

## **5.1 Scope of Priority Projects**

### **5.1.1 Water Supply System**

Expansion and rehabilitation of Salaulim Water Supply Scheme were selected as the priority projects because the scheme has the most serious problem of water shortage from the urgency point of view. The project scale was set based on a careful examination of water demand, supply capacity, raw water availability and the PWD's financial capabilities. The priority projects have been selected from the components of Stage 1 of the Salaulim Scheme. The priority projects are described below:

- Expansion of the Salaulim Treatment Plant by 100,000 m<sup>3</sup>/day, resulting in a total capacity of 260,000 m<sup>3</sup>/day.
- Rehabilitation and Improvement of the Existing Salaulim Treatment Plant, which has a production capacity of 160,000 m<sup>3</sup>/day.
- Construction of a 20,000 m<sup>3</sup> Master Balancing Reservoir (MBR) at Sirvoi rock hill.
- Installation of 73.65 km of Transmission Mains,  $\phi$  150 to  $\phi$  1400
- Rehabilitation of 13.8 km of the Existing Transmission Mains,  $\phi$  1200
- Construction of six Reservoirs
- Construction of five Pumping Stations
- Replacement of 4 units of Pumping Equipment at Verna Pumping Station
- Improvement of Operation and Maintenance such as installation of flow meters, control valves and float valves and improvement of safety standards of WTPs for 7 WSSs
- Establishment of Central Laboratory

In addition to the facility expansion and rehabilitation, reduction of NRW is also major objective of the priority projects. To reduce NRW in Goa State, NRW Reduction Roll-out Plan is recommended. The NRW reduction plan includes rehabilitation of distribution facilities, improvement of quantity measurement system at treatment plants and transmission system, and replacement of defective water meters on house connections. Furthermore, in addition to the facility improvements, organizational improvements such as establishment of NRW Reduction Unit, capacity building for implementation of the NRW reduction plan are proposed in the feasibility study as part of the priority projects.

### 5.1.2 Sewerage System

On the selection of priority projects, sewerage is advantageous comparing to onsite or decentralized system because sewerage shall be constructed in urban areas with large population and benefits spreads widely. Each sewerage project was evaluated from the aspects of number of beneficiary, cost effects, positive impacts and urgency.

Regarding the present situation of the sewerage services in the Study Area, the PWD Goa does not have sufficient institutional setup to run their services, resulted in low house connection rates. Under this situation, it is recommended to limit the number of priority project in order to manage and run sewerage systems at an appropriate level.

Considering above aspects, three (3) projects, namely North Coastal Belt (new), Margao (expansion) and Mapusa (new) were selected as priority projects. The Summary of the priority projects are shown Table 51.1.

**Table 51.1 Priority Projects for Sewerage Development**

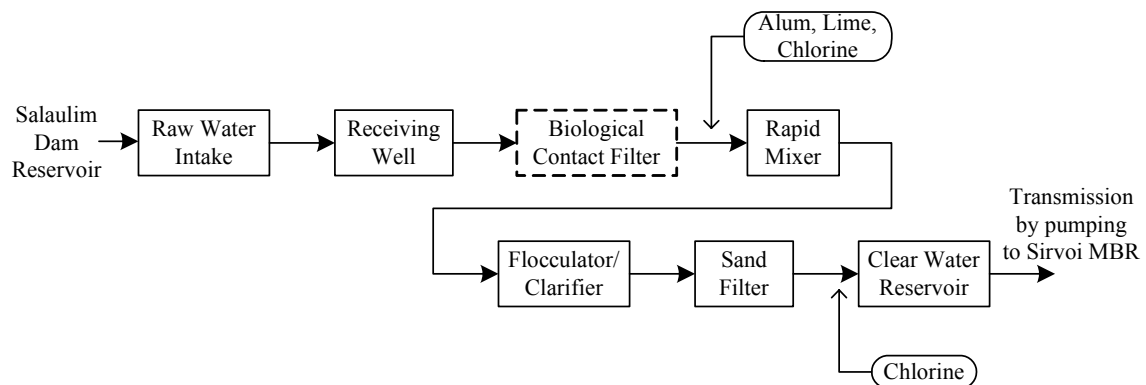
Location	Unit	North Coastal Belt	Margao	Mapusa	Remarks
Expansion Area	ha	398	221	180	
Population in the Expansion Area	Person	22,129	36,779	34,942	
Trunk Sewer Construction	km	6.1	6.0	3.9	
Branch Sewer Construction	km	47.8	44.2	31.5	
Pumping Station Construction	Nos.	1	1	0	
Treatment Plant Capacity	MLD	5.6	(7.5)+6.7	5.4	(Existing)

## 5.2 Water Supply System

### 5.2.1 Expansion Work

#### (1) Expansion of Salaulim WTP: 100,000 m<sup>3</sup>/day

It is proposed to increase the treatment capacity of Salaulim WTP by 100,000 m<sup>3</sup>/day, to cope with future demands in 2018. Therefore, the total capacity will become 260,000 m<sup>3</sup>/day. The proposed WTP is recommended the rapid sand filtration system as well as the existing process plus manganese sand filtration process to remove manganese contained in raw water. The proposed treatment process is shown in Figure 52.1.



Note: Biological Contact Filter will be installed if it was judged necessary based on results of continuous water quality monitoring on Ammonia-Nitrogen.

**Figure 52.1 Treatment Process of the Proposed Salaulim WTP**

**(2) Installation of Transmission Mains: 73.65 km**

To transmit the treated water from the proposed Salaulim Plant to the existing and proposed reservoirs, via the Sirvoi Master Balancing Reservoir, transmission mains of 73.65 km in total length with diameters of  $\phi$  150 to  $\phi$  1400 need to be installed.

**(3) Proposed Reservoirs**

1) Master Balancing Reservoir at Sirvoi: 20,000 m<sup>3</sup>

Since the proposed treatment plant is located at lower level of the existing plant, a pumping is required to transmit the treated water to a high altitude reservoir which is a master balancing reservoir and then from the master balancing reservoir the water will be transmitted and distributed to respective distribution reservoirs or service areas under gravity flow. Construction of a master balancing reservoir (MBR) of 20,000 m<sup>3</sup> at Sirvoi Rock Hill is proposed.

2) Other Reservoirs: 6 reservoirs

It is proposed to construct the six reservoirs (excluding the Sirvoi MBR) to supply the treated water to the expanded service area.

**(4) Pumping Stations: 5 stations**

The constructions of five pumping stations are proposed as the priority projects in order to pump transmitted water into the proposed reservoirs for supplying water to the expanded service area.

## **5.2.2 Rehabilitation Work**

### **(1) Rehabilitation of Salaulim WTP: 160,000 m<sup>3</sup>/day**

The Salaulim WTP was constructed in 1989 with a production capacity of 160,000 m<sup>3</sup>/day and is the sole WTP of Salaulim WSS. Therefore deterioration of facilities and equipment have become a significant problem for stable operation of the plant and water supply to the service area. The equipment and facilities in the Salaulim WTP are used for almost 20 years.

According to the site investigations during the study period, the equipment and facilities in the WTP have not been maintained proactively and operated based on written operation and maintenance manual. Therefore, the equipment and facilities have been deteriorated, some equipment are not able to operate properly, and many leaks have been found at piping systems.

In order to secure water supply to the existing service area from the Salaulim WTP, it has been judged that the rehabilitation works for the Salaulim WTP is indispensable and selected as a priority project.

### **(2) Transmission Main from Margao to Verna: 13.8 km of $\phi$ 1200**

Rehabilitation of the existing transmission mains from the existing Salaulim WTP to Verna Pumping Station which is prestressed concrete (PSC) pipe has been identified as a high priority for securing the sustainable and continuous supply of treated water from both the existing and proposed treatment plants, since pipe break accidents have occurred frequently because of deteriorated quality of the pipes.

The PWD is, therefore, replacing the PSC pipes of a diameter of 1,200 mm, which are laid from the Salaulim WTP to Margao with mild steel (MS) pipes. The PWD has replaced about 10 km PSC pipes with MS pipes as of July 2006. The replacement of the remaining 11.3 km PSC pipes are under implementation and will complete within the year 2007 according to the PWD's information. Therefore, the priority projects include the replacement of the remaining transmission lines of PSC pipes which is about 13.8 km of 1,200 mm from Margao to Verna Pumping Station.

### **(3) Replacement of Pumping Equipment at Verna Pumping Station: 4 units**

The existing Verna Pumping Station has six pumps which are used to pump water to the Verna Master Balancing Reservoir. The proposal includes replacing four units of the existing pumping equipment (pumps and motors). This is required because water demand is expected

to increase in the Mormugao Taluka (especially domestic demand in the Vasco da Gama Municipality and the industrial demand in the Verna Industrial Area); and because the design life of the existing pumping equipment has been exceeded. The specifications of the new pumps are  $28.16 \text{ m}^3/\text{min} \times \text{H}69\text{m} \times 456\text{kW} \times 4$  units (pumps and motors). Remaining other 2 units are proposed to be replaced at the Stage II.

### **5.2.3 Improvement of Operation and Maintenance**

#### **(1) Installations of Flow Meters at Reservoirs and WTPs: 371 meters**

The study proposes to install the flow meters at all existing reservoirs for all the 7 WSSs in order to understand the flow rate into the distribution system belonged to the respective reservoirs as well as float valves to avoid unnecessary overflow from the reservoirs. Also the installations of flow meters at all WTPs are included in the priority projects to control and understand the flow discharged from the WTPs.

#### **(2) Installations of Flow Meters and Flow Control Valves at Transmission Mains: 30 locations**

As the priority projects, the flow meters are proposed to be installed at major points of the existing and proposed transmission mains for all the 7 WSSs in order to understand the flow rate through the transmission mains. In addition, the control valves are recommended to be provided upstream or downstream of proposed flow meters for controlling the transmission flow appropriately.

#### **(3) Improvement of Safety Standards at WTPs**

The existing WTPs are operating and maintaining under the poor safety standards. The priority projects include the following safety improvement works for the operation and maintenance of all WTPs.

- Improvement of chlorine facilities such as isolation and ventilation of chlorine room, replacement of piping from chlorine gas cylinder to chlorinator with copper pipes, installation of gas detector, etc.
- Improvement of other plant safety such as railing of open channels, guarding of moving equipment/shaft, etc.

