4.32				4.32	
Baner			12.60					12.60			
Kharadi					16.8				16.80		
total	35.52	16.08	39.18	27.60	16.80	35.52	8.16	66.78	16.80	35.52	16.08

Table 13.1.9 Rehabilitation Schedule of Facilities Constructed by this Project

(unit: Crores INR)

Name of STP	2034	2035	2036	2037	2049	2050	2051	2052
Naidu			39.6				39.6	
Bhairoba				30.0				30.0
Mundhawa	11.4				11.4			
Vadagaon	10.8				10.8			
Warje	10.8				10.8			
Botanical garden	7.8				7.8			
Tanajiwadi		8.4				8.4		
Dhanori		12.0				12.0		
Masty Beij Kendra		7.2				7.2		
Baner		13.2				13.2		
Kharadi		14.4				14.4		
Total	40.8	55.2	39.6	30.0	40.8	55.2	39.6	30.0
Croes INR								
Total	408.0	552.0	396.0	300.0	408.0	552.0	396.0	300.0
Million INR								

The required costs for the two cases are covered by capital budget of PMC. Therefore, required overall

costs are total of tables from Table 13.1.8 and Table 13.1.9.

2) Revenue for capital budget

Table 13.1.10 shows revenue from taxes to be used for capital budget. Although PMC may adjust allocation from this revenue to capital budget and operational budget, it is assumed that this amount is the basis for the Project. The number of household in 2014 is projected at 594 thousands and per household tax 1,460 INR. These figures are used for estimation of expected tax revenues for capital budge.

Table 13.1.10 Tax Revenues for Capital Budget in 2014

Unit: INR

	Tax Revenue f
Octroi	618,879,774
Consolidated Property Tax	38,619,882
Street tax	72,613,947
Conservancy Tax	0
Special Conservancy Tax	35,173,530
Fire Tax	102,904,475
Total	868,191,608

Source: Report from PMC Property Tax Collection Department in November, 2014

Table 13.1.11 shows cash flow of the capital budget. For the projection of house connections, 5.5 persons/HH is applied. Income per household by year through the future is assumed that the income in 2014 will be maintained through the future, as a conservative assumption. This projected cash flow shows that capital investment by the Sewerage Division does not cause negative cash balance. This concludes that the PMC's Sewerage Division is financially capable on their capital investment. Figure 13.1.1 presents comparison between Tax Revenue for Capital Budget and Necessary Budget for this Project.

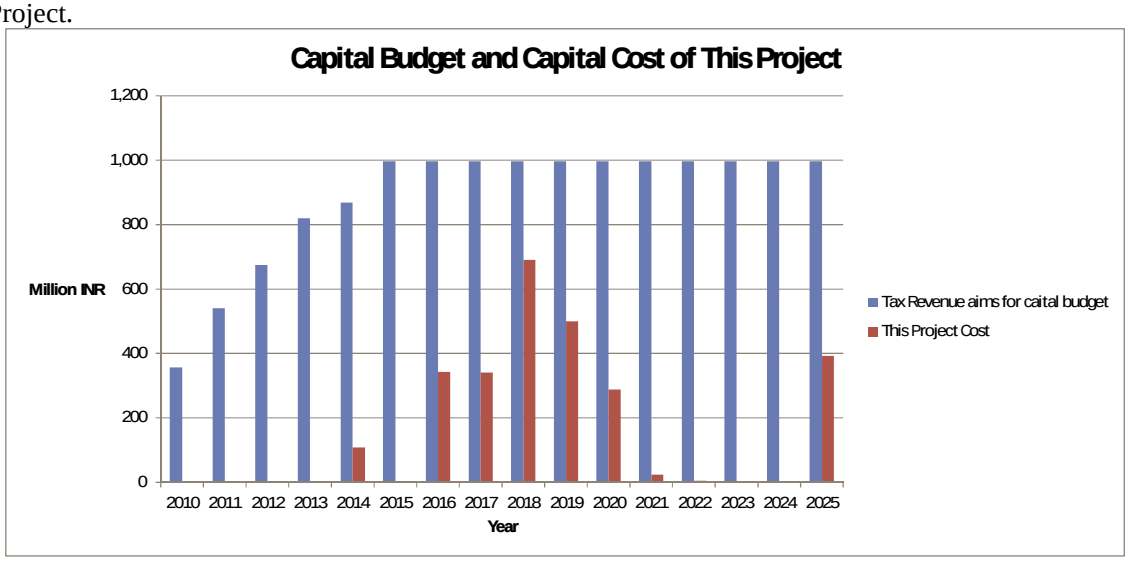

Figure 13.1.1 Comparison between Tax Revenue and Necessary Capital Cost for this Project

Table 13.1.11 Cash Flow Analysis for Capital Investment

(unit: million INR)

			Exp. Tot.Bu	Rehabilitatic	Construction		Balance
Year	Population	H/H/Conn	(1)	(2)	(3)	(2)+(3)	(1)-(2)-(3)
2014	3,271,205	594,764	868			0	868
2015	3,755,442	682,808	997	0	137	137	860
2016	3,916,108	712,020	1,040	0	44	44	996
2017	4,076,774	741,232	1,082	0	302	302	780
2018	4,127,930	750,533	1,096	355	423	778	318
2019	4,179,085	759,834	1,109	161	444	605	505
2020	4,230,241	769,135	1,123	0	387	387	736
2021	4,281,397	778,436	1,137	0	30	30	1,106
2022	4,332,553	787,737	1,150	0	4	4	1,146
2023	4,383,708	797,038	1,164	0	0	0	1,164
2024	4,434,864	806,339	1,177	0	0	0	1,177
2025	4,486,020	815,640	1,191	392	0	392	799
2026	4,537,175	824,941	1,204	276	0	276	928
2027	4,588,331	834,242	1,218	168	0	168	1,050
2028	4,856,618	883,021	1,289	0	0	0	1,289
2029	5,124,905	931,801	1,360	0	0	0	1,360
2030	5,393,191	980,580	1,432	0	0	0	1,432
2031	5,661,478	1,029,360	1,503	0	0	0	1,503
2032	5,929,765	1,078,139	1,574	0	0	0	1,574
2033	6,046,543	1,099,371	1,605	355	0	355	1,250
2034	6,163,320	1,120,604	1,636	490	408	898	738
2035	6,280,098	1,141,836	1,667	552	552	1,104	563
2036	6,396,875	1,163,068	1,698	396	396	792	906
2037	6,513,653	1,184,300	1,729	300	300	600	1,129
2038	6,630,430	1,205,533	1,760	0	0	0	1,760
2039	6,747,208	1,226,765	1,791	0	0	0	1,791
2040	6,863,985	1,247,997	1,822	668	0	668	1,154
2041	6,980,763	1,269,230	1,853	0	0	0	1,853
2042	7,097,540	1,290,462	1,884	168	0	168	1,716
2043	7,184,704	1,306,310	1,907	0	0	0	1,907
2044	7,271,868	1,322,158	1,930	0	0	0	1,930
2045	7,359,031	1,338,006	1,953	0	0	0	1,953
2046	7,446,195	1,353,854	1,977	0	0	0	1,977
2047	7,533,359	1,369,702	2,000	0	0	0	2,000
2048	7,625,875	1,386,523	2,024	355	0	355	1,669
2049	7,719,527	1,403,550	2,049	569	408	977	1,072
2050	7,814,330	1,420,787	2,074	552	552	1,104	970
2051	7,910,296	1,438,236	2,100	396	396	792	1,308
2052	8,007,441	1,455,898	2,126	300	300	600	1,526

(1) Expected tax revenue for capital budget
(2) Capital budget for rehabilitation of existing sewerage facility
(3) Capital budget and rehabilitation of sewerage facility constructed by this Project

i) Revenue for operational budget

Revenue from sewerage tax and sewerage benefit tax in 2014 is 1,738 million INR (Table 13.1.4). Using moving average and number of household in 2014, expected tax revenue from these two taxes arrives at 1,354 INR per house. Using this figure for sewerage charges expected revenue was projected. Table 13.1.13 shows the calculation results. If 45% of this tax revenue is allocated to operational budget of the Sewerage Division and other 55% for storm water drainage and conservancy, results are almost similar to present situation. In this case, negative cash balance will be emerged in 2023 after operation of some facilities through the year 2028. However, total revenue from sewerage tax and sewerage benefit tax will be still larger than total O&M cost of sewerage facilities.