#### **(4) Establishment of Central Laboratory**

At present the PWD can not measure all the water quality parameters complied with the recommended guidelines in India, “Manual on Water Supply and Treatment, CPHEEO, May 1999” for water supply and “Ambient Standards for Ambient Air, Automobiles, Fuels, Industries

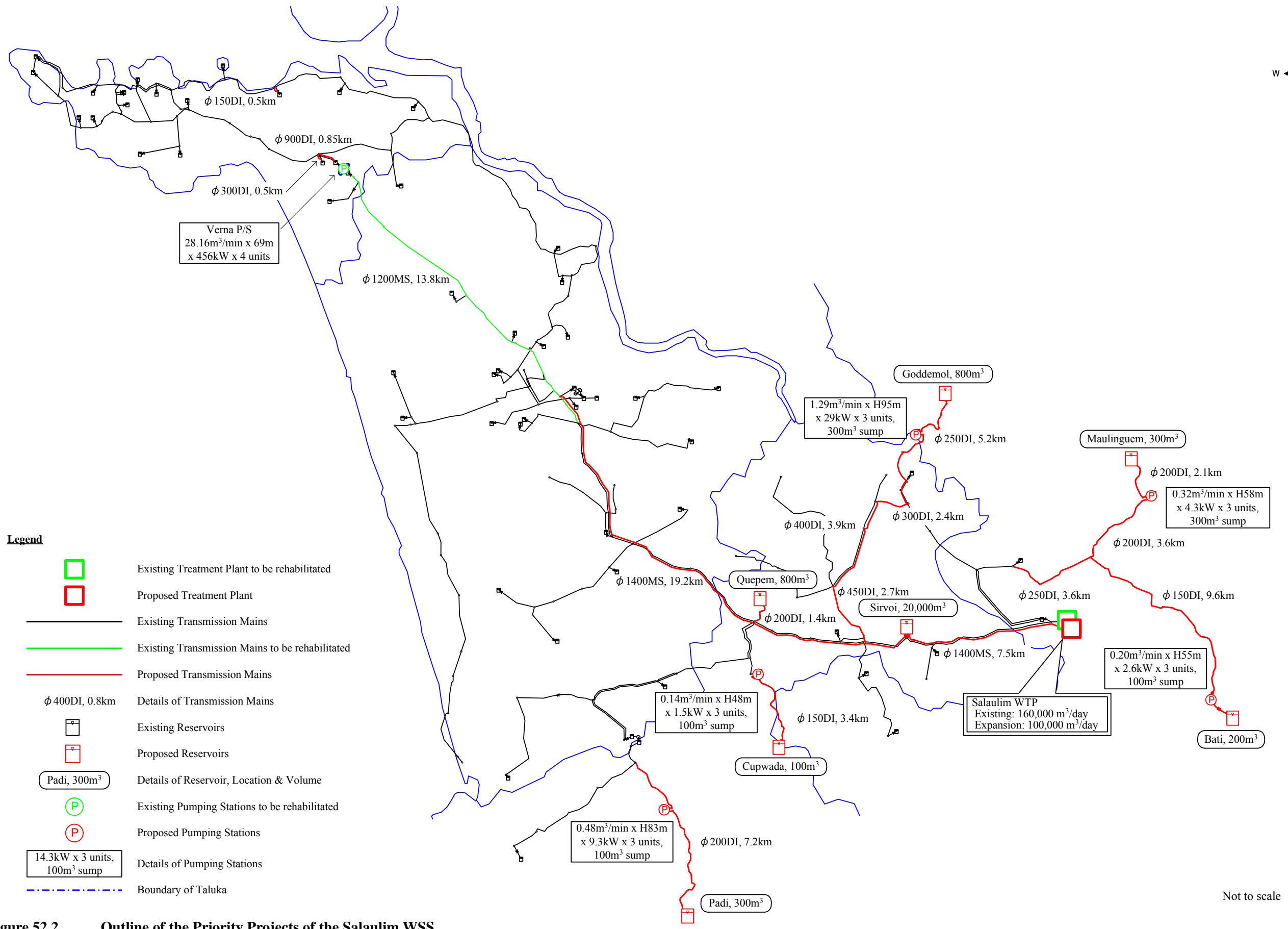
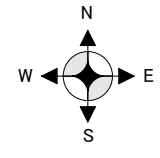
and Noise, Central Pollution Control Board, July 2000“ for sanitation. The priority projects include the establishment of the central laboratory with adequate testing equipment which can measure all the required parameters.

#### 5.2.4 Summary of the Priority Projects

In conclusion Table 52.1 shows a summary of the priority projects and Figure 52.2 also shows a outline of the priority projects for the Salaulim WSS excluding the work components 3 in Table 52.1, “Improvement of Operation and Maintenance”.

**Table 52.1 Summary of the Priority Projects**

Work Component	Description
1. Expansion Works (for Salaulim WSS)	
Salaulim WTP	100 MLD
Transmission Mains	73.65 km, 150 – 1,400 mm
Reservoirs	Sirvoi MBR, 20,000 m <sup>3</sup>
	6 reservoirs, 100 – 800 m <sup>3</sup>
Pumping Stations	5 stations
2. Rehabilitation Works (for Salaulim WSS)	
Salaulim WTP	160 MLD
Transmission Mains,	Margao to Verna, 13.8 km, 1,200 mm
Pumping Equipment	4 units of Pumping Equipment at Verna Pumping Station
3. Improvement of Operation and Maintenance (for all 7 WSSs)	
Installation of Flow Meters	23 nos at WTPs
	348 nos at reservoirs with float valve
	30 nos at transmission mains with flow control valve
Safety Standards for WTPs	Chlorination Facility and others
Central Laboratory	established at Tonca, Panaji



**Figure 52.2 Outline of the Priority Projects of the Salaulim WSS**

### 5.3 NRW Reduction Roll-out Plan

The 'NRW reduction roll-out plan' has been formulated based on the experiences gained from the 'NRW reduction pilot project' conducted by the joint PWD/JICA Study Team during April/May 2006 and the review of current PWD NRW performance and practices during the first and second phases of the study. During the pilot project, not only leakages but also illegal or unregistered connections were found. The premise on which the plan is based is as follows:

- NRW is at an unacceptable level and will need to be reduced by adopting a more proactive approach to NRW reduction
- The NRW reduction pilot project was a success in demonstrating the benefits to be gained in reducing NRW by taking an 'active' approach and PWD are keen to build on the transfer of knowledge and technology gained during the project
- PWD would benefit from gaining additional assistance in developing and delivering the roll-out plan to ensure its success and to maximise benefits and sustainability
- A number of actions, resources and investments are required to bring NRW under control and to sustain it at economic levels. This may include the need to let external contracts as well as to enhance in-house efforts
- NRW reduction activities will need to become 'a way of life' as opposed to a series of adhoc or one-off exercises

#### 5.3.1 Actions to be Addressed by the NRW Reduction Roll-out Plan

A successful NRW reduction roll-out plan will need:

**Leadership** – From the top of the organisation, there must be a "Champion" to ensure that the whole organisation concentrates upon the basics of increasing income and reducing the physical leakage

**Commitment** – Throughout the organisation there must be a determination to follow through the processes that reduce NRW.

**Resources** – Significant resources are required to make the step change necessary to reduce NRW. Once NRW is under control and efficient and effective processes are in place then the resource can be reduced to a lower level. It must be recognised that NRW control is an ongoing operation.



Based on the experience gained from the NRW reduction pilot project, the following actions will need to be addressed:

- Improve network management practices
- Agree standards for new connections and repairs including standard specifications for materials, fittings, meters, layout, non-return valves, sealing, testing, calibration etc
- Introduce leakage policy and improved methods
- Replace all defective (leaking) house connections
- Repair all existing visible leaks
- Introduce metering policy and improved practices
- Replace all defective meters
- Conduct enabling works and leakage control measures
- Set up Active Leakage Teams within each Division or Region with appropriate tools to find and fix leaks. It may also be prudent to establish a 'central coordinating' role to collate and share Regional performance across the State
- Institutionalise NRW management measures and tackle 'apparent' as well as 'real' losses
- Ensure 100% billing and improve revenue collection practices

It should be noted that the premis on which the feasibility study for water supply is based, emphasises the provision of 24 × 7 supplies in future. This brings with it the challenges of ensuring that leakage control measures are put in place to keep leakage 'in-check', as potentially, increasing the hours of supply could increase the level of water lost as a result of leaks if the current 'passive' approach to leakage management is not changed.

### **5.3.2 Strategies for Setting up and Running NRW Reduction Activities**

There are a number of options available to PWD in tackling the current levels of NRW and for putting measures in place to firstly bring it within acceptable limits and then to maintain it at economic levels.

#### **External Technical Assistance Approach**

Even with the enthusiasm generated from the success of the NRW reduction pilot project, it will be difficult to get the roll-out programme 'off the ground' by using entirely PWD staff with out additional external technical assistance. External technical assistance will provide the expertise and 'driving force' to formulate and initiate roll-out so that PWD can implement the plan successful following a thorough planning phase. In short, external technical assistance would:

- Help PWD in planning a successful roll-out program
- Help PWD in developing capacity to implement the programme
- Help start-up of the State wide roll-out programme
- Support PWD during implementation of the programme
- Support PWD in analysing the benefits of the programme

Based on the number and complexity of water supply schemes, it would be preferable to seek external technical assistance by means of including a part of the priority projects.

### **5.3.3 Priority of Implementation**

Implementation of NRW reduction measures will need to be prioritized regardless of whether the approach to tackling NRW is conducted in-house or by a combination of the three approaches described above. PWD will need to consider prioritization based on the following:

**Areas wise:** Areas suffering severe water shortages/intermittent supplies should be tackled as a priority as savings in water resulting from NRW reduction measures will make more water available to existing customers and provide supplies to those that currently do not receive a supply. This will improve supply coverage, increase revenues and improve service delivery and public image.

**Scheme wise:** The water supply schemes that provide the largest volume of water or supply the largest amount of customers or contributes the largest amount of revenue should be tackled as a priority as these will return the greatest benefits in the short term. However, it should be noted that the larger schemes will present the biggest challenges as these are likely to contain longer transmission/piped distribution lines and more reservoirs. The current lack of reservoir level control and flow measuring devices will need to be rectified accordingly.

### **5.4 Sewerage System**

On the selection of priority projects, sewerage is advantageous comparing to onsite or decentralized system because sewerage shall be constructed in urban areas with large population and benefits spreads widely. Each sewerage project was evaluated from the aspects of number of beneficiary, cost effects, positive impacts and urgency.

According to the result of comparison study to select the priority projects, three (3) projects, namely North Coastal Belt (new), Margao (expansion) and Mapusa (new) were selected as priority projects. The summary of basic values of sewerage system in the Feasibility Study is

shown in Table 54.1. In addition to the construction of sewerage facilities, sewer cleaning equipment is also proposed to be procured as part of the priority projects to secure an appropriate maintenance of sewers.

In North Coastal Belt STP, a part of treated effluent is further treated by sand filters for reuse as gardening water. The remaining treated effluent is also treated to reduce the suspended solids because it is discharged near to the world famous beach resorts.

**Table 54.1 Summary of Basic Values of Sewerage System in Stage I**

Location	Unit	Margao		Mapusa		North Coastal Belt Calangute & Candolim	
		Stage I	M/P	Stage I	M/P	Stage I	M/P
Target year		2015	2025	2015	2025	2015	2025
Covered population	Person	80,680	118,193	34,260	68,255	19,772	39,358
Sewage flow	m <sup>3</sup> /day	13,678	20,861	5,354	10,782	5,090	11,172
Sewage treatment plant							
Capacity (New)	m <sup>3</sup> /day	6,700	13,400	5,400	10,800	5,600	11,200
(Existing)	m <sup>3</sup> /day	7,500	7,500	-	-	-	-
(Total)	m <sup>3</sup> /day	14,200	20,900	5,400	10,800	5,600	11,200
Treatment method		Activated sludge method					
		Conventional + (Sand filtration)		OD + (Sand filtration)		OD + Sand filtration	
Location		Margao		Mapusa		Calangute	
Discharge river		Sal River		Tributary of Mandovi R.		Baga River	
Sewage quality		In	Out	In	Out	In	Out
BOD	mg/l	300	30	300	30	240	10
SS	mg/l	250	100/50	250	100/50	200	100/50(10)

Notes: (Sand filtration) Sand filtration is a future plan for Margao and Mapusa

Sewage quality of SS out: Effluent quality standard/ expected effluent quality (with sand filtration)

The general Layout plans of sewerage system and STP of Margao, Mapusa and North Coastal Belt are presented in Figures 54.1 to 54.6.