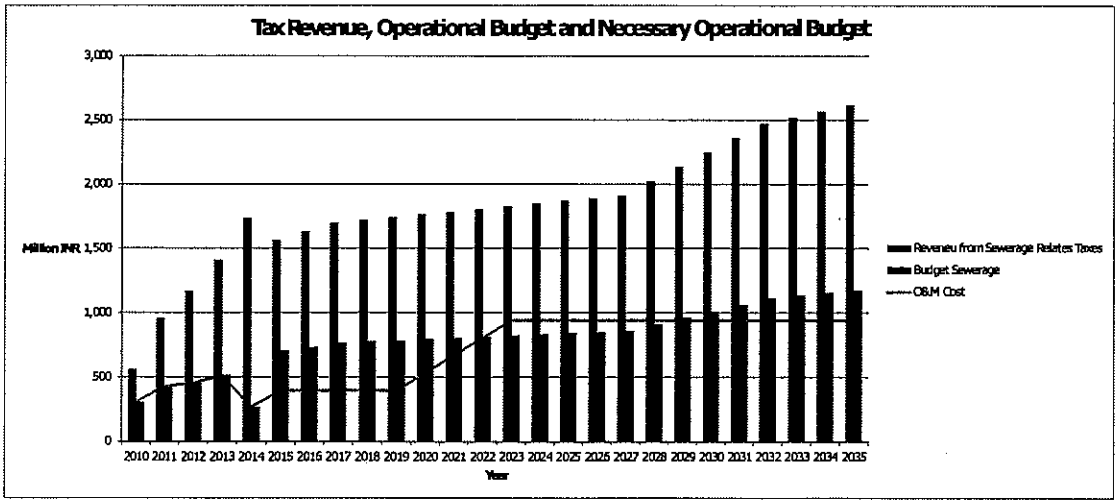

Figure 13.1.2 Sewerage Related Tax Revenue, Operational Budget of Sewerage Division and O&M Cost

Table 13.1.13 Cash Flow Analysis for Operational Cost

(unit: million INR)

			Revenue	Allocation	O&M Ex	O&M New	(2)-(3)	(5)-(4)	(1)-(3)-(4)
Year	Population	H/H/Conn	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2015	3,755,442	682,808	1,566	705	394		311	311	1,172
2016	3,916,108	712,020	1,633	735	394		341	341	1,239
2017	4,076,774	741,232	1,700	765	394		371	371	1,306
2018	4,127,930	750,533	1,721	775	394		381	381	1,328
2019	4,179,085	759,834	1,743	784	394		390	390	1,349
2020	4,230,241	769,135	1,764	794	394	137	400	263	1,234
2021	4,281,397	778,436	1,785	803	394	273	410	136	1,118
2022	4,332,553	787,737	1,807	813	394	410	419	9	1,003
2023	4,383,708	797,038	1,828	823	394	547	429	-118	887
2024	4,434,864	806,339	1,849	832	394	547	438	-108	909
2025	4,486,020	815,640	1,871	842	394	547	448	-99	930
2026	4,537,175	824,941	1,892	851	394	547	458	-89	951
2027	4,588,331	834,242	1,913	861	394	547	467	-80	973
2028	4,856,618	883,021	2,025	911	394	547	518	-29	1,085
2029	5,124,905	931,801	2,137	962	394	547	568	21	1,197
2030	5,393,191	980,580	2,249	1,012	394	547	618	71	1,308
2031	5,661,478	1,029,360	2,361	1,062	394	547	669	122	1,420
2032	5,929,765	1,078,139	2,473	1,113	394	547	719	172	1,532
2033	6,046,543	1,099,371	2,521	1,135	394	547	741	194	1,581
2034	6,163,320	1,120,604	2,570	1,157	394	547	763	216	1,630
2035	6,280,098	1,141,836	2,619	1,178	394	547	785	238	1,678
2036	6,396,875	1,163,068	2,668	1,200	394	547	807	260	1,727
2037	6,513,653	1,184,300	2,716	1,222	394	547	828	282	1,776
2038	6,630,430	1,205,533	2,765	1,244	394	547	850	304	1,824
2039	6,747,208	1,226,765	2,814	1,266	394	547	872	326	1,873
2040	6,863,985	1,247,997	2,862	1,288	394	547	894	347	1,922
2041	6,980,763	1,269,230	2,911	1,310	394	547	916	369	1,970
2042	7,097,540	1,290,462	2,960	1,332	394	547	938	391	2,019
2043	7,184,704	1,306,310	2,996	1,348	394	547	954	408	2,055
2044	7,271,868	1,322,158	3,032	1,365	394	547	971	424	2,092
2045	7,359,031	1,338,006	3,069	1,381	394	547	987	440	2,128
2046	7,446,195	1,353,854	3,105	1,397	394	547	1,003	457	2,164
2047	7,533,359	1,369,702	3,141	1,414	394	547	1,020	473	2,201
2048	7,625,875	1,386,523	3,180	1,431	394	547	1,037	490	2,239
2049	7,719,527	1,403,550	3,219	1,449	394	547	1,055	508	2,278
2050	7,814,330	1,420,787	3,259	1,466	394	547	1,073	526	2,318
2051	7,910,296	1,438,236	3,299	1,484	394	547	1,091	544	2,358
2052	8,007,441	1,455,898	3,339	1,503	394	547	1,109	562	2,399

(1) Expected revenue from sewerage tax and sewerage benefit tax
(2) Budget allocation to Sewerage Division
(3) Operation and Maintenance of existing facility and (4) O&M cost by this Project

(6) Improvement by the Water Supply Division

The Water Supply Division has negative cash balance *2). For improving this situation, PMC pro-

posed to increase the water charges as shown in Table 13.1.14.

In addition, PMC is shifting to the volumetric charge system and expected to have a positive cash balance after 2026. *3)

Table 13.1.14 Water Charge Improving Plan

		2018-2023	2024-2028	2029-
Sr	Particulars	INT/kL	INT/kL	INT/kL
A	Water Connection Charges			
	Domestic Connection	5,000	5,500	6,050
	Non-Domestic Connections	10,000	1,100	12,100
B	Water Usage Charges (Domestic)			
	0-22.5 m3/mo.(150 lpcd)	3.00	4.00	5.00
	22.5-30 m3/mo.(150 to 200 lpcd)	6.00	7.00	8.00
	30-37.5 m3/mo.(200 to 250 lpcd)	9.00	10.00	11.00
	Above 37.5 m3/mo.(Above 250 lpcd)	10.00	11.00	13.00
	Water Usage Charges (Non-Domestic)	35.00	39.00	43.00

13.2 Budget of the Project

13.2.1 Capital Budget

(1) Cash out (Expenditure)

The following assumptions are used for estimating the required fund as shown in Table 13.2.1:

- Base cost for construction work and consulting services is in 2014 year price level
- Basic escalation: 2% of annual escalation rate on foreign currency portion and 4.2% on local currency portion
- Contingency: 5% to both physical contingency of construction and consulting services
- 3% for administration cost of PMC and NRCD
- VAT: 5% to LC portion (A+B)
- Import Tax: 15% to FC portion (A+B)

Table 13.2.1 Exchange Rate

Currency Exchange Rate	US$	JPN
US$	1	119.40
INR	1	1.9

Based on the estimated cost, the fund requirements for implementing the project is summarized in

Table 13.2.2. This amount is counted as cash out (expenditure) for cash flow analysis mentioned later in this chapter. Necessary rehabilitation and facility/equipment replacement cost, shown in Table 13.1.9 shall be considered in the capital budget required.

(2) Cash in (Revenue)

Cost sharing for capital investment between NRCD and PMC is assumed to be 85% and 15%, respectively. NRCD provides this capital cost from their annual budget. PMC also manages it from its capital budget. However, the facility rehabilitation cost shown in Table 13.1.9 should be shouldered solely by PMC. This financial analysis assumes that this capital cost could be provided as a grant from PMC to the Project. The financial capability of PMC is analyzed in 13.1.2

13.2.2 Operational Budget

(1) Cash out (Expenditure)

Table 13.1.13 shows requirements for the operational budget for the planned facilities in this Project in 2014 price level.

(2) Cash in (Revenue)

As already mentioned, column (5) in Table 13.1.13 shows revenue for operational cost.

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CHAPTER 14 Institutional Improvement

The provision of adequate, reliable sewerage management services to the people of Pune City requires an appropriate organization, operating structure and human resources, who are willing as well as capable to manage, operate, maintain and perform the required services during pre-construction, construction and post construction (operation and management) stages. In practical sense, it requires Sewerage and Water Supply Department (SWSD) to become a self-supporting department and for that requires institutional development. What is basically needed is changes in their internal processes that focuses not only on improving the physical infrastructure, but also encourages building up of their organizational infrastructure. As some of the institutional processes are dynamic and constantly changing, analysis and improvements have to be undertaken on a continuous basis, recognizing that the processes of undertaking various activities are equally important as what they are meant to achieve (outputs).

This chapter examines the requirements during construction and proposes a project implementation structure and personnel system to ensure that the project is implemented as intended. It also assesses the management, operation and management system requirements after project completion. It is not enough for the project to be successfully implemented; but project gains have to be sustained through organizational development. This entails SWSD, PMC to have the appropriate structure that clearly delineates and describes unit and individual roles, responsibility, and accountability, as well as defines authority, coordinative and communications flows, from the top to bottom (horizontally) and across (vertically) the entire organization spectrum.

The chapter concludes with the formulation of institutional/organizational improvement action plans on specific operational areas of SWSD functions and services. On the issue of financial self-reliance, action plans are proposed to strengthen financial and asset management, streamline sewerage tax revision, and to improve the collection system and customer service. The preparation of financial statements and the long-term business plans are elements to support SWSD to operate in a self-reliant manner. Since organizational improvement involves people (human resources) and developing their capacities to perform at optimum levels, an action plan on human resources / personnel management is also proposed. Lastly, institutional improvement also necessitates having codified policies and procedures (management systems) to ensure high standards of efficiency and effectiveness, thus action plans for improving the management information system, improving collection efficiency and linking it to water meter installation has been proposed.

14.1 Stakeholder Analysis

There are various key project stakeholders for sewerage management of PMC. This includes stakeholders at Government of India level, State level, Local level besides local communities and NGOs. The key stakeholders with interest in the project implementation include: Government of India, represented by

National River Conservation Directorate (NRCD) under the Ministry of Environment and Forests, Ministry of Urban Development (MoUD), Jawarharlal Nehru National Urban Renewal Mission (JnNURM) besides Government of Japan, represented by JICA Headquarters (Tokyo) and JICA India Office. The state-level stakeholders include Department of Urban Development (UDD); Water Resources Department (WRD), Government of Maharashtra (GoM), whereas local level stakeholders include Pune Municipal Council (PMC).