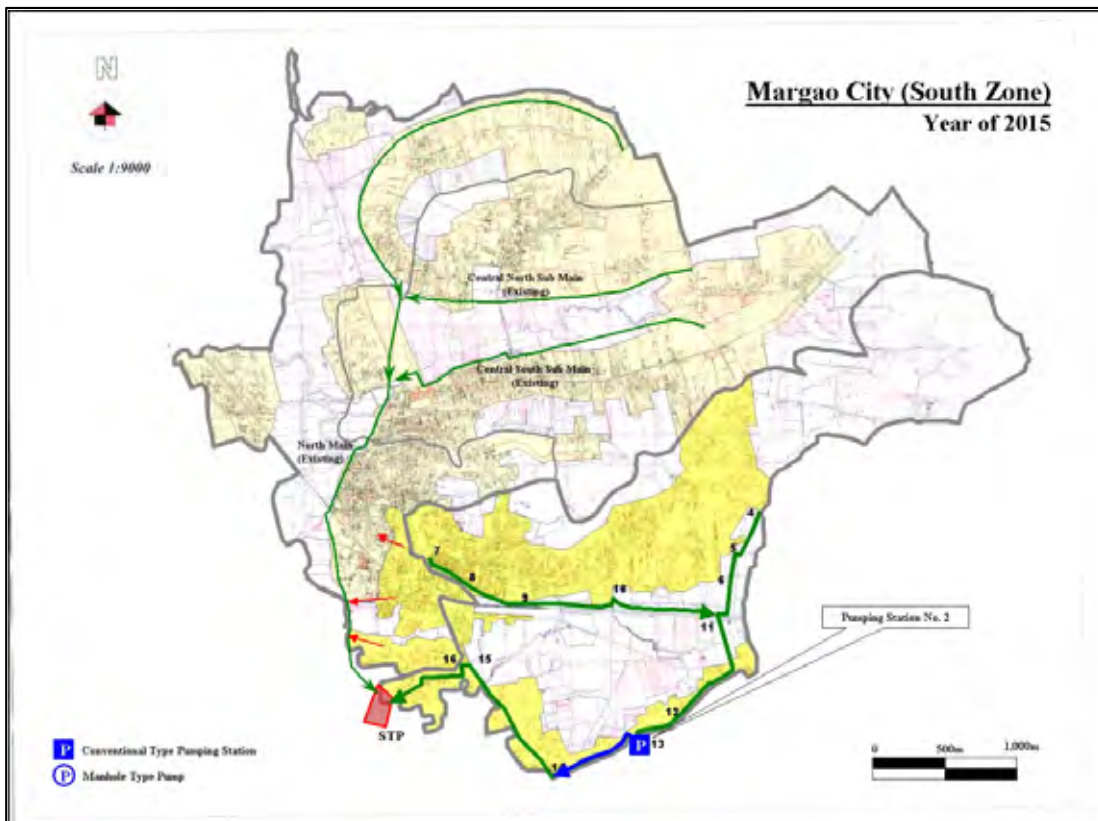


Figure 54.1 General Layout Plan of Margao Sewerage System

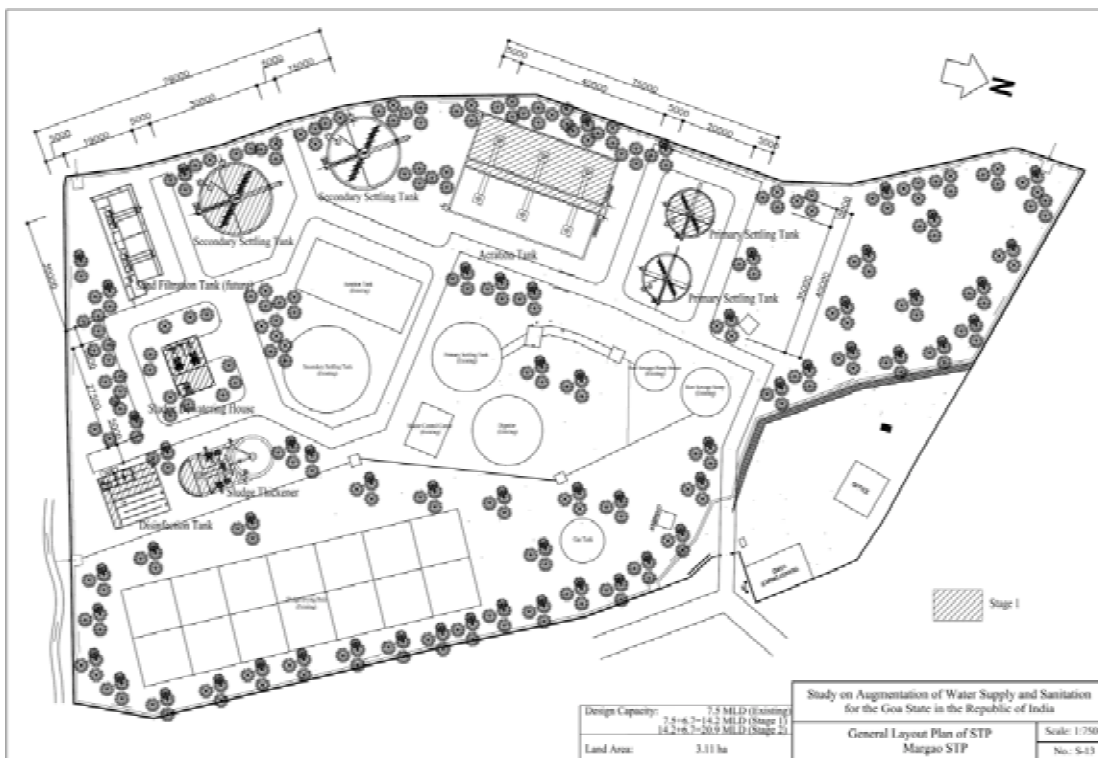


Figure 54.2 General Layout Plan of Margao STP

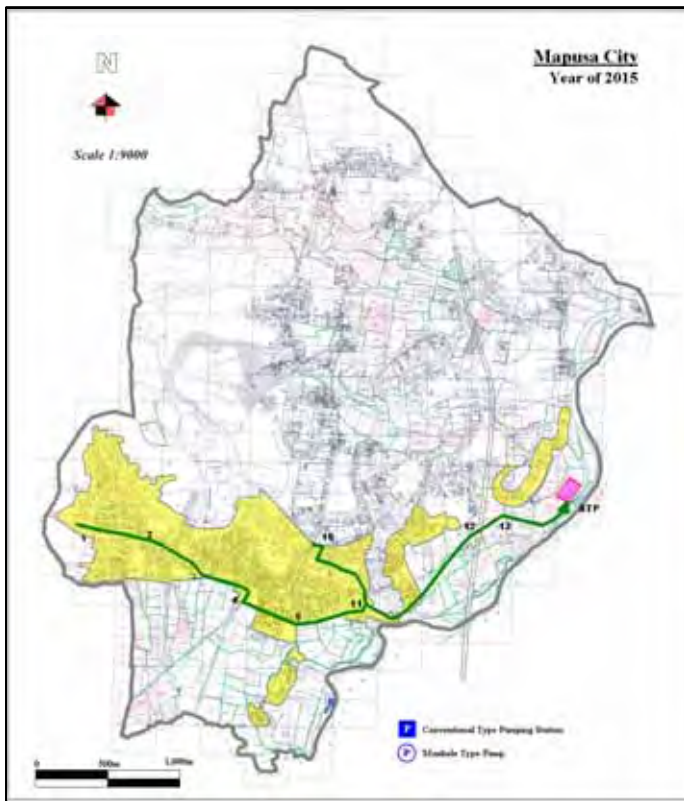


Figure 54.3 General Layout Plan of Mapusa Sewerage System

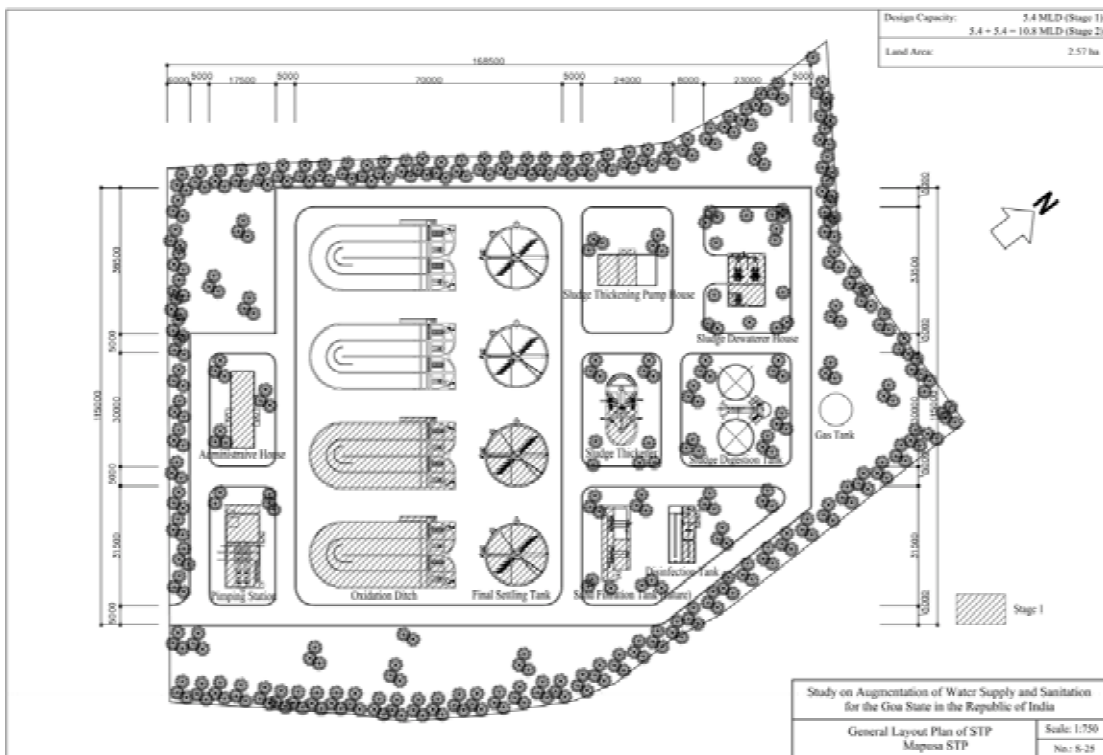
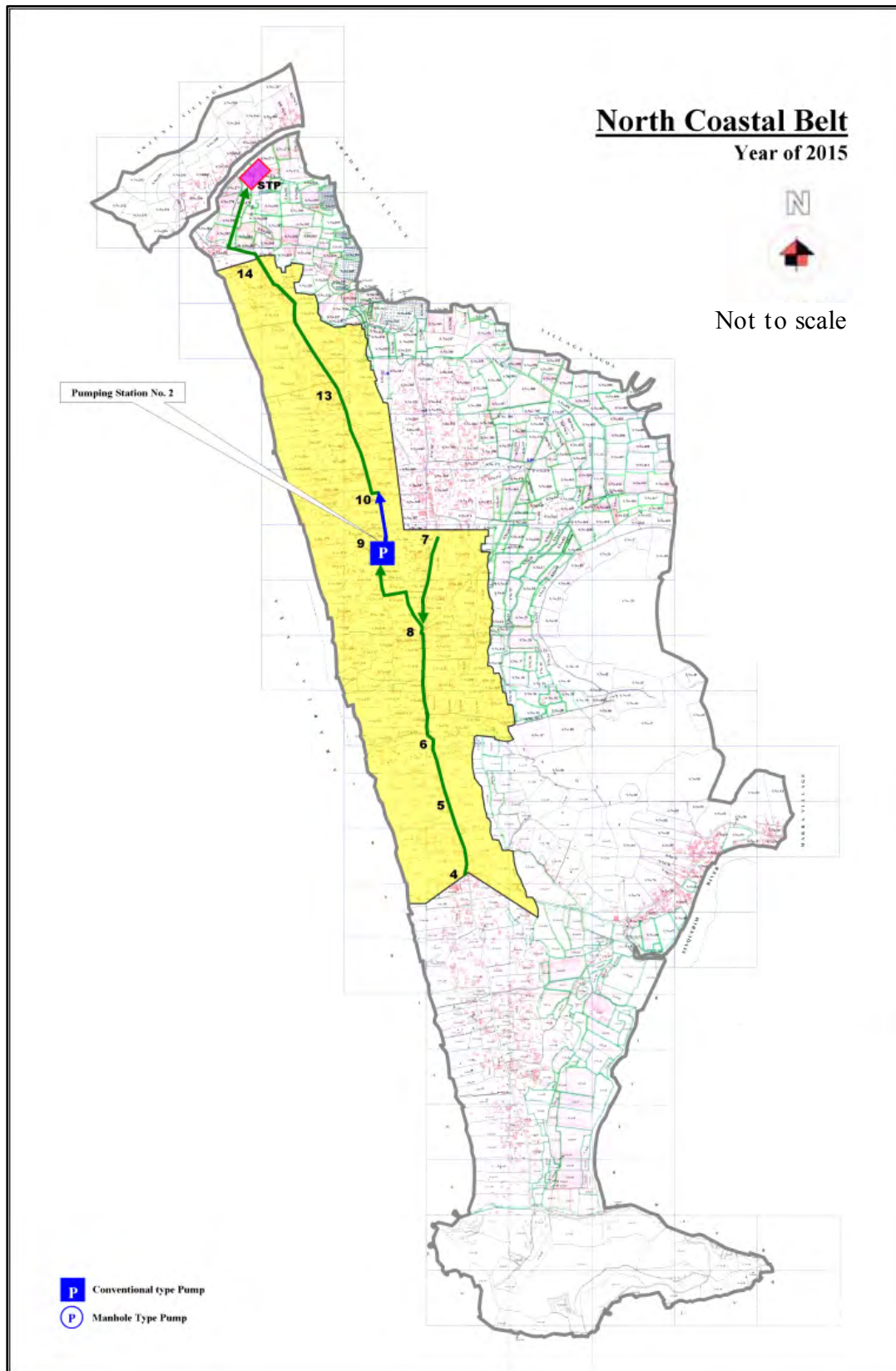
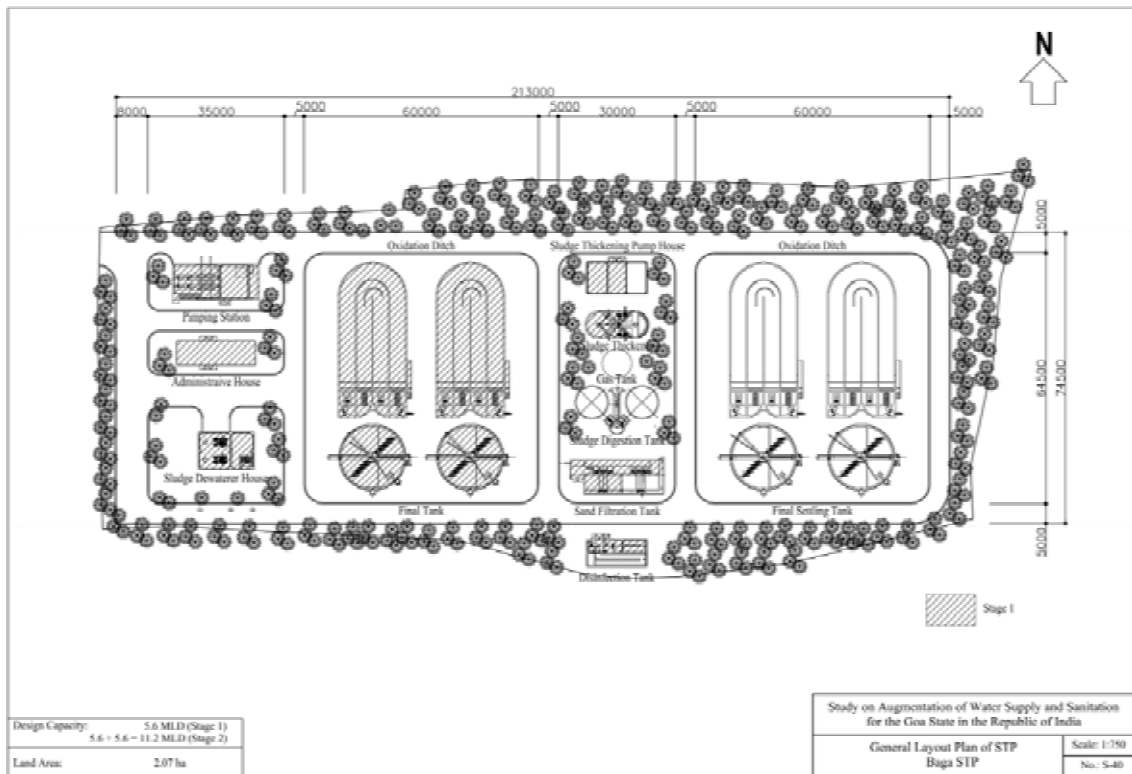


Figure 54.4 General Layout Plan of Mapusa STP



**Figure 54.5**      **General Layout Plan of North Coastal Belt Sewerage System**





**Figure 54.6 General Layout Plan of Baga (North Coastal Belt) STP**

### 5.5 Operations & Maintenance Improvement Plan

This O&M improvement plan has been formulated based on the knowledge gained primarily from discussions with PWD during the three phases of the study and is based on the review of current PWD O&M performance and practices. The assumptions related to water and wastewater schemes are as follows:

**For water supply schemes, the premise on which this plan is based is as follows:**

- The feasibility study for enhancement and augmentation of existing water production facilities emphasises the use of familiar technologies (in-line with existing installations)
- Improved methods of process control will be employed including the testing and analysis of process water and final water delivered to the customer's tap
- Improved network designs will be employed and include devices for the measurement and control of pressures and flows in order to 'balance' the networks and to aid the management and control of NRW
- Improved operations management practices will be employed including the need to collect and act on asset and process data

- Improved maintenance management practices will be employed including the need to employ a more ‘proactive’ approach to maintenance such as the use of planned preventative maintenance practices to ensure efficient plant availability and operability
- Improved safety standards will be employed to ensure safe installation, maintenance and operation of disinfection and chlorine handling facilities

**For sanitation schemes, the premise on which this plan is based is as follows:**

- The feasibility study for enhancement and augmentation of existing sewage treatment facilities emphasises the use of familiar technologies (in-line with existing installations) as well as the ‘oxidation ditch’ method of treatment
- Improved methods of process control will be employed including the testing and analysis of effluents prior to discharge into public water bodies to ensure compliance with environmental legislation in force. This includes the safe disposal of screenings, grit and sludge generated at plants as a result of the sewage treatment process
- Improved operations management practices will be employed including the need to collect and act on asset and process data
- Improved maintenance management practices will be employed including the need to employ a more ‘proactive’ approach to maintenance such as the use of planned preventative maintenance practices to ensure efficient plant availability and operability
- Improved sewerage network designs will be employed to ensure efficient flows to ensure self cleaning properties to minimise deposits
- Modern techniques and tools will be employed to ensure that the sewerage networks are regularly cleaned and maintained to prevent sewer blockages and sewage flooding
- Improved safety standards will be employed to ensure safe installation, maintenance and operation of equipment in potentially explosive atmospheres

**5.5.1 Actions to be Addressed by the O&M Improvement Plan**

As well as being based on the assumptions mentioned above, the O&M improvement Plan builds on the suggestions and strategies formulated in the Master Plan. The Plan addresses the shortfalls identified in the review of current O&M performance and practices and the need for:

- Policy formulation, setting of departmental targets and objectives
- Asset management plans and for asset information to be recorded



- O&M manuals that clearly states the parameters, procedures, schedules and responsibilities for effective plant operation
- ‘Planned preventative maintenance’ practices to be adopted
- Installation of devices for measuring inflow and outflow to accurately determine the volume of water into supply. Additionally, installation of good quality revenue meters to accurately determine consumption
- H&S policy/manuals and contingency/emergency plans; to raise H&S awareness and to improve the level of installation, operation and maintenance of chlorine facilities
- Statistical process control techniques and to act on process data to optimise water quality and wastewater effluent standards
- Providing and acting on meaningful and timely management information
- Improved maintenance and H&S practices at water treatment plants (WTP’s), sewage treatment plants (STP’s), pumping stations and when working in highways and in sewers
- Improved sewer cleaning, sludge management and trade-effluent compliance
- Improved housekeeping standards and computerisation of O&M administrative activities