14.1.1 Central Level Stakeholders

- **NRCD** under MoEF, GOI

The National River Conservation Directorate (NRCD) in the Ministry of Environment, Forests and Climate Change implements the Centrally Sponsored Schemes of National River Conservation Plan (NRCP) and National Plan for Conservation of Aquatic Eco-systems'(NPCA) for conservation of rivers, lakes and wetlands in the country. The objective of the river action plans is to improve water quality of rivers through implementation of pollution abatement schemes in identified polluted stretches of rivers. The NPCA aims at conserving aquatic ecosystems (lakes and wetlands) through implementation of sustainable conservation plans, and governed with application of uniform policy and guidelines. With aimed control of water quality of Mula-Mutha river system, NRCD is supporting the project and is one of the major stakeholder.

- **The Ministry of Urban Development, GOI**

The MoUD is responsible for formulating policies, supporting and monitoring programmes and coordinating the activities of various Central Ministries, State Governments and other national authorities related to urban development, town and country planning besides addressing development issues. One of the urban development issues as well as one of the key mandates of the Ministry is undertaking schemes to create facilities to manage sewerage as well as solid wastes (or indirectly - water supply, sewage, drainage and sanitation facilities) subject to the overall national perspective. During 2008, MoUD launched and operationalized the Service Level Benchmarks (SLBs) identifying basic minimum service level performance parameters for four basic urban services, namely: water supply, sewage, solid waste management, and storm water drainage. MoUD is also very active in undertaking and implementing first and second generation urban reforms for urban infrastructure in water supply, sanitation and drainage and implements the JnNURM, UIDSSMT, Satellite Townships program etc. Two major reforms being pursued by the MoUD, which cascades down to the State Governments and ULBs are:

(i) The *regulatory frameworks* aimed at protecting consumers, applying environmental standards and supporting the delivery of services to the poor in financing and delivery of infrastructure at the municipal level, especially in the water and sanitation sector, together with the appro-

priate training programme and capacity support to regulators developed in partnership with the private sector and urban research institutions; and

(ii) The introduction of *accrual based accounting system* for ULBs' and suggestions for model budgeting and accounting formats, including the preparation and circulation of a National Municipal Accounting Manual (NMAM), detailing the accounting policies, procedures, guidelines designed to ensure correct, complete and timely recording of municipal transactions and produce accurate and relevant financial reports.

- **The Jawarharlal Nehru National Urban Renewal Mission (JNNURM)**

JNNURM aims to create productive, efficient, equitable and responsive cities by and bring about improvement in the existing service levels in a financially sustainable manner. Since its launch in Dec 2005, projects and development reforms have been pursued in 63 identified cities. The focus had been on integrated and planned development, renewal of infrastructure services, efficiency in urban infrastructure service delivery mechanisms, community participation, and accountability consisting of two sub-mission: "urban infrastructure and governance" and basic services to the urban poor (BSUP). The Mission also implements optional and mandatory reforms at the level of the States. The mandatory reforms are:

(i) Adoption of accrual-based double entry system of accounting in ULBs and para-statal agencies;

(ii) Introduction of a system of e-governance using IT applications;

(iii) Reform of property tax using GIS;

(iv) Levy of reasonable user charges for services by ULBs and parastatals agencies with the objective of recovering full cost of O&M or recurring cost by the end of next seven years (by 2013);

(v) Internal earmarking of budgets for basic services to the urban poor,

(vi) Provision of basic services to the urban poor including improved housing, water supply and sanitation and delivery of other existing universal services of the government for education, health and social security.

There were 10 thrust sectors under JNNURM including water supply, sewerage and river water quality, for which PMC has been supported through Central and State funding. However, with limited fund release and the uncertainty over the future of JNNURM funding, PMC need to gear up to support its mandated projects.

14.1.2 State level Agencies

1) Department of Water Supply and Sanitation, Government of Maharashtra

The **Water Supply and Sanitation** Department (WSSD), GoM focuses on urban and rural water supply, sanitation and sewerage functions in the state. The WSSD does not only operate and maintain urban and

rural water supply schemes, but ensures that it provides safe drinking water for domestic, commercial, institutional and industrial requirements. It caters to the needs of the people of Maharashtra, whether urban or rural, including supplying water to the needy. It is also responsible for planning, designing and executing schemes for establishing safe water sources and water schemes and related facilities. Its objective is to make every habitation accessible to safe drinking water.

2) Water Resources Department, GoM

The Water Resources Department (WRD) has the responsibility of ensuring irrigation to the State of Maharashtra by developing and constructing major and medium irrigation and multipurpose projects, including lift irrigation projects, all of which not only increase the irrigation potential of land, but also provide raw water supplies to the State for water supply and hydro-power. It also undertakes flood management in the state by construction of flood control (restoration and improvement works) as well as construction of major dams and drainages besides taking charge of the management and preservation of the water resources of the State, which inter alia includes both surface water and ground water resources. WRD is a direct major stakeholder as it plans to reuse the treated water for irrigation in downstream areas, in lieu of drinking water supply to PMC. Therefore, a close coordination between WRD and PMC is a desired need.

3) Urban Development Department, GoM

In the state of Maharashtra, UDD is responsible for all matters relating to

- Administration of Municipal Council(s), Nagar Panchayat(s), and Small Town Committees;
- Administration of the State Town and Country Planning Organization;
- Control and supervision of the Planning and Development Authorities; and
- Urban development including development controls, urban sanitation, urban drainage, urban sewerage and urban traffic, transportation etc.

The PMC and UDD signed a tri-patriate memorandum of agreement (MoA) with JNNURM for undertaking various state and local level urban reforms to carry forward the 74th Constitutional Amendment Act. This included undertaking maintenance of sewerage and wastewater (mainly domestic, commercial, and industrial) facilities by PMC as well as recovering full O&M costs by 2012-13.

4) Pollution Control Board, GoM

The state Pollution Control Board is responsible for enforcement of pollution standards in the state, Though, empowered, yet it mostly follows GOI guidelines and standards. Accordingly, it is legally mandated to monitor all discharges in river water i.e. from various STPs and enforce quality of Mula-Mutha river system.

14.1.3 Local level Stakeholders

1) Pune Municipal Council (PMC)

Pune, a major city of Maharashtra is the centre of various cultural, commercial and political activities in the State. This is the second Class I City, besides Mumbai, in the State. However, with its rapid growth, it is facing the emerging challenges of developing its urban infrastructure in order to support and drive the sustainable growth development processes without compromising its urban environment.

The PMC is the urban local body, tasked to provide the basic urban services to its area and populace. Through its City Development Plan (CDP), PMC reaffirmed its "commitment to develop and implement strategies and programs with an aim to bring about focused development in infrastructure and provide its citizens a high quality of life and universal access to basic urban amenities while maintaining the rich cultural and heritage base of the city."

In terms of sewerage management, PMC's mission is "To provide residents (customers) with cost-effective and quality sewerage services by collecting all wastewater generated from service areas and treating it as per mandatory requirements"[5] Thus, PMC is a key stakeholder as this project supports it towards achieving its sewerage vision.

Pubic of Pune and of Downstream Areas of Mula-Mutha River

The public of Pune (as customer) is an important stakeholder as they are the recipient of improved sewerage services against payment for these services. Thus, they would like better services at lower charges. Similarly, cultivators using treated wastewater (water discharged after treatment by STPs) for irrigation (after dilution in the river system) on the downstream side are other major stakeholders.

14.1.4 Responsibility Analysis of Stakeholders

Responsibility analysis of these stakeholders indicate that though GOI and GoM are responsible for setting policies, acts, rules and standards, yet PMC is the major implementing agency responsible for sewerage management. PMC technically is independent in development and construction of sewerage facilities but is financially relies on state budget for support. In general, no serious duplication and overlap of responsibilities have been observed. However, financial autonomy and dependence on state budget or central sponsored projects/schemes has been a major area of concern for development of sewerage services by PMC.

14.2 Organizational Improvement Model

At present, PMC has a total of 18000 staff, including about 500 engineers (450 civil and 50 electrical/ mechanical engineers) carrying out a variety of functions related with buildings, roads, street electrification, water supply, sewerage, etc. The details of the functional hierarchy in sewerage functions is pro-

[5] Revised *City Development Plan for Pune, Pune* Municipal Council (Government of Maharashtra), 2012.

vided below:

14.2.1 Situational Analysis of Sewerage Functions in PMC

Structurally, the sewerage services are part of "Sewerage and Water Supply Department of PMC". The sewerage facilities managed by PMC include about 2200 km of sewer network, 14 IPSs and 10 STPs with an installed capacity of 567 MLD. The management of Sewerage function is organized as follows:

- Planning, Construction supervision and O&M of sewerage facilities (STPs and IPSs): Under the supervision of Superintending Engineer (Projects & Coordination), the team of Executive Engineer (1), Deputy Engineers (4) and Junior Engineers (8) carry out all works related to project planning, supervising construction and later monitoring the O&M. Planning work for sewer network is also undertaken by the same staff. Task delegation is random and there are no separate units for planning, construction and O&M. .
- O&M of old STP at Naidu Hospital and IPS at Kasba: As mentioned above, out of the 10 STPs and 14 ISPs, Pune MC has outsourced O&M of 9 STPs and 13 IPSs to private agencies. However, O&M of 1 STP (Naidu Hospital) and 1 IPS (at Kasba) is carried out in-house under the Superintending Engineer (Electrical), supported by Executive Engineer (1), Deputy Engineer (1) and Junior Engineers (3).
- Construction of the Sewer network: SE (Sewerage) is responsible for construction of sewer network, supported by a team of 11 engineers comprising of Executive Engineer (1), Deputy Engineers (3) and Junior Engineers (7). Their key function is to carry out works valued above INR 2.5 million and sewer lines with diameter of 450 mm or above.
- Individual connection to Sewer Network: For sanctioning individual connections to the sewer network, the city area is divided into four zones, each under a Zonal Commissioner assisted by an Executive Engineer. Each zone is further sub-divided into 15 wards (these are not related to the 152 Administrative Wards), each having one Deputy Engineer and one Junior Engineer to oversee customer requirements relating to sewer line, chambers etc. Accordingly, there are 4 Zonal Commissioners, supported by Executive Engineers (4), Deputy Engineers (15) and Junior Engineers (15).