- The setting up of ‘pilot offices’ to develop best practice
- Institutionalising the O&M improvement measures within each region by use of best practices developed within the pilot offices

### **5.5.2 Strategies for Setting up and Running O&M Improvement Activities**

There are a number of options available to PWD in tackling the current levels of O&M performance related to water treatment facilities, water distribution networks, wastewater treatment and sewerage networks and for putting measures in place to improve management capability, plant performance and availability, service standards and service delivery.

Given the number of offices and staff responsible for the operation and maintenance of the water and sanitation schemes throughout the State, it will be difficult to get the O&M improvement plan ‘off the ground’ by using entirely PWD staff with out additional external technical assistance. Implementing improvements requires not only the need to develop improved methods of working but also ‘**change management**’ skills to ensure that the improved methods are successfully adopted and applied in practice. External technical assistance will provide the expertise and ‘driving force’ to formulate and initiate improvements

as well as a 'Change Management Plan' so that PWD can implement improvements successfully. In short, external technical assistance would:

- Help PWD in planning a successful O&M Improvement Plan including the need for a 'Change Management Plan'
- Help PWD in developing capacity to implement the O&M Improvement
- Help start-up of the State wide pilot office improvement teams and priorities tangible and achievable improvements
- Support PWD during implementation of the programme
- Support PWD in analysing the benefits of the programme

Based on the number of functional skill requirements needed to bring about changes in the management of O&M activities, it would be preferable to seek external technical assistance by means of including as part of the priority projects.

## **5.6 Institutional Development Plan**

### **5.6.1 Capacity Building Agenda**

Based on the earlier assessments of strengths and weaknesses of PHE, a detailed Capacity Building Plan is presented in the following Table 56.1. It has been agreed with PHE that, to successfully implement the plan, an external technical capacity building support project during 2007-2012.

The technical assistance will include the provision of advisory services to PHE, provision of software, augmentation of computer hardware. A budget, in the order of about US 6.2 M for the 6-year period (2007-2012) has been developed. This is about 4% of the proposed capital investment project.

### **5.6.2 Restructuring Agenda**

Following assessment of internal institutional arrangements, a scheme-based structure is recommended.

- Service area is defined by the presence of facilities; implies that the service area responsibility of each water or sewerage system will be expanding in the future.

- Responsibility for expansion of services to un-served areas will be with the Technical Services Office – not with the system managers.
- Operation and maintenance of small village services will, for practical reasons, have to be managed by the “nearest” system manager.
- Revenue and cost performance will be tracked by scheme; and consolidated at the Department level.

The Study recommended a detailed description of the functions and responsibility of each work group, including proposed staffing levels up to the year 2012. The staff productivity ratio is envisaged to be improved from the current 16.1 staff per thousand connections to 14. This may be achieved by intensified campaign for new connections over the period, from about 194,000 in 2005 to 236,500 in 2012, while retaining, more or less, the current number of staff.

The Study proposes that PHE:

1. Review proposed restructuring of PHE
2. Seek authorization and approval of new organization structure.
3. Implement new PHE structure.
4. Introduce a system and methodology for regular review of organization structure and staff competency mix in each of the working groups in the future.

### **5.6.3 Policy Agenda**

In addition to the broader legislation suggested in the Master Plan, additional policy decisions are needed for this institutional development plan to proceed, as follows:

- Authorize reorganization of PHE.
- Authorize use of an independent accounting system which will be implemented parallel with the existing financial reporting system now implemented by PHE.
- Enable PHE to retain revenues generated, plus a state subsidy indexed on revenue generated (or other performance targets) to support water and sewerage services.
- Authorize PHE to adopt personnel rules and regulations (including, compensation enhancement schemes, incentives, sanctions, job classification, training, etc). Guarantee security of tenure of staff who may be adversely affected by these changes.
- Create mechanisms for regular dialogue with consumers and consumer groups.
- Consider a state policy requiring mandatory connection to the sewerage system within a fixed time to achieve viability of investments.