  The SE (Projects and Coordination), SE (Sewerage) and SE (Electrical) report to City Engineer. Further, The City Engineer and 4 Zonal Commissioners report to the Additional Municipal Commissioner (General).

  Zonal Commissioners, Executive Engineers, Deputy Engineers and Junior Engineers have their offices in the field. Superintending Engineers upwards in the hierarchy have their offices at Pune MC Headquarters. The Sewerage sector organization structure described above, is summarized in the figure below. Besides, task of planning and construction supervision of WTP and WSP is also entrusted to Superintending Engineer (Projects & Coordination) and his staff (mentioned under Sewerage sector above).

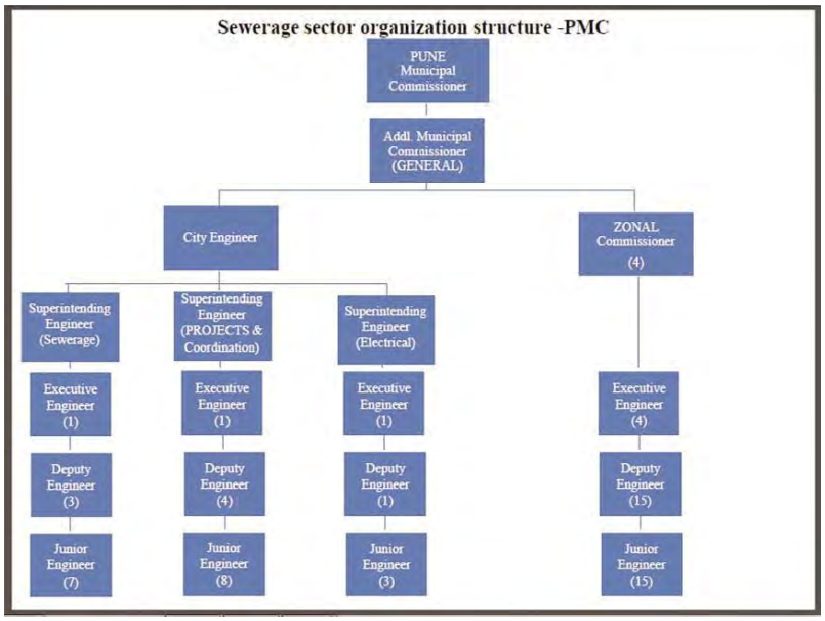


Figure 14.2.1 Structure of Sewerage Management Function in PMC

Operation Processes

a. Project approval and sanction

Before commencement of implementation of any project, following approvals are needed:

- Budget sanction
- Technical sanction and
- Financial sanction.

The 'Budget' and the 'Financial' sanctions are awarded by the 'Standing Committee' of PMC, and the technical sanction is awarded by the 'Estimates Committee'. The "Standing Committee" comprises 17 Councilors (elected from 152 Ward Councilors) and Commissioner (member-Secretary). These 17 Councilors select a Chairman from operational considerations.

Budget sanction: All 'capital' as well as 'O&M' schemes/ projects are conceptualized by the 'Project and Coordination Division'. A tentative cost figure is calculated and allocated to the project. The 'docket' with all proposals is discussed and consent taken from the City Engineer who forwards the same to the Municipal Commissioner for presentation to the 'Standing Committee' for Budget approval. This activity is carried out annually during the months of January to March and approval is awarded before the start of next financial year i.e. April 01.

Technical sanction: Once the project budget approval (in principle) has been obtained, engineers from the 'Project and Coordination Division' prepare detailed estimates, either in-house or by outsourcing the preparation to local agencies. Detailed Project Report is put up for Technical sanction to the 'Estimates

Committee', which meets twice each month. This Committee is headed by Additional Municipal Commissioner (General) and has City Engineer plus all Heads of Departments (HoD) as members.

Financial sanction: Tendering process is initiated using stipulated bid selection process, after the projects are approved by Estimates Committee i.e. after 'Technical sanction'. This provides with a financial need. Later, all details related to the project are presented by the Municipal Commissioner to the 'Standing Committee' for obtaining the 'Financial Sanction'. Municipal Commissioner is assisted in the process by City Engineer and the concerned HoD. To facilitate this process, the 'Standing Committee' meets each Tuesday of the week.

The above process is followed for all works costing INR 2.5 million and above. To make the sanctioning process faster for works below this limit of INR 2.5 million, the proposals are put up to Prabhag Samiti's (Mini Standing Committees) which operates in various Ward Offices of PMC and have a similar composition as at PMC's main office.

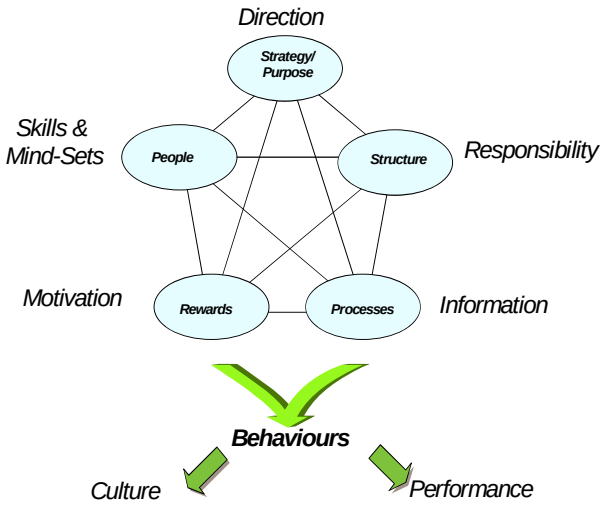
b. Construction:

Project management functions, based on discretionary allocation of task, are assigned to specific team of engineers for construction monitoring by the respective HoD. Here it is worth mentioning that during execution of the project, any variation /deviation related to quantity, cost, policy or legal provisions, has to follow the following process of approval:

- A detailed note pertaining to the variation/deviation is prepared by the Deputy Engineer, scrutinized by Executive engineer and then by Superintending Engineer.
- The Superintending Engineer has to get approval of the Internal Auditor's office and Vigilance office before it is put up for Additional Municipal Commissioner (General) and Municipal Commissioner to consider.
- The Municipal Commissioner then presents the detailed note pertaining to the variation /deviation to the Standing Committee for approval.

14.2.2 Organizational Diagnosis

Improving the existing organization of PMC as a whole is a prerequisite in executing, maintaining and improving the sewerage services. In general, organizational improvements focus on Policies, Systems, Processes, Human resources (both numbers and competencies), Structure, Resources (mainly Finance), work environment (physical and behavioral) etc. In other words, one can use the basic model of organizational strengthening, based on the work of J. R. Galbraith's "Star Framework" as presented in figure below. The sequence of the organizational 're-design' should include a relook at the five elements that are required, when changed/new institutional roles are created within PMC.



(Source: Adapted from Galbraith's Star Framework)

Figure 14.2.2 Organizational Strengthening Model

1) Situational Analysis

In the current institutional structure of PMC the functions of policy making, and service provision are not clearly delineated, and lead to conflicting objectives, political interference and lack of incentives and accountability. There is lack of clarity on institutional arrangements, particularly with regard to functions such as planning, financing, regulation, and management, etc.

To commence with any improvement and for creating a related plan, it is essential to understand the prevailing situation in PMC. Interactions with key officials and observations have resulted in a compilation of organizational challenges faced by PMC management and staff. These "areas for improvement/issues" are enumerated below:

- **Strategic Issues**

- Multiple authorities (Administrative, Executive and Legislative - three chains of instructions) and multiple responsibilities of field staff have led to reduced productivity; the staff is frequently faced with the question whether to follow the Ward Councilor's directive or Executive Engineer's instructions.
- Lack of Quality policy leading to project time over run leading to loss of economic benefits (70 % of projects experience time over run).
- Poor cadre management and inadequate recruitment planning has led to shortage of appropriate staff. (though it is informed that plans are in place to induct 500 Engineers into PMC by the end of this year).
- Policies on transfer etc. needs to be more transparent and linked with workload.
- Lack of effective human resource management & development policy (performance management, man-power planning, need based training etc.)