**Table 56.1 Synopsis of Capacity Building Plan and Indicative Timetable**

Current weakness & opportunities <sup>1</sup> to be addressed	Expected 2012 Outcome		Proposed Capacity Building Activities	2007				2008				2009				2010				2011				2012				
	“PHE is better able to...	... through .....		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
<b>A. Physical (operation and maintenance) System</b>																												
<u>O&amp;M deficiencies</u> <ul style="list-style-type: none"> <li>Not all O&amp;M procedures and standards written, documented and readily available for both water supply and sewerage.</li> <li>Limited operation and maintenance skills and equipment.</li> </ul>	<ul style="list-style-type: none"> <li>Operate and maintain properly all water supply production, treatment and distribution facilities and sewerage collection, treatment and disposal facilities.</li> </ul>	<ul style="list-style-type: none"> <li><b>Operation and maintenance standards &amp; guidelines</b> (OMG's). These guidelines will also be the basic training materials for O&amp;M.</li> <li><i>[Process Owner: Technical Services Office]</i></li> </ul>	A-1	Agree on overall scope, content and structure of the PHE Operation and Maintenance Guidelines – from specific intake structures to specific pumping stations to specific brands of water meters (in use).																								
			A-2	Gather and review all existing O&M documents.																								
			A-3	Draft/update OMG's. Compile OMG's as the PHE O&M Manual																								
			A-4	Conduct a detailed technical review of the OMG drafts.																								
			A-5	Design & implement a system for regular internal review, upgrading and formal adoption of the OMG.																								
<u>Water supply system monitoring</u> <ul style="list-style-type: none"> <li>Difficulty in quickly assessing impact of pressure-flow variations in the water system along transmission lines and network.</li> </ul>	<ul style="list-style-type: none"> <li>Take operating or design decisions based on rapid considerations of several demand, flow and pressure conditions.</li> </ul>	<ul style="list-style-type: none"> <li>Use of <b>hydraulic modeling</b> software.</li> </ul>	A-6	Evaluate, procure and install appropriate hydraulic modeling software. Train staff on use of the software in daily operation decisions.																								
<u>High NRW</u> <ul style="list-style-type: none"> <li>NRW is high due to various reasons.</li> <li>Pilot exercise has demonstrated benefits of an NRW program; staff trained; equipment available.</li> </ul>	<ul style="list-style-type: none"> <li>Reduce NRW resulting in more water availability for use/sale; higher revenues, reduced operating expense; and possible capital deferment.</li> </ul>	<ul style="list-style-type: none"> <li>An expanded program for <b>Control of Non-revenue water</b></li> <li><i>[Process Owner: NRW Reduction Team]</i></li> </ul>	A-7	Implement expanded Non-Revenue Water Reduction Plan and 'active leakage teams' to reduce NRW to an 'economic' level (based on pilot project)																								
			A-8	Evaluate viability of outsourcing leakage reduction plans, including meter replacement, leakage repair, operation and/or maintenance of assets etc.																								
<u>Outsourcing opportunities</u> <ul style="list-style-type: none"> <li>Good experience with outsourcing of bill preparation function.</li> </ul>	<ul style="list-style-type: none"> <li>Promote and engage more public-private partnerships in service provision.</li> </ul>	<ul style="list-style-type: none"> <li>Clearer PHE <b>outsourcing policy and procedures</b>.</li> <li><i>[Process Owner: Management Services Office]</i></li> </ul>	A-9	Assess PHE experience and lessons from current outsourced activities. Identify and assess other possible areas of current operations which may be outsourced or provided through service contracts and assess the advantages or benefits of doing so.																								
			A-10	Draft a policy note adopting principles to use in deciding when to outsource; how to outsource (transparency), including sample agreements.																								
<u>Project management deficiencies</u> <ul style="list-style-type: none"> <li>No experience with major externally-funded capital investments.</li> </ul>	<ul style="list-style-type: none"> <li>Manage major externally financed capital investment and project management effectively.</li> <li>Utilize project funds on investments that deliver best return for PHE based on master plans and asset planning criteria.</li> </ul>	<ul style="list-style-type: none"> <li>Formal <b>project management standards and procedures</b> for externally-financed projects, particularly project supervision, accounting and reporting requirements and procurement of goods and services by international competitive bidding procedures.</li> <li><i>[Process Owner: Project Management Department]</i></li> </ul>	A-11	Organize Project Management Unit to supervise and monitor implementation (procurement, project planning and monitoring, project supervision, reporting, project accounts, etc.)																								
			A-12	Familiarize with of existing project management policies, systems, procedures and other requirements of external funding agency; comparison and coordination with local management requirements.																								
			A-13	Set-up required project management support systems.																								
<b>B. Organization Planning System</b>																												
<u>Planning Deficiencies</u> <ul style="list-style-type: none"> <li>Goa State's annual development plans are not translated into a PHE corporate or business plan.</li> <li>Minimal participation of managers and supervisors, and possibly other stakeholders, in planning.</li> </ul>	<ul style="list-style-type: none"> <li>Prepare, update and monitor annual &amp; 5-year plans to ensure that the strategic intent and corporate objectives are supported, assigned, measured, monitored and met by all key players.</li> </ul>	<ul style="list-style-type: none"> <li>Adoption of a <b>PHE business model</b></li> <li>Introduction of <b>formal</b> corporate planning and annual <b>business planning process</b>.</li> <li>Input and <b>participation</b> from more managers and staff in the process.</li> <li><i>[Process Owner: Corporate Planning Office]</i></li> </ul>	B-1	Review strategic intent, vision and mission statements and share these with the entire workforce.																								
			B-2	Adopt proposed new business model and corporate planning model. Facilitate a series of discussion meetings / training with participation up to section heads and supervisors in the process.																								
			B-3	Pilot/facilitate a corporate (and annual) planning and review exercise, including budgeting, for the following year																								
			B-4	Review the pilot experience and institutionalize the process.																								

<sup>1</sup> As presented in the progress report and interim report.

Current weakness & opportunities <sup>2</sup> to be addressed	Expected 2012 Outcome		Proposed Capacity Building Activities	2007				2008				2009				2010				2011				2012						
	"PHE is better able to..."	... through .....		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4			
<b>C. Customer Service System</b>				<b>Process Owner: Marketing and Public Information Office</b>																										
<ul style="list-style-type: none"> <li>Low customer service orientation among PHE staff.</li> <li>Customer complaints about difficulties in dealing with PHE.</li> </ul>	<ul style="list-style-type: none"> <li>Increased responsiveness to customer service requests;</li> </ul>	<ul style="list-style-type: none"> <li>Streamlined procedures for convenience of customers (a <b>Customer Focus Program</b>).</li> <li>MIS-based <b>Customer Service Management (CSM)</b> module.</li> <li>[Process Owner: Marketing &amp; Public Information Office]</li> </ul>	C-1	Implement independent survey of public perception about PHE and common business transactions with public.	■																									
			C-2	Analyze survey results and formulate a customer focus program and community relations program		■																								
			C-3	Design a customer service management module, including database, service request tracking system.																										
			C-4	Verify and input current customer records into the database.																										
			C-5	Install, test the new Customer Service Management module.																										
			C-6	Train customer service staff on the use of the CSM module.																										
<ul style="list-style-type: none"> <li>No formal customer service standards (example, billing cycles not standardized, response time to complaints)</li> </ul>	<ul style="list-style-type: none"> <li>Meet the service expectations of its customers.</li> </ul>	<ul style="list-style-type: none"> <li><b>Complaints and response time analysis</b> done monthly</li> <li>Formal <b>customer service standards</b></li> <li>[Process Owner: Management Services Office]</li> </ul>	C-7	Review meter reading, billing and collection cycle practices; identify measures to improve procedures, such as spot billing, handheld registers, etc	■																									
			C-8	Review current practices and develop a clear set of customer service standards or norms which PHE will commit to provide to each customer.			■																							
			C-9	Adopt the upgraded customer service standards and revise the Customer Charter (and service contract) to reflect the customer service standards. Disseminate to the public.					■																					
<ul style="list-style-type: none"> <li>Lack of customer participation.</li> <li>Lack of customer confidence in PHE.</li> </ul>	<ul style="list-style-type: none"> <li>Get timely feedback from customers by implementing a systematic customer focus program and by promoting more regular dialogue with the public.</li> </ul>	<ul style="list-style-type: none"> <li>Systematic <b>customer feedback</b> system.</li> <li><b>Public confidence-building tools</b>, such as Citizen Advisory Councils, Annual Consumer Confidence Report, etc.</li> <li>Implementation of <b>public awareness, information and education program</b>.</li> <li>[Process Owner: Marketing &amp; Public Information Office]</li> </ul>	C-10	Design and implement a more pro-active customer feedback system (Go out and get feedback; do not just wait for it to come; engage in dialogue with customers and customer groups).																										
			C-11	Organize Citizens Advisory Council. Assess and develop other means to enable due consideration of consumers' views in the planning of services.		■																								
			C-12	Assess, formulate and implement a continuous community relations program for current and prospective customers. Introduce community relations activities such as open days, schools liaison, road shows, customer literature, customer surveys etc.																										
<ul style="list-style-type: none"> <li>Low connection rates to sewer systems</li> </ul>	<ul style="list-style-type: none"> <li>Enable customers to connect to the sewerage system.</li> </ul>	<ul style="list-style-type: none"> <li><b>Loan program</b> which is funded, widely-used and operational.</li> <li>[Process Owner: Office]</li> </ul>	C-13	Design a system and proposal to offer customers a soft loan to connect to the water and sewerage system, including toilet improvement. (i.e., formulate documentation and assist PHE in seeking financing of the revolving fund)	■																									
<b>D. Financial Management and Control System</b>																														
<ul style="list-style-type: none"> <li>Difficult to assess financial performance of PHE as a public utility due to absence of readily-available data.</li> <li>Current data and reports more suited to an asset creation (or project) organization.</li> </ul>	<ul style="list-style-type: none"> <li>Prepare standard financial accounting reports for water and sewerage utilities.</li> </ul>	<ul style="list-style-type: none"> <li>Accurate and timely <b>financial and operating reports</b> – operating highlights, monthly income statements, balance sheets.</li> <li><b>Benchmarking</b> indicators reports</li> <li>[Process Owner: Accounting Office]</li> </ul>	D-1	Develop the financial accounting system and procedures for PHE.	■																									
			D-2	Design and install system, train staff, supervise start-up. Monitor use of new system.			■																							
			D-3	Formulate, test and implement benchmarking report format.																										
<ul style="list-style-type: none"> <li>PHE is not able to assess the impact of tariff structure adjustments on the overall revenue.</li> </ul>	<ul style="list-style-type: none"> <li>Determine, on an factual and continuing basis, the appropriate tariff structure (including blocking) with due consideration for low-income groups.</li> </ul>	<ul style="list-style-type: none"> <li>Simple <b>simulation models</b> to forecast revenues.</li> <li>Monitoring <b>access of low-income groups</b> to PHE services.</li> <li>[Process Owner: Accounting Office]</li> </ul>	D-4	Develop a simulation model to examine the impact of adjusting tariff structure on revenues and consumption patterns of various customer groups.																										
<b>E. Administrative Support System</b>				<b>Process Owner: Asset Management Office</b>																										
<ul style="list-style-type: none"> <li>No formal system to guide decision-making on asset acquisition and maintenance matters, i.e., not based on data about serviceability, demand, risk analysis, value analysis and other 'life cycle' parameters</li> <li>No analysis of maintenance expenditures.</li> </ul>	<ul style="list-style-type: none"> <li>Implement a systematic preventive maintenance program</li> <li>Control asset expenditures (equipment justification, financing, operation and control) in line with strategic intent, i.e., funds are used on assets that deliver best return based on life cycle parameters</li> </ul>	<ul style="list-style-type: none"> <li>Introduction of an <b>asset management system</b>, integrated with the MIS, which contains asset history and analysis of maintenance expenditure, breakdown frequency, burst frequency etc.</li> <li>[Process Owner: Asset Management Office]</li> </ul>	E-1	Organize the Asset Management Office and adopt a methodology for asset planning that links overall strategic direction with financial planning and project delivery.	■																									
			E-2	Design, identify software (part of integrated MIS), install, train and start up the PHE asset Management System		■																								
			E-3	Review existing asset management system; evaluation and valuation of existing assets. Monitor application.																										
			E-4	Implement a computerized Asset Register for all above and below ground assets and determine asset conditions for all assets.																										
			E-5	Introduce a preventive maintenance program for all assets using the asset maintenance management program.																										
<ul style="list-style-type: none"> <li>Inventory and spare parts system needs to be better planned and controlled.</li> </ul>	<ul style="list-style-type: none"> <li>Efficiently manage level of supplies and materials inventories through better inventory controls.</li> </ul>	<ul style="list-style-type: none"> <li>Effective <b>inventory and spare parts control</b> and availability</li> <li>[Process Owner: Asset Management Office]</li> </ul>	E-6	Examine the current inventory planning and control policies and practices in PHE.	■																									
			E-7	Recommend and implement policy and system management improvements to inventory and property management systems, including Inventory Management Module.			■																							

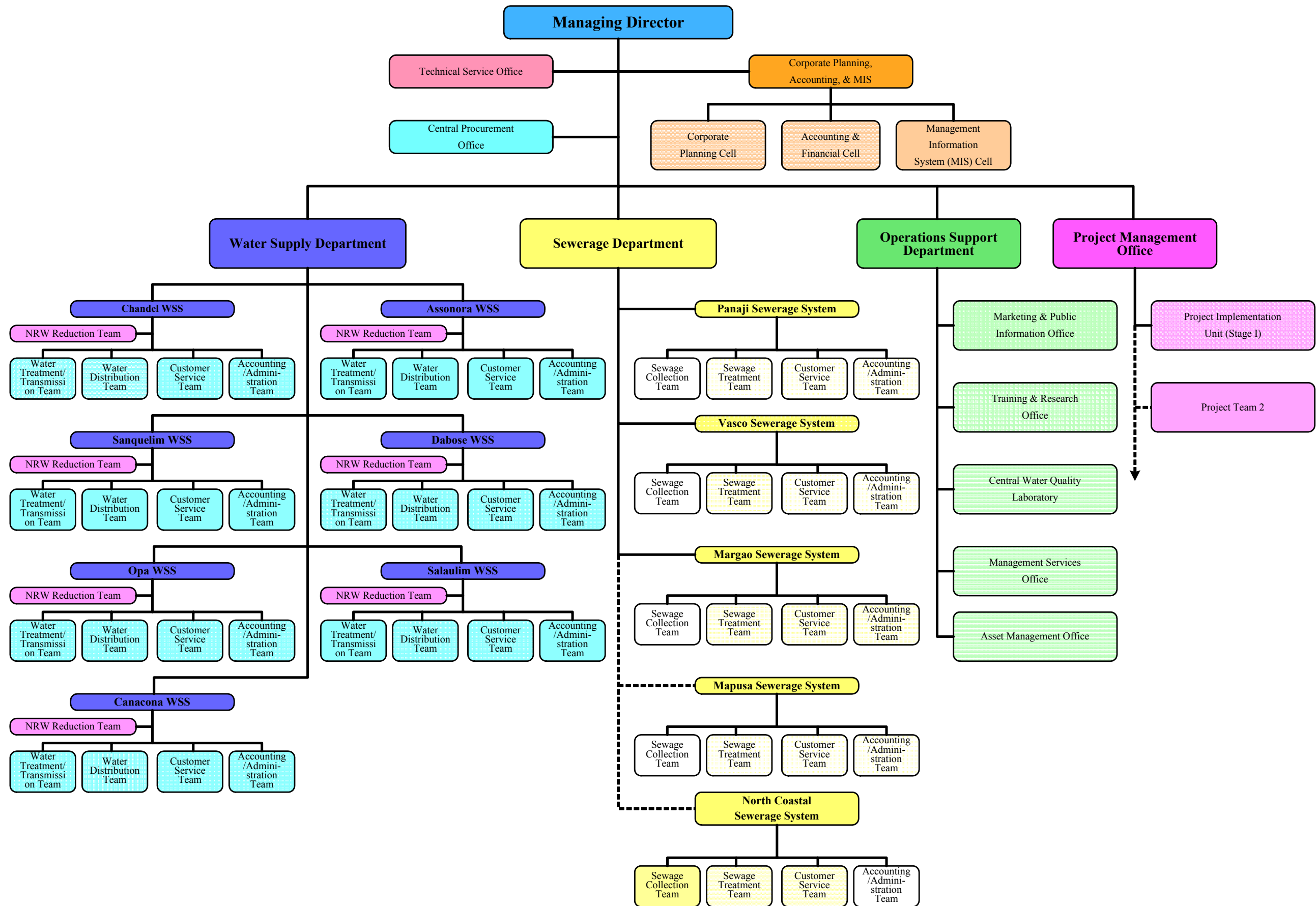
<sup>2</sup> As presented in the progress report and interim report.

Current weakness & opportunities <sup>3</sup> to be addressed	Expected 2012 Outcome		Proposed Capacity Building Activities	2007				2008				2009				2010				2011				2012						
	"PHE is better able to..."	... through .....		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4			
<b>F. Human Resources Management &amp; Development System</b>			<b>[Process Owner: Training &amp; Research Office]</b>																											
<ul style="list-style-type: none"> <li>Insufficient job descriptions and qualification standards for all job titles</li> </ul>	<ul style="list-style-type: none"> <li>Define clearly the job requirements, standards and qualification for all job titles</li> </ul>	<ul style="list-style-type: none"> <li><b>Job descriptions</b>, with clear <b>qualification</b> requirements</li> </ul>	F-1	Develop, review and update existing job descriptions for all PHE job titles.	█	█	█	█																						
			F-2	Propose practical qualification requirements and productivity standards and indicators for each of the job titles.																										
<ul style="list-style-type: none"> <li>No method for determining staffing requirements and skill specifications</li> </ul>	<ul style="list-style-type: none"> <li>Deploy the appropriate number of staff and skill mix in each work team.</li> <li>Project future skill and staffing requirements.</li> </ul>	<ul style="list-style-type: none"> <li>Adoption of rational <b>staffing and manpower projection</b> methods</li> </ul>	F-3	Conduct simple observation, work load analysis to propose a reasonable initial criteria or target to apply for staffing projections.																										
			F-4	Identify and define practical (more job specific) staffing indicators to be introduced, for example, no. of treatment operators/process train or no of water meter readers/HH/month, etc. in each department.																										
			F-5	Propose a system for regular annual updating of manpower needs based on type of skills and competency needs (not only number of staff needed).																										
<ul style="list-style-type: none"> <li>Inadequate performance evaluation and incentive system.</li> </ul>	<ul style="list-style-type: none"> <li>Assess the performance of staff and work groups;</li> <li>Provide reasonable incentives for outstanding performance.</li> </ul>	<ul style="list-style-type: none"> <li>Objectives-based <b>performance review system</b> and additional <b>performance-based incentives</b>.</li> </ul>	F-6	Formulate and get approval for an enhanced performance review and incentive system.																										
			F-7	Implement new performance review and incentive program.																										
<ul style="list-style-type: none"> <li>Unsafe working conditions, particularly in the chlorination facilities, along the major roads and streets and in confined-space facilities.</li> </ul>	<ul style="list-style-type: none"> <li>Provide staff basic safe working conditions</li> </ul>	<ul style="list-style-type: none"> <li><b>Worker safety program</b></li> <li>Health Safety and Security audits</li> </ul>	F-8	Appoint a "process owner" for health, safety and welfare matters in each working subunit. "																										
			F-9	Design and implement a H&S Strategy and site-specific System of Local Organization and Arrangements (LOAD) to handle hazards.																										
			F-10	Conduct Health Safety and Security audits and ensure that all operational and commercial sites are upgraded.																										
<ul style="list-style-type: none"> <li>Lack of long-term human resources development plan.</li> <li>Limited opportunities for staff development and training.</li> <li>Narrow "competencies".</li> <li>Financial analysis skills limited.</li> </ul>	<ul style="list-style-type: none"> <li>Provide high quality training opportunities for all staff by expansion of in-company training systems and capacity.</li> </ul>	<ul style="list-style-type: none"> <li>Regular year-round program of in-company <b>training</b> for all staff. (See Training Plan for details)</li> <li>Establishment of training and research office.</li> </ul>	F-11	Organize the PHE Training and Research Office to plan and implement an year-round program of staff development activities.																										
			F-12	Review and adoption of the overall framework for technical and managerial training proposed in this Study.																										
			F-13	Adopt a training management system (planning & monitoring, including records keeping)																										
				Establish linkages with other training and development centers in the country and Asia.																										
			F-14	Develop, implement and evaluate training plan (as proposed in this Study)																										
			F-15	Organize trainer training and materials development.																										
			F-16	Establish a staff library (for information and research) at a central location with hi-speed Internet access as part of the Training Center for use of all staff.																										
<b>G. Management information system (MIS)</b>			<b>Process Owner: MIS Unit</b>																											
<ul style="list-style-type: none"> <li>Data and record keeping not standardized; "individualized" information systems.</li> <li>Minimal sharing ("consolidation") of information among working units.</li> <li>Limited familiarity with information systems and information technology.</li> </ul>	<ul style="list-style-type: none"> <li>Standardize, share and exchange information across departments on a regular and continuing basis for sound decision making with improved data collection, processing, information integrity, reporting and dissemination.</li> <li>Use information technology effectively.</li> </ul>	<ul style="list-style-type: none"> <li>Use of appropriate <b>Management Information System</b></li> </ul>	G-1	Design comprehensive integrated MIS Development Plan, with initial focus on the following application modules: <ul style="list-style-type: none"> <li>Asset Management Module</li> <li>Financial Management and Control (Accounting) Module.</li> <li>Customer Service Module (including customer database, billing &amp; collection and complaints monitoring)</li> <li>Inventory Control Module</li> </ul>																										
			G-2	Install hardware and software; train managers and staff; start-up system.																										
			G-3	Develop MIS expansion plan for other application areas (such as Project Management, Human Resources Management, etc)																										

<sup>3</sup> As presented in the progress report and interim report.



Table 56.2 Proposed Organization Structure



## 5.7 Cost Estimate and Implementation Schedule

### 5.7.1 Introduction

The construction period of the priority projects is expected to be three years. Structural component of water and sewage treatment plants will be constructed in the first two years, while the M&E works and the test operation will be carried out in the last year. Rehabilitation of the existing water treatment plant will be carried out in parallel to the expansion works.

About other transmission mains, trunk sewers, branch sewers, reservoirs and pumping stations, there are no restrictions, so the works can be carried out at any convenient time within a period of two and a half years.

### 5.7.2 Water Supply

A summary of the water supply annual costs is presented in Table 57.1.