- **Processes and System Issues**

- No 'Job Description Document' exists in PMC, resulting in discretionary allocation of tasks based on ad hoc assignment of functions depending on the urgency and staff availability at that given time.
- Systematic review mechanism to monitor plans and regulations is not followed. Procedures, though laid down, are not followed due to paucity of time which is further attributed to insufficient staff.
- SOPs have been prepared for the STPs and IPSs but there is no documented standard procedure available to guide the O&M of the sewerage network.
- Currently, 'physical and financial progress (expenditure incurred)" are considered as major indicators of progress of work. However, quality of construction does not receive due attention.

- **Structural Issues**

- Functional units like strategic planning, asset management, cost control etc. are not specified. With huge assets, asset management defines, describes and provides maintenance guidelines for key elements: more specifically sewerage networks, pumping, storage, and treatment facilities. It is important to have appropriate management information on asset condition, infrastructure costs and performance, and the consolidated requirements for repairs and maintenance, as well as appropriate maintenance schedules standards.

- **HR Issues**

- Work load analysis required to match geographical spread, manpower and other resources - rightsizing of all units for "adequate" and "appropriate" human resources
- Shortage of full time operational staff in PMC's sewerage team, who can be trained, retained and incentivized to perform well. This has affected the management of services, as well as works supervision.
- Feeling of 'ownership' missing among PMC staff – cause is attributed to nepotism, practices;
- Lack of structured Training policy for both induction s well as in-service trainings. The higher level officials need to be exposed (using study visits) to have attitudinal changes, Whereas, middle level officials knowledge may be focused. Similarly, lower level officials be provided with requisite skills. The areas may be contract management, construction management, overall project management, IT skills, Team building, conflict resolution etc. .

The identified issues (policy, structure, process, system, human resources and other resources) have to be further validated and and strategies evolved for improvements using appropriate models by PMC consultants, who should undertake more in-depth data collection and undertake desired analysis so as to evolve a quantitative base for the improvements. This shall include development of HRM and HRD poli-

cy supporting motivation and behavioral changes besides competency assessment (to identify gaps) and proposals for capacity building/trainings.

14.3 Institutional Improvement

After a situational assessment of the Sewerage and Water Supply Department, PMC, there is a merging need for an integrated improvement (action) plan covering various institutional aspects, such as management, operation and maintenance, finance, legislation, natural and social conditions. There are a number of issues, for which action plans need to be developed, which is expected to be undertaken by Pune MC with the assistance of the Project Management Consultants. These are:

(1) Self-supporting operation of sewerage management
(2) Preparation of long-term and annual business plans
(3) Development of asset database
(4) Improvement of information management system
(5) Policy for revision of sewerage tax and sewerage benefit tax and improvement of collection
(6) Mandatory water meter installation (more **to calculate sewerage charges** on volumetric basis as a % of water use)
(7) Preparation of financial statements
(8) Customer service
(9) Human resources/personnel management
(10) Improved coverage including slum sanitation

Some of these shall require needful awareness campaigns to support the main action plans. The topics to be taken-up for the information/awareness campaigns may include:

- Promotion of service connections for new areas/connections
- Information and education on importance of water metering for new and existing connections as well as on benefits received in regularization of illegal/unauthorized connections
- Promotion of the necessity of payment of sewerage taxes (indirectly property taxes)
- Information and education on wastewater reuse and possible techniques

14.3.1 Self-supporting Organizational Management

The current sewerage management of PMC follows a vicious cycle. Due to shortcomings in services, the people are reluctant to pay sewerage tariff resulting to a low collection rate. As a consequence, the revenue of SWSD, PMC is lower than the expenses on operation and maintenance of sewerage management. Due to limitations in budget and human power, development and maintenance works are also inadequate, and replacement of degraded facilities and new investment are difficult to undertake, which, in turn, results in the limitations in sewerage management services.

Figure 14.3.1 shows estimated revenue and expenditure on Sewerage Management in PMC for 2013-14. Expenditure consists of non-plan expenditure (41%), operation and maintenance cost (11%), and capital investment (48%). The revenue, which is collected along with property tax includes sewerage tax and sewerage benefit tax and can covers about 93% of O&M expenditure. On a business management perspective, the SM services in PMC are nearly self- sustaining, if only O&M expenses are accounted. However, when development expenses are considered, it is operating in serious deficit.

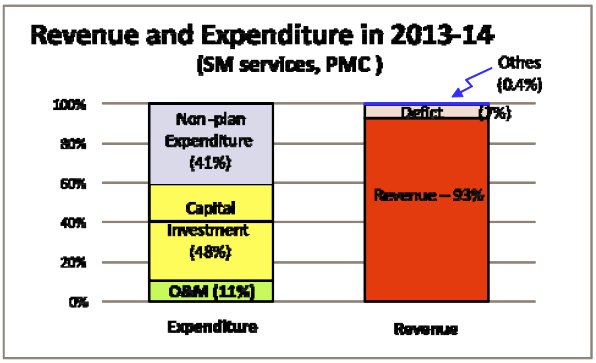


Figure 14.3.1 Revenue and Expenditure of the SM services in PMC (2013-14)

At present, all budgets for operation and maintenance of sewerage services is provided by PMC. The budgeting and accounting system of PMC though can provide major details of financial operations, yet has limitations in SWSD"s ability to perform operational improvements based on its own financial plan. This aspect of management is due both to the lack of a business insight as it is due to the existing governmental system. To convert the current situation into a financially sound situation, improvement of financial conditions through establishing the self-supporting management system is very important.

Cost allocation for financially self-supporting organizational management

Among the factors to achieve the sustainable and self-reliant operation, financial self-reliance is especially important. It is necessary to decide on the distinction of cost allocation between public and private revenue sources, and to reduce subsidies from the public revenue sources. The cost to be covered of the self-supporting organization includes operating cost, replacement cost, and capital investment. The operating costs, often called operation and maintenance expenses, are the costs from regular operation of sewerage services, including manpower, chemicals, electricity and and routine and periodic maintenance (minor repairing) of the facilities. Replacement cost is the depreciation cost of the capital replacement of existing facilities, whereas capital investment includes costs of developing assets for sewerage collection and treatment, offices etc.

At present, the capital investments are met by the PMC budget, which receives its significant part from the State. After the project completion, it is recommended that at least a) annual O&M cost and b) replacement cost of existing facilities, and preferably c) a part of the debt service obligations for the future

capital investment be covered by SWSD, PMC through tariff charges on the customers/beneficiaries. Table 14.3.1 presents the recommended cost allocation after project completion.

Table 14.3.1 Cost Allocation for Sewerage Services

Costs	Present	After the Project
a) Operating Costs	SWSD, PMC (State)	SWSD, PMC (by consumers)
b) Replacement Costs	SWSD, PMC (State)	SWSD, PMC (by consumers)
c) Capital Investment	SWSD, PMC (State/Central Govt)	SWSD, PMC (by consumers), Partly by Govt.

Ideal Situation for Formation of Self-Supporting Organizational Operation

Under the 74th constitutional amendment act of GOI, it is mandatory for respective governments to increasingly transfer responsibility of urban services to Urban Local Bodies in the urban areas. In line with this, PMC has been undertaking sewerage services within its municipal limits. No doubt, some organizations are using another type of self-supporting organizational management model with performance-based contract or management contract with private firms (Delhi Jal Board model). However, under the current situation, where total outsourcing of services may be difficult, PMC need to initiate with 'clear" separation of financial accounts for sewerage services from other accounts of the ULB as a first step toward transforming it as a self-supporting unit (organizational model). .

In this regard, "Ring-fencing" is an ideal method to establish self-accounting system of the sewerage services. Ring-fencing is defined as a "legal or financial arrangement of separating the activities, assets, liabilities, revenues and costs, generated by a specific business from the general business of an entity". In the context of the Sewerage services of PMC, the objective to introduce the ring-fencing is to separate financial accounts of the sewerage services from other accounts of the ULB. The purpose shall be generate more accurate information that can be utilized in decision making on resource management, operational improvement, and financial management, resulting in better services to the public/customers. The procedure to introduce this innovative financial concept is as follows:

- Affirmation of legal basis and the commitment
- Mapping of system and procedures
- Organizational review and realignment
- Improved Accounting Systems and Procedures

Improved Accounting Systems and Procedures may include:

- Setting up the books of accounts,
- Establishment of the beginning balance for the balance sheet account,

- Determination of revenue and expenditure for the year,
- Preparation of income statement,
- Preparation of balance sheet,
- Preparation of cash flow statement, and
- Closing the temporary account balance. through ring-fencing,

Overall, it is expected that more efficient management of expenditures shall be made and sewerage tax rates shall be calculated more accurately. Besides, collection efficiency needs to be improved (PMC has a substantially good record of +90%) by introducing more accountability of field staff.

Short-term and long-term plan for Self-supporting Organizational Management

Ring-fencing should enable PMC to undertake better financial management, impacting the formulation of its future management plans. Followings are the short-term and long-term plan toward the self-supporting organizational management of sewerage services, and details of Action Plan for Establishment of Self-supporting Organizational Management are provided in Table 14.3.2.

【Short-term Plan】

1) Improvement of sewerage services within PMC
2) Establishment of the self-accounting system (Ring-fencing) of sewerage services within PMC

【Long-term Plan】

3) Operation of Sewerage Unit without financial support from PMC/State
    a) Total Recovery of O&M (manpower, chemicals, electricity, periodic and routine maintenance) costs → within 5 years
    b) O&M cost + Depreciation of Capital Assets → after 10 years
    c) O&M costs + Depreciation of Capital Assets + 10-20% of Capital cost → after 15 years
4) Establishment of the self-supporting organization

Table 14.3.2 Action Plan for Establishment of Self-supporting Organizational Management

Sr. No.	Action	Issued to Be Discussed/Studied	Target Date (MM/YY)	Budget (INR)	Responsible Official
(1) Short-term Action Plan					
1-1	Situational Analysis of Organizational Operation and Problem Detection	Activity: - Gather basic information (subscribers' information, tariff collection data, personnel, organizational structure, fixed assets, financial indicators, etc.) - Map the process of key financial and commercial activities - Conduct problem analysis and identify possible/adaptable solutions	Sept 2015	Nil	CE/SE
1-2	Assessment of relationships between Sewerage Unit, PMC and other external entities	Activity: - Enumerate all activities related to the sewerage services - Identify office or entity that performs the activity - Identify necessary arrangement between SWSD, PMC and other entities to remove duplications and to support unattended responsibilities towards efficient services	Dec 2015	Nil	CE/SE
1-3	Review of Ideal Situation for Formation of Self-Supporting Operation of sewerage services	- Ring-fencing - Performance-based contract/management contract	March 2016	Nil	Commissioner/CE/FO
1-4	Introduction of separate accounting System for sewerage services	Ideal Steps of Introducing Ring-fencing: - Affirmation of legal basis - Affirmation of the PMC's commitment - Mapping of ideal system and procedures - Improvements in Accounting systems	May 2016	Nil	Commissioner/CE/FO
1-5	Monitoring and Evaluation of the accounting system	- Monitoring system - Performance indicators	2017～	Nil	Commissioner/CE/FO
(2) Long-term Plan					
1-6	Establishment of self-management system without financial support from the State	Long-term Objective for Cost Recovery: - O&M cost → after 5 years - O&M cost + Depreciation→ after 10 years - O&M costs + Depreciation + a part of Capital cost→ after 15 years	2022-2036	Nil	Commissioner/CE/FO
1-7	Discussion with Other Agencies toward Self-Supporting sewerage services	- Within PMC - External Organizations	2032-33	Nil	Commissioner/CE/FO
1-8	Establishment of Self-Supporting Operations of sewerage services	- Capacity development of the PMC - Condition of the management transfer - Management transfer to the SWSD, PMC	2034	Nil	Commissioner/CE/FO

14.4 Development of Asset Management System for Sewerage Services

Details of available assets for sewerage management have not been maintained in an asset database. They are available at different locations and a unified record is not available. For asset management and their timely maintenance such a database is required on priority. Therefore, mapping system for sewerage services may comprise of:

- Automated/manual mapping system and its integration with GIS,
- Geographical information system (GIS), and
- Facility management system (FM),

Out of these, the use of geographical information system (GIS) shall be for processing and analyzing the asset information on the geographical (with latitude, longitude and altitude) base map. Later, a integrated facility management system shall be developed to include and integrate the asset database with the geographical location. The facility management system shall assist in maintenance scheduling and estimation of costs required to undertake the routine and periodic maintenance.

14.5 Facilitate Preparation of Sewerage Management 'Business Plan'

A **business plan** is a formal statement of a set of business goals, the reasons they are believed to be attainable, **and the plan for reaching those goals.** For utility organizations like PMC, when the existing functions are to assume a major change (as is the case), a 5-10 year business plan is the need besides a long term plan for senior bureaucrats, politicians etc., as they may wish to consider long term returns in that timeframe. It is expected that ***PMC's Business Plan*** shall reflect the aspirations during the next ten years i.e. up to 2025 to support scaling up of sewerage (coverage and quality) services for the city of Pune. The 'Business Plan' generally answers the questions, *"Where is* PMC *now?"*, *"Where does* PMC *want to be?"* and *"How is* PMC *going to get there?"*

The business plan also sets out baseline for the performance of PMC, its priorities and aims for the future. Therefore, a well developed Business Plan may should guide the implementation of projects and reforms to be undertaken by PMC. In addition, the Business Plan should provide the requisite basis for any resource mobilization to enhance the credit worthiness of PMC.

14.5.1 Background

Pune Municipal Corporation (PMC) is the seventh largest metropolis in India. To cope up with the rapid growth and urbanization especially of last 20 years, PMC aims to develop comprehensive infrastructure to not only cater to existing demands of sewerage management but also to meet future demands. The major challenges (both existing and upcoming) for sewerage management are:

- To control/regulate discharge of untreated sewerage from PMC areas to limit pollution of water of Mula-Mutha river. PMC presently treats about 80% of sewerage before discharge.
- To extend sewerage network to uncovered/new developing areas (43 km network at Baner, additional

70 km mains/sub mains in PMC), from where sewerage shall flow into PMC sewerage system

- To have adequate capacity for sewerage treatment (as a mandatory responsibility) - presently inflows for treatment at 9 STPs are 392 MLD (capacity of 477 MLD), whereas projected needs are much higher (728 MLD in 2011, rising to 873 MLD in 2027)
- To improve/rehabilitate part of existing sewerage treatment facilities (One STP of 90 MLD at Naidu, replacement of 7 pumps etc.)
- To have efficient, effective and economic operation of sewerage management facilities as existing capacity and capability of PMC is limited with regards to sewerage management

To address the above challenges on a sustained basis, PMC need to develop a long term and a short term (5 year) business plan to not only manage the collection, treatment and disposal facilities but also to establish a sustainable and sound management system for the sewerage sector. The business plan in a way integrates plans for addressing the technical challenges, customer satisfaction, financial sustainability and organizational improvements for effective sewerage management and its monitoring.

14.5.2 Scope of the Business Plan

The PMC deals with planning, execution and operation and maintenance of sewerage services for the people of Pune. It is assumed that the scope of this business plan shall be limited and focus only on the Sewerage Services, since long-term projection and detailed activities of other interrelated sectors is not well known. Therefore, the proposed business plan presents the long-term plan and annual action plan for PMC.

14.5.3 Contents of the Business Plan

The following could be the contents of the prospective business plan.

1) Executive Summary
2) Introduction (background, national water policy, legal background, organization)
3) Vision, Mission, Goals
4) Strategy and Long-term Action Plan (target, strategy, activities)
5) Annual Action Plan (target, scope of work)
6) Financial Plan (tariff revision, investment plan)
7) Organizational Plan (self-supporting organizational management)

14.5.4 Establishment of Basic Policies for Sewerage Management Business Plan

No doubt, PMC has laid its Vision and Mission for the sewerage management services to Pune and its immediate environs. However, detailed plans and supporting policies are not available. For development of a business plan, it is necessary to have a close review of the existing and planned situation of an organization (sewerage unit), normally reflected by its Vision. Since ‘sewerage management functions” are a part of PMC, it is difficult to have a vision, away from the vision of PMC. From the vison of PMC, the important attributes, which are related to sewerage management are customer satisfaction and improved

livelihood. To achieve this, the **mission (action oriented)** statement for **Sewerage management** for SWSD, PMC could be: *"To be a self-sustaining unit providing residents (Customers) with high-quality, cost-effective sewerage services by collecting all wastewater generated from service areas and treating it as per mandatory requirements."*

14.5.5 Objectives of Business Plan and Phasing

Business objectives are the ends that PMC sets out to achieve. It need to create a business plan to enable it to achieve these ends. Practically stating - "plans" are the "means to these ends". The objectives and plans, that PMC is developing, are determined by balancing the requirements of the various stakeholders (Government, elected representatives, public/customers, employees etc.). The objectives of PMC are thus a blend of various interests of the stakeholder groups. For sewerage management, the set of objectives are:

- To reduce water pollution in Mula-Mutha river by bringing the discharge to NRCD prescribed levels
- To improve customer satisfaction on quality of services as well as value for money
- To increase sewerage coverage to 100% of population of PMC, Pune Cantonment Area and Identified villages
- Rehabilitation of existing sewerage facilities (within next 5 years)
- Organizational improvements and capacity building of PMC staff for efficient and cost effective management of sewage facilities
  effective management of sewerage facilities
- Full realization/recovery of sewerage bills (indirectly by recovering property tax bills- wherein a specified allocation is towards sewerage)
- Establish a mechanism to ensure full recovery of O&M cost of sewerage management in 5 years; It was indicated by PMC that present sewerage charges (revenue from sewerage charges and sewerage benefit tax) are nearly adequate to meet the cost of O&M (manpower, electricity, chemicals, normal repair) costs.
- Full recovery of cost of sewerage management (O&M, Depreciation, Interest, other charges) by PMC in 10 years (by 2026) and even capital costs by 2035.