**Table 57.1 Annual Cost Estimate for Water Supply Components**

Item	Amount (Rs. In Million)					
	Total	2008	2009	2010	2011	2012
1. Construction Cost	3,519.38			737.91	1,906.20	875.27
1) Expansion Project	2,256.72			451.39	1,280.29	525.04
(1) Water Treatment Plant	738.01			147.61	369.01	221.39
(2) Transmission Main	1,395.20			279.07	837.16	278.97
(3) Reservoir	114.75			22.95	68.85	22.95
(4) Pumping Station	8.76			1.76	5.27	1.73
2) Rehabilitation Works	955.30			191.22	536.91	227.17
(1) Water Treatment Plant	362.80			72.71	181.40	108.69
(2) Transmission Main	537.86			107.58	322.72	107.56
(3) Pumping Station	54.64			10.93	32.79	10.92
3) Water Quality Control	17.50			0.00	17.50	0.000
4) O&M Improvement	289.86			95.30	71.50	123.06
(1) Water Supply System O&M	266.06			71.50	71.50	123.06
(2) NRW Reduction Improvements	23.80			23.80	0.00	0.00
2. Engineering Cost	351.94	70.00	130.00	43.79	70.62	37.53
3. Administration Cost	193.57	3.50	6.50	39.09	98.84	45.64
4. Land Acquisition	0.00	0.00	0.00	0.00	0.00	0.00
5. Physical Contingency	387.13	7.00	13.00	78.17	197.68	91.28
6. Price Contingency	1,240.57	5.15	19.78	184.71	645.11	385.82
Total excluding Price Contingency	4,452.02	80.50	149.50	898.96	2,273.34	1,049.72
Total	5,692.59	85.65	169.28	1,083.67	2,918.45	1,435.54
Total In Million US\$ (in Million US\$1.00=Rs.45.24)	125.82	1.89	3.74	23.95	64.51	31.73



Notes: 1) Improvement and rehabilitation of distribution system and installation of house connections should be conducted as routine work of the PWD. Therefore, costs for these portions are not included in table above. However, these costs are taken into account for following economic/financial analysis.

2) Components of 3) Water Quality Control and 4) O&M Improvement are derived from improvement of O&M improvement plan, therefore, these components are not listed as priority projects for water supply as shown on Table 52.1.

### 5.7.3 Sewerage

A summary of the sewerage annual costs is presented in Table 57.2.

**Table 57.2 Annual Cost Estimate for Sanitation Components**

Item	Amount (Rs. In Million)					
	Total	2008	2009	2010	2011	2012
1. Construction Cost	881.20			262.92	314.34	303.94
1) Margao	344.97			98.91	123.03	123.03
(1) Trunk Sewer	108.18			36.06	36.06	36.06
(2) Branch Sewer	132.15			44.05	44.05	44.05
(3) Pump	10.84			0.00	5.42	5.42
(4) Sewage Treatment Plant	93.80			18.80	37.50	37.50
2) Mapusa	234.56			68.12	85.22	81.22
(1) Trunk Sewer	77.73			25.91	25.91	25.91
(2) Branch Sewer	75.33			25.11	25.11	25.11
(3) Pump	0.00			0.00	0.00	0.00
(4) Sewage Treatment Plant	81.50			17.10	34.20	30.20
3) North Coastal Belt	286.67			80.89	106.09	99.69
(1) Trunk Sewer	79.23			26.41	26.41	26.41
(2) Branch Sewer	103.44			34.48	34.48	34.48
(3) Pump	10.40			0.00	5.20	5.20
(4) Sewage Treatment Plant	93.60			20.00	40.00	33.60
4) O&M Improvement	15.00			15.00	0.000	0.00
2. Engineering Cost	105.74	20.00	40.00	11.55	17.72	16.47
3. Administration Cost	49.34	1.00	2.00	13.72	16.60	16.02
4. Land Acquisition	18.20	9.10	9.10	0.00	0.00	0.00
5. Physical Contingency	100.52	2.91	4.91	27.45	33.21	32.04
6. Price Contingency	318.16	2.11	7.40	64.86	108.36	135.43
Total excluding Price Contingency	1,155.00	33.01	56.01	315.64	381.87	368.47
Total	1,473.16	35.12	63.41	380.50	490.23	503.90
Total In Million US\$ (in Million US\$1.00=Rs.45.24)	32.57	0.78	1.40	8.41	10.84	11.14

### 5.7.4 Capacity Building, Institutional/Organizational Improvement

A summary of the capacity building, institutional/organizational improvement annual costs is presented in Table 57.3.

**Table 57.3 Annual Cost Estimate for Capacity Building, Institutional/ Organizational Improvement**

	Amount (Rs. In Million)						
	2007	2008	2009	2010	2011	2012	Total
1. Institutional/Organizational Improvement Cost	48.99	49.34	49.58	49.39	44.41	42.47	284.18
2. Engineering Cost	5.01	5.05	5.07	5.06	4.55	4.35	29.09
3. Administration Cost	2.70	2.72	2.73	2.72	2.45	2.34	15.66
4. Physical Contingency	5.40	5.44	5.47	5.45	4.90	4.68	31.34
5. Price Contingency	0.00	4.00	8.31	12.87	15.98	19.79	60.95
Total minus Price Contingency	62.10	62.55	62.85	62.62	56.31	53.84	360.27
Total	62.10	66.55	71.16	75.49	72.29	73.63	421.22
Total (in Million US\$1.00=Rs.45.24)	1.37	1.47	1.57	1.67	1.60	1.63	9.31

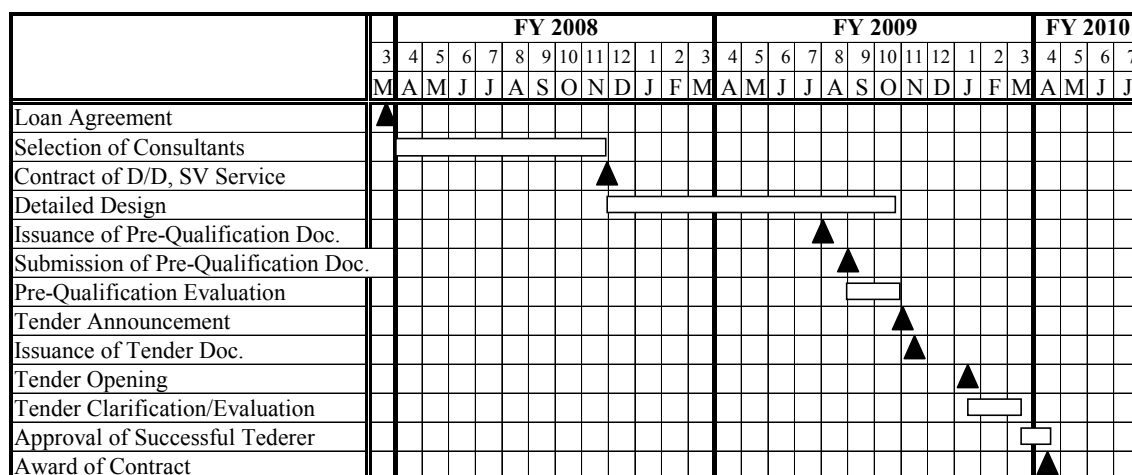
**5.7.5 Implementation Schedule**

Construction period for water supply and sewerage systems is scheduled to be for three years from year 2010 to 2012. A consultancy service for the capacity development is scheduled to be implemented at the same time.

**5.7.6 Schedule of Pre-construction Stage**

Before award of contracts for contractors, there are several procedures or stages are required such as detailed design, pre-qualification of contractors, bidding, and bid evaluation as pre-construction stage.

Schedule of the pre-construction stage is prepared as shown on figure below to be able to commence the constructions or services for capacity development from the year 2010. As shown on this schedule, it is recommended to complete budgetary arrangements by the end of fiscal year 2007.



**Figure 57.1 Schedule of Pre-construction Stage**

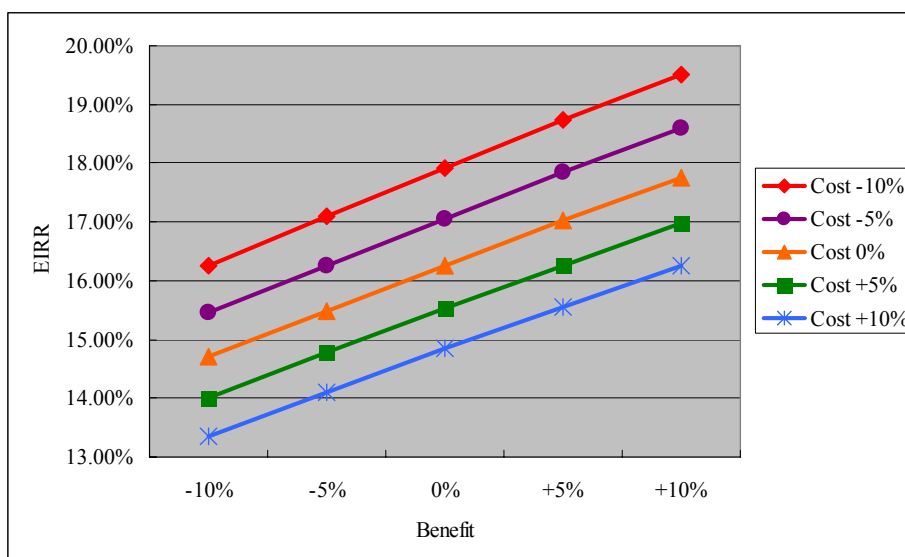
## 5.8 Economic and Financial Analysis

Economic and financial analyses were conducted applying same method as master plan.

### (1) Priority Projects for Water Supply

The EIRR of the proposed priority projects was estimated at 16.3%, which exceeds the opportunity cost of capital at 12%. This indicates that the projects are economically viable. The NPV, and B/C ratio was Rs.1,064 million and 1.35, respectively.

The results of sensitivity analysis indicated that the priority projects for water supply are still economically viable with more than 12% EIRR, even under the fluctuations of costs and benefits within the range of plus minus 10%, as shown in the Figure 58.1.



**Figure 58.1** Sensitivity Analysis of EIRR of Priority Projects for Water Supply

Feasibility of the priority projects for water supply was analyzed, assuming the following tariff increases applied each year until the year 2025. The FIRRs were as follows:

**Table 58.1** FIRR estimation for each case of tariff increase

Case	Tariff increase per annum				FIRR
	Domestic		Non-domestic		
Case 1	Domestic	0 %	Non-domestic	0 %	N.A.
Case 2	Domestic	3.00%	Non-domestic	1.50%	4.50%
Case 3	Domestic	3.50%	Non-domestic	2.00%	5.20%
Case 4	Domestic	4.00%	Non-domestic	2.50%	5.88%

Note: \*1; Rate of tariff increase excludes the inflation adjustment.

Water tariff in the year 2025 by applying annual 3.50% increase is estimated at 2.04% of the average household income, assuming continuous economic growth of Goa State. The percentage is under the household's willingness to pay (2.48%) and is below the household's affordability to pay (3.5%). The project is deemed to financially feasible when the annual tariff increase of 3.5% and 2.0% is implemented for domestic and non-domestic sectors respectively, since the FIRR exceeds the discount rate at 5.15%.

Sensitivity analysis was conducted for the Case 3 of Table 58.1. Shaded areas in Table 58.2 are the combinations of cost and benefit changes that make the priority projects not to be financially feasible. Basically, when the cost increases, benefit must be raised at the same percentage of cost increase in order to be the projects feasible. On the other hands, by reducing the total costs of projects including O&M costs, PHE is able to restrain the increase of the benefit, in other words, necessary tariff revenues.

**Table 58.2 Sensitivity Analysis of FIRR of Priority Projects for Water Supply**

%		Benefit				
		-10%	-5%	0%	5%	10%
Cost	-10%	5.20%	5.71%	6.20%	6.66%	7.12%
	-5%	4.69%	5.20%	5.68%	6.14%	6.59%
	0%	4.21%	4.71%	5.20%	5.66%	6.10%
	5%	3.76%	4.26%	4.74%	5.20%	5.64%
	10%	3.33%	3.83%	4.30%	4.76%	5.20%

**(2) Priority Projects for Sewerage**

The economic evaluation indicated that EIRR was 12.7%. NPV, and B/C ratio was Rs.47 million and 1.06, respectively. The project is economically viable because the EIRR exceeds the opportunity cost of capital at 12%.