14.5.6 Setting of Long-term Targets and Strategy of the Business Plan

One of the ideal long-term targets of the SWSD, PMC is to become a financially self-supporting unit. This includes improvement of sewerage services within PMC (improved collection and treatment, improvement of O&M, improvement of administrative efficiency). Based on discussions with PMC officials, technical, financial and institutional goals have been established. These include the following:

Long- term goals: The long-term goals have been set for a period of about 20 years (say by 2035). This includes

- 100% realization/recovery of sewerage bills
- Increased Customer satisfaction
- Efficient operation of STPs meeting all mandatory requirements
- Recovery of total cost of O&M (operational as well as substantial capital component)
- Fully operational asset management system
- Improved reuse of treated water (existing 5.4% to 40%)

Medium term goals: These are goals, which are targeted for next 7-8 years, especially for coverage, infrastructure development, potential PPP/outsourcing arrangements, O&M sustainability etc. This includes:

- Expansion of sewerage network for improved coverage (100%) of design population
- Increased capacity of STPs (adequate for the design population of 2027)
- Recovery of O&M costs (staff salaries, electricity, chemicals, normal repair and maintenance) and some depreciation, interest etc. on capital works
- Asset management and customer grievance management system in place
- Improved reuse of treated water (existing 5.4% to 15%)

Short term goals: Short term goals addresses immediate operational parameters such as procurement, coverage etc,. It may typically cover the goals set for next four years (by 2019-20). For sewerage component of PMC, this should mainly include:

- Expansion of sewerage network for improved coverage (90% to about 97%)
- Increased capacity of STPs (addition of 127 MLD at Naidu and Bhairova)
- Recovery of O&M costs (staff salaries, electricity, chemicals, normal repair and maintenance)

14.5.7 Activities to Achieve Long-term Target of the Business Plan

The improvement of sewerage service needs various efforts including expansion of sewerage services, improved treatment facilities, O&M efficiency, administrative efficiency etc. Table 14.5.1 presents various activities to achieve target of the long-term business plan.

Table 14.5.1 Activities to Achieve Long Term Targets of the Business Plan

#	Activity	Detail Action	Target
1	Establishment of Self-supporting Organizational Management	- Situational analysis of organizational operation and problem detection - Arrangement of relationship between SWSD, PMC and other external organizations - Review of ideal situation for formation of self-supporting organizational management - Introduction of self-accounting system - Establishment of self-management system without	- Establish self-accounting system by 2016 (including financial statements) - O&M cost recovery by 2020 - O&M cost and depreciation cost recovery by

		financial support from the State - Discussion with other agencies toward self-supporting organizational operation - Establishment of self-supporting organizational operation	2030
2	Revision of Sewerage Tariff	- Problem identification of current tariff - Establishment of basic principles for tariff revision - Study on tariff revision methodologies - Study on management efficiency improvement efforts - Short-term, mid-term, and long-term cash flow analysis - Setting new tariff rates based on volumetric way (linking to metered water use) - Pilot project - Revision of tariff rate based on the updated inventory and pilot project experience - PMC Approval - Starting new tariff system and collection system - Developing a system of Periodic revision of tariff rates and its implementation	- Setting new tariff rates by 2016 - 1st revision of new tariff system by 2021 - 2nd revision of new tariff system by 2026 - 3rd revision of new tariff system by 2031
3	Increase in Sewerage Tariff/tax Collection Rate	- Situation analysis on current tariff collection - Study on diversification on tariff collection methodologies - Implementation of the pilot project - Make detailed implementation plan - Monitor the activities of the detailed implementation plan - Monitor performance indicators on the tariff collection rate and use it for improvements	- 100% by 2021
4	Improvement of Operation and Maintenance Efficiency	- Study the current situation and causes of inefficient operation and maintenance of facilities - Set the target of the improvement of the operation and maintenance efficiency of facilities - Develop strategies for improvement of O&M efficiency of facilities - Develop detailed implementation plan - Monitor the activities of the detailed implementation plan - Monitor the performance indicator on the improvement of the operation and maintenance efficiency of facilities	- Targeted improvements per annum
5	Improvement of Administrative Efficiency	- Study the current situation and causes of inefficiency of administration and staff deployment - Set the target of the improvement of efficiency of administration and staff deployment	- Targeted Improvements per annum

		- Develop and implement capacity building strategies - Develop the strategies for the improvement of efficiency of administration and staff deployment - Develop detailed implementation plan - Monitor the activities of the detailed implementation plan - Monitor the performance indicator on the improvement of efficiency of administration and staff deployment	

14.5.8 Preparation of Annual Business Plans

Annual business plan is basically a breakdown of the long-term business plan. The short-term (the first five years) target of the long-term business plan is to achieve cost recovery of operation and maintenance cost, and the first five year's activities in the annual business plan have to be corresponding to this target.

The business plan is aimed at coordinating efforts of the various departments to achieve a common purpose at the least possible human, material, and financial cost and to ensure that policies, program, and project support and reinforce each other. In drafting the annual business plan, the respective taskforce teams will be organized to schedule activities taking into consideration, the strategies, milestone and deliverables specific to the plan.

The activities of the annual business plan will be implemented based on the duly prepared and approved annual budget. The preparation of the annual business plan and the annual budget will have to be interactive and properly coordinated to ensure that the both are well synchronized.

14.5.9 Financial Plan

The financial plan provides a framework for policy makers and implementing bodies to collaborate with producing the sewerage services program that is clear, consistent, sustainable and financially feasible. The financial plan also shows the revenue and expenditure of future services and how they are to be funded. The objectives of the financial planning are: [6]

Providing a structure to enable a policy dialogue to take place, involving all relevant stakeholders, with the aim of producing a consensus on a feasible future of Sewerage Services

- Illustrating the impact of objectives and targets in a long term perspective
- Facilitating external financing by providing clear and transparent data on financing requirements

To see a balance of revenue and expenditure and assure the sustainability of the PMC's sewerage services, cash flow statements for short-term, mid-term, and long-term operation would have to be developed. The

[6] "Strategic Financial Planning for Water Supply and Sanitation", OECD 2009.

available cash flow analysis indicates the flows of PMC's revenue and expenditure during a certain period. Cash inflow comes from PMC's operations and includes the sewerage tax revenue and sewerage benefit tax including connection fee and penalty fee, whereas cash outflow includes operating expenditure and replacement cost. Cash flow analysis should help Sewerage Services within PMC to cover operational costs from the services, and assist PMC in foreseeing potential problems in the future.

Also, financial plan enables policy makers to have a more objective discussion of tariff policy. The tariff is the main source of sewerage management and a key ingredient for successful and sustainable operation of the services. To achieve the long-term target of the business plan, adequate revision of sewerage tariff may be required (though it looks adequate at this time).

14.5.10 Action Plan for Developing Business Plan

An action plan for developing long-term and annual business plans is presented in Table 14.5.2.

Table 14.5.2 Action Plan for Preparation of Long-term and Annual Business Plan

Sr. No.	Action	Issued to Be Discussed/Studied	Target Date (MM/YY)	Responsible Official
1-1	Data Collection and Analysis of O&M records as well as relevant Financial Data	- Data collection (Customer inventory, population projection, demand projection, production projection, financial data) - Problem analysis	Sept 2015	CE/SE
1-2	Establishment of Basic Policies for Sewerage Business Plan	- Basic policy establishment - Vision, Mission, Goal of the Sewerage Services, PMC	Dec 2015	Commissioner/CE
1-3	Setting of Long-term Targets and Strategy	- Long-term target setting - Long-term strategy to achieve the target - Cash flow analysis	March 2016	Commissioner/CE/FO
1-4	Setting of Annual Target and Scope of Work	- Short-term target setting - Strategic actions to achieve the target	End of each fiscal year	Commissioner/CE/FO
1-5	Preparation of Annual Business Plans	- Key issues - Strategic action - Responsible person - Budget requirement	End of each fiscal year	Commissioner/CE/FO
1-6	Approval of PMC Council (if needed)	- Chief Engineer's approval - Commissioner's approval - Municipal Council's approval	30/06/2016	Commissioner/CE/FO
1-7	Monitoring of Annual Business Plans	- Periodical monitoring Indicators - Annual evaluation - Achievement of operational indicators	End of each fiscal year	Commissioner/CE/FO
1-8	Preparation of Long-term Business Plans	- Vision, Mission, Goals - Strategy and Long-term Action Plan - Financial Plan - Organizational Improvement Plan	July 2016	Commissioner/CE/FO
1-9	Monitoring, Evaluation and Feedback to Improve Long-term Business Plan	- Mid-term evaluation (1): after 4 years - Mid-term evaluation (2): after 9 years - Final evaluation: after 14 years	2026, 2031, 2036	Commissioner/CE/FO

14.6 Institutional Strengthening Action Plan and Schedule

A number of activities have been proposed under institutional strengthening of PMC. The major activities, expected outcomes, sub activities, monitoring indicators and lead agencies etc. have been provided in Table 14.6.1.

Table 14.6.1 Institutional Strengthening Action Plan for Sewerage Management in PMC

Sl. No.	KEY OBJECTIVE	KEY OUTPUT	KEY ACTION REQUIRED	PERFORMANCE INDICATOR	Timeline	LEAD IMPLEMENTING AGENCY
1	**Policy, and Planning and its Implementation**					
	Policy and Planning on rational basis	Development of Long term Vision and Policy	Creation of a Key Unit	Approved Policy and Plan documents	March 2015	PMC
	Functional Policy and Planning Unit for SM in PMC	Policy and Planning Unit in PMC	Creation of a key monitoring Unit (PMU	Establishment of Unit	Sept 2015	PMC
		Implementation of Policy	Break up of Policy into suitable medium and long term objectives Development/Updation of Medium and Long Term Business Plan	Medium/long term objectives defined Implementation of long term objectives already initiated continues Updation of Medium and Long Term Business Plan achieved Implementation of me-	Dec 2015 Mar 2016	PMC

Sl. No.	KEY OBJECTIVE	KEY OUTPUT	KEY ACTION REQUIRED	PERFORMANCE INDICATOR	Timeline	LEAD IMPLEMENTING AGENCY
				dium term objectives achieved Implementation of long term objectives initiated and continues	June 2016 Dec 2016	
	Master Plan and Time based Plan Development	Preparation of Master Plan and Annual and Five year Plans	Synchronization of annual and multi-year plans with medium/long term objectives	Synchronization achieved	March 2016	PMC
	Ensure adequate and sustainable funding for sewerage management (development and maintenance)	Availability of resources to meet commitments	Study to explore various options to mobilize additional resources	Studies completed. Commitments for Increased funding (real terms) for both capital and maintenance funds agreed/witnessed	March 2016	PMC
2	**Delivery of Sewerage Infrastructure (Sewer Network, IPSs, STPs etc.)**					
	Efficient delivery of Detailed Project Reports	Preparation of sound DPRs in-	Prepare SBDs including TORs for all types of out-	Standard documents and	July 2016	PMC (to outsource the STP

Sl. No.	KEY OBJECTIVE	KEY OUTPUT	KEY ACTION REQUIRED	PERFORMANCE INDICATOR	Timeline	LEAD IMPLEMENTING AGENCY
	(DPRs)	cluding integration of environment and social aspects	sourced works and services. Ensure accountability of DPR consultant	manuals in place Reduction in incidences of time/cost overruns on projects over a period of time		design function, as required on occasional basis)
	Ensuring that designs are based on sound engineering and environmental practices	Designs reviewed for conformity	Creation of a Design Review Team	Team notified and system of review in place	July 2016	PMC
	Improved management of Pre-Construction activities (land acquisition etc.)	Timely actions on management of pre-construction activities	Training of PMC staff (sewerage management Unit) Coordination with Revenue and other Departments Incorporating intermediate milestone for pre-construction activities	Delivery of required trainings Standing Coordination Committee established. Reduction in incidences of Contractor's claims for idle man-power & machinery Reduction in incidence of complaints by PAPs	July 2016 In place April 2017 April 2017	PMC, Revenue

Sl. No.	KEY OBJECTIVE	KEY OUTPUT	KEY ACTION REQUIRED	PERFORMANCE INDICATOR	Timeline	LEAD IMPLEMENTING AGENCY
			in SBD for DPR preparation.	(percentage)		
	Procurement of Works, Goods and Consulting Services	Time bound procurement	Evolve SBDs as per necessity Strengthening local contracting/consulting and entrepreneurial industry Interaction with prospective bidders	Updated SBDs Reduction in bid processing time System of interaction with prospective bidders put in place Early Resolution to issues of local contracting industry	Aug 2016 Aug 2016 Aug 2016	
	Project and Contract management during construction	Projects completed without time and cost overruns and conforming to set quality standard	Prepare Guidelines/ handbook/Manual of contract management for use of departmental officers for each type of SBD. Study adequacy and appropriateness of existing	Guidelines/Handbooks prepared and put in practice Reduction in incidence of cost and time over runs. Reduction in incidence of conflict situations, arbi-	July 2016 Mar 2017 March 2017	PMC, GoM

Sl. No.	KEY OBJECTIVE	KEY OUTPUT	KEY ACTION REQUIRED	PERFORMANCE INDICATOR	Timeline	LEAD IMPLEMENTING AGENCY
			Quality Management (QM) system and strengthen it as per needs including review of QC/QA/ Q Audit functions.	trations and litigations. Recommendation of QM Study put in place (ex. Third party quality assurance)	June 2016	
3	**Sewerage Asset Management**					
	Development of GIS based Asset Database of Sewerage Services	GIS based Asset Database	Inventory Identification GIS base map development Asset survey (Customer connections, IPSs, Mains, STPs …) Transfer on GIS map	Functional GIS based asset database	March 2017	PMC
	SM services to the satisfaction of the customer/public	Encroachment Free Sewerage Management Operations	Maintenance Strategy for SM Assets Encourage long term Performance/maintenance contracts	Strategy for SM developed Performance based maintenance contracts (PBMC) being practiced	Mar 2016 July 2016	PMC, GoM, NGOs

Sl. No.	KEY OBJECTIVE	KEY OUTPUT	KEY ACTION REQUIRED	PERFORMANCE INDICATOR	Timeline	LEAD IMPLEMENTING AGENCY
			Develop Maintenance Manuals Undertake periodic user satisfaction study	Maintenance Manuals prepared and used System of undertaking user satisfaction surveys introduced	July 2016 Sept 2016	
	Control of Encroachments on Sewage assets	Encroachment Free Sewerage facilities	Prepare cartographic maps defining boundaries for STPs and IPSs Physical identification of encroachments and make efforts to reduce them Development of a system to guard and control encroachments Use enforcing provisions of law (which authorizes PMC) to remove encroachments	Encroachment Free Sewerage facilities	March 2017 Apr 2016 July 2016 Continuous	PMC
4	**Safety in Sewerage Management**					

Sl. No.	KEY OBJECTIVE	KEY OUTPUT	KEY ACTION REQUIRED	PERFORMANCE INDICATOR	Timeline	LEAD IMPLEMENTING AGENCY
	Enhancing safety of workers during construction, operation and maintenance		SBDs to include safety arrangement at construction sites as a BOQ item Sensitize the PMC sanitation workers, Contractors, Consultants and the staff.	Number of accidents directly attributable to engineering factors monitored Number of accidents reduced over a period of time Improved workmen safety Modified SBDs Accident/casualty statistics monitored	Sept 2016 Sept 2016 Sept 2016	PMC
5	**Capacity Building of PMC staff** (within PMC, Construction industry)					
	Development of match between required people (based on tasks and spending capacity) and available people	Adequate capacity developed Adequate number of competent staff (engaged on regular basis	Put up in place a rationalized Human resource plan along with recruitment and rationalized Human Resources Development and Manage-	HRM Policy including recruitment implemented Adequate number of HR in place	June 2016 July 2016	PMC, Construction and Maintenance Industry

Sl. No.	KEY OBJECTIVE	KEY OUTPUT	KEY ACTION REQUIRED	PERFORMANCE INDICATOR	Timeline	LEAD IMPLEMENTING AGENCY
		or outsourced for intermittent use)	ment Policy Fill up vacancies through available and permitted recruitment mechanisms.			
	Availability of Trained/Competent people in the PMC	Desired number of staff with required competencies	Redefine Training Strategy to include development of in-house core competencies and other competency gap areas Identify grey areas preventing full utilization of available infrastructure and suggest mitigation measures Developing mechanism to encourage staff to take	HRD Policy in Place Adequate number of staff imparted trainings, participation in conferences, study visits to required locations (in-country and abroad) Staff Appraisal Report form modified to HRD linked performance management system A Training Report prepared and disseminated	Aug 2016 Aug 2016 to 3 years (process to continue as per policy) March 2017 and then each year	PMC, GoM

Sl. No.	KEY OBJECTIVE	KEY OUTPUT	KEY ACTION REQUIRED	PERFORMANCE INDICATOR	Timeline	LEAD IMPLEMENTING AGENCY
			training by including it in staff appraisal report Continue regular training programs	(could be electronic) annually		
	Networking with international/national/state level institutions organizations	Exposure to international and national level good practices	Obtain institutional membership of international organizations and enter into MoUs with them.	Memberships and MoUs with international organizations Periodically disseminate lessons/experiences and their applicability	April 2016 Continue from Dec 2016	
	Efficient IT-ICT support	Harnessing potential of IT effectively to improve quality of service delivery	Prepare Information Strategy Plan Develop (outsource) techno-IT expertise Establishment of IT Cell	Information Strategy and Plan prepared An IT Cell established with required staff, hardware, software and other IT infrastructure Operational GIS enabled sewerage manage-	March 2016 Dec 2016	PMC, IT Department of GoM

Sl. No.	KEY OBJECTIVE	KEY OUTPUT	KEY ACTION REQUIRED	PERFORMANCE INDICATOR	Timeline	LEAD IMPLEMENTING AGENCY
		Application of SCADA in sewerage management	Use of MIS and GIS applications Improving website	ment services and MIS Use of website institutionalized Operational SCADA with Centralized Control Station and dashboard provisions	April 2018	
6	**Sensitizing the department towards social and environmental needs**	Functioning Social and Environmental Cell (SEC)	Establish SEC Develop PMC procedures for integration of SE issues Propagation of above procedures Include training courses on SE issues	SEC established Training courses conducted regularly	March 2016 July 2016 and then continue	

Sl. No.	KEY OBJECTIVE	KEY OUTPUT	KEY ACTION REQUIRED	PERFORMANCE INDICATOR	Timeline	LEAD IMPLEMENTING AGENCY
7	**Community Participation**	Community aware and participating	PA, PP strategy in place IEC Campaigns for Community awareness as per PA, PP strategy	Improved level of awareness Improved level of community participation in sanitation activities	Mar 2017 Mar 2017	PMC, NGOs
8	**Customer Satisfaction**	Citizen Charter Perception surveys/user satisfaction surveys Online complaint handling system in place	Development of citizen's charter on level of services Perception surveys at start, towards mid-point and towards end of any major project (work could be outsourced). Responsive System to address complains/grievances	Data analyzed for quality of services and value for money Average time taken to handle customer Complaints/Grievances	Mar 2016 Sept 2016 and then bi annually	PMC, NGOs
9	**Financial Sustainability** (medium Term**)**	Setting of tariff	Mechanism of setting up tariff/sewerage tax	O&M Cost (salaries, electricity, chemicals and	March 2019	PMC

Sl. No.	KEY OBJECTIVE	KEY OUTPUT	KEY ACTION REQUIRED	PERFORMANCE INDICATOR	Timeline	LEAD IMPLEMENTING AGENCY
				general repair and maintenance) recovered from sewerage taxes and related revenues		