Sensitivity analysis was conducted for EIRR of sewerage priority projects. Shaded areas in Table 58.3 are the sets of cost and benefit changes that make the priority projects not to be economically viable. It must be careful that the projects may not become economically viable if the project costs increase more than 10% without benefits increase.

**Table 58.3 Sensitivity Analysis of EIRR of Priority Projects for Sewerage**

%		Benefit				
		-10%	-5%	0%	5%	10%
Cost	-10%	12.74%	13.40%	14.05%	14.68%	15.29%
	-5%	12.09%	12.74%	13.37%	13.98%	14.58%
	0%	11.48%	12.12%	12.74%	13.34%	13.92%
	5%	10.92%	11.55%	12.15%	12.74%	13.31%
	10%	10.39%	11.01%	11.60%	12.18%	12.74%

The FIRR was not available for the proposed sewerage priority projects. The benefit cost ratio (B/C) was found to be only 0.13, which indicates the present value of benefits is only 13% of the present value of costs. NPV was minus Rs.1,075 million. Sensitivity analysis indicated that sewerage priority projects are financially not feasible even under the any combination of costs and benefits changes within the range of plus minus 10%.

Generally, it is not easy to recover the full costs of sewerage project including capital expenditure, since sewerage charge is usually not high enough to recover the full cost. On the other hands, benefits of sewerage are not limited to the users but also to the others. Therefore, it is recommended for sanitation services to aim the cost recovery for operation and maintenance in the long run and provision of public fund as subsidy.

Financial plan was compiled regarding sanitation service of PHE covering all the existing and expansion facilities with sanitation master plan. Annual tariff raise until 2025 was calculated at 7.5% for domestic and 6.0% for non-domestic at constant price to secure the cost recovery of the operation and maintenance costs excluding depreciation costs and interest expenses.

Sewerage charge in 2025 raised at 7.5% per annum at constant price will be less than the ceiling of ATP and WTP for sanitation under the assumption of 3% annual growth of average household income at constant price.

Above tariff raise may cause the strong resistance from customers and PHE may not able to conduct the tariff raise enough to recover the O&M costs. For such a case, the required amounts of subsidy are predicted as follows for sewerage enterprise to keep providing the service for several cases of sewerage tariff raise, which are less than the proposed rate of tariff raise.

**Table 58.4 Annual Necessary Subsidy and Accumulated Subsidy for Each Tariff Raise**

(Unit: Rs. in million)

Tariff raise	Necessary subsidy/year (constant price)						Accumulated subsidy by 2042
	2010	2015	2020	2025	2030	2035	
Domestic:0%, Non-domestic:0%	181	238	380	356	344	348	<b>10,787</b>
Domestic:3%, Non-domestic:2%	180	234	364	321	301	305	<b>9,870</b>
Domestic:4%, Non-domestic:3%	180	231	356	301	277	282	<b>9,375</b>
Domestic:5%, Non-domestic:4%	179	229	347	278	248	253	<b>8,755</b>
Domestic:6%, Non-domestic:5%	179	226	336	249	214	219	<b>8,051</b>
Domestic:7.5%, Non-domestic:6%	179	223	324	211	168	173	<b>7,101</b>

Notes: \*1; Excluding inflation adjustment. The table shows the extracts of subsidy for every five years, but actually subsidy inputs is required every year until the year 2042.

Regarding the sewerage enterprise, it is recommended that 7.5% annual tariff raise for domestic and 6.0% annual tariff raise for non-domestic at constant prices, since it is advisable to recover the major O&M costs for sewerage. Nevertheless, in case that the less tariff raise is conducted actually, it is impossible for the enterprise to keep providing the project benefits continuously without the inputs of above mentioned subsidy to the sewerage enterprise.

## 5.9 Social Consideration and Environmental Impact Assessment

### (1) Public Consultation

It is important to consult with the stakeholders to generate support for the priority projects. The main component of the third stage of public consultation was a 3rd stakeholder meeting. The 3rd stakeholder meeting was held by the PWD in cooperation with the JICA Study Team on 18 July 2006. Results from the Rapid-EIA study were presented to the stakeholders at this meeting. These results could include the impact of the priority projects, analysis of alternative project options, recommended mitigation measures, and environmental monitoring programs. The need for the PWD to provide better daily customer services was highlighted in the discussion as well as second stakeholder meeting.

### (2) Implementation of Rapid-EIA

In practice, any water supply and sewerage projects are not included targeted sectors for EIA requirement in National level. However, environmental clearance is necessary in relation to any development projects within Goa State. However, the proponent needs to prepare the "Rapid-EIA" to gain official approval from the Goa State Pollution Control Board and DST&E and to satisfy requirement of international donor agencies. Accordingly, the Rapid-EIA report must submit to the Impact Assessment Wing as soon as practicable to obtain the permission of environmental and social consideration clearance. The Study Team assisted the PWD to

conduct the Rapid-EIA for the selected priority projects. The Rapid -EIA report was prepared in accordance with JICA's Environmental and Social Consideration Guidelines.

### **(3) Results of Rapid-EIA and Recommended Mitigation Measures**

The Rapid-EIA study was undertaken to identify any potential negative or positive impacts on the social and natural environment, resulting from the Feasibility Study for the priority projects. A full evaluation of potential significant anticipated impacts both environmental and social aspects, and the recommendation of mitigation measures are provided in the Rapid-EIA report (see Volume V Appendix Feasibility Study). It is recommended that a Rapid-EIA report that prepared by the project proponent (PWD) must submit to the DST&E without delay.

Several mitigation measures for avoiding anticipated negative impacts were also considered in the Rapid-EIA report. Before implementation of the priority projects, PWD must formulate the Environmental Management Plan in detail to present both domestic and international agencies as part of an environmental clearance procedure. It is also essential to involve the staff who will be responsible for the execution of the Environmental Management Plan as well as to train the staff in practising the mitigation actions.

## **5.10 Emergency Measures To be Taken by the PWD/PHE**

### **5.10.1 Water Supply System**

#### Preparation of Asset Drawings

The PHE is recommended to prepare the drawings of its assets and maps with adequate scales, and keep those not only at the headquarters, division offices and sub-division offices but also at the site of each facility.

#### Collection of Operation and Maintenance Data

The PHE is recommended to collect and maintain operation and maintenance data and records, and keep those not only at the headquarters, division offices and sub-division offices but also at the site of each facility.

#### Cleaning up the Facilities

The PHE is recommended to clean up at all facilities and to keep clean not only for appearance and keeping chemicals of good condition and quality but also for as safety measures.

#### Repair of Visible Leaks

There are many visible leaks at the WTPs and at the air and scour valves located along the

transmission and distribution mains. It is recommended to repair all visible leaks as soon as possible.

#### Implementation of On-going Projects without Delay

The PHE is implementing the projects such as Dobose, Canacona, Assonora, pipe installation to Panaji and replacement of existing transmission from Salaulim WTP at present. For preparation of the master plan and feasibility study, these projects are taken into account. The PHE is recommended to execute/complete these projects without any delays or suspensions.

#### Ganjem and Maisal Schemes

The PHE has plans of implementation of the Ganjem (25 MLD) and Maisal (10 MLD) Schemes for securing the water supply to Panjim as emergency measures. General plans on these schemes have prepared respectively according to the request and information from the PHE and the results are attached to Volume IV Appendix for Master Plan. It is, however, recommended that the PHE should study in detail the necessary capacity of each scheme based on the demand projection and possibility of supply area from each scheme comparing with costs required.

#### Development of Distribution Network

It should be noted that since the priority projects cover only transmission pipelines upto the reservoirs, the PHE should develop distribution network systems from the reservoirs depending on the expansion of the service area for the Salaulim WSS and install the distribution pipelines and house connections every year as the routine works.

#### NRW Reduction Roll-out Plan

PWD will need to consider implementation of the NRW Reduction Roll-out Plan and in doing so will need to progressively implement the detailed NRW mitigation measures in order to bring NRW under control now and into the future. The scale of the tasks involved in tackling NRW reduction should not be underestimated and PWD will therefore need to decide on the best strategic approach in bringing NRW under control as well as maintaining it within acceptable and economic levels in future bearing in mind the desire to augment schemes and to provide 24 hour supply capability.

### **5.10.2 Sewerage System**

#### Sanitation Improvement Outside the Sewerage Area

It is recommended that the PWD undertake sanitation improvement for the areas outside of the sewerage service area. To achieve this, the PWD should provide technical and financial



assistance to residents for the construction and maintenance of on-site and decentralized treatment facilities. It is also recommended that the PWD improve its public relations regarding sanitation.

#### Sewer Cleaning

The blockage of sewers causes serious problems for sewerage systems. Blockages not only generate odor, but can also cause sewage overflow into gutters and contamination of groundwater. Periodic sewer cleaning is necessary to prevent blockages and to prevent a decline in the sewer capacity (caused by the accumulation of sand, soil and other materials). It is therefore recommended to undertake a survey of sewer conditions, to prepare a cleaning schedule, to procure cleaning equipment, to secure appropriate personnel, and to prepare a budget.

#### Ambient Water Quality Monitoring

Water quality data analyzed by PWD or agencies concerned are not adequately accumulated and it is difficult to utilize these data for evaluation of environmental conditions. The PWD is recommended to monitor surface and groundwater quality, in order to assess and improve water quality. An effective monitoring system should involve relevant organizations and agencies, such as the pollution control board, the health department, and the water resource department and Central Laboratory which will be established under the priority project. It is recommended that water quality monitoring data be shared between the related organizations and agencies.

### **5.10.3 Capacity Building**

#### Physical System

PHE can immediately take the following steps prior to the implementation of the capacity building plan with respect to the management of the physical water and sewerage systems.

- Prepare an initial list of areas where operation and maintenance guidelines should be developed. There are areas suggested in the O&M assessments.
- Draft a standard format for how each guideline should look like;
- Gather and centralize all existing written equipment manuals and “as-built” drawings;
- Implement the expanded NRW Reduction Program based on the pilot study to other key areas and,
- Identify and agree on other areas of current operations which could be outsourced for public private partnerships.

### Organization Planning System

On the organization planning system, much of the improvements will have to be initiated during the period of external technical assistance itself. Many of the improvements needed are founded on a new set of corporate values and processes which need to be understood.

### Customer Service System

The following steps can be initiated by PHE with respect to the customer service system improvements.

- Review and update its present “Citizens Charter” with a view towards challenging its own ability to provide high quality services to the consumers.
- Continue holding regular consultations with the public on current issues, similar to those Stakeholders Meetings initiated during the Study period.
- Clean up and verify customer database using independent house-to-house surveys in preparation for the implementation of a computerized system.
- Organize and implement the concept of Citizens Advisory Councils to advise PHE management on how to proceed.

### Administrative System

To facilitate the introduction of an asset management system and an improved inventory control system, PHE can immediately take up the following tasks.

- Initiate a simple registry of available existing assets, including the current condition of the asset.
- Prepare a unified process map starting from the requisition, procurement, store-keeping, issuance and reporting of all supplies and commonly-used spare parts.

### Human Resources Management and Development System

In preparation for the human resources management system improvements, PHE should:

- Conduct a detailed review of the existing available job description in the CPWD Manuals and prepare additional annotations and remarks about other tasks which the incumbents are currently doing or are responsible for.
- Implement the health and safety improvement recommendations indicated in the O&M improvement plans.
- Organize, on an interim basis, a training committee to start planning and implementing basic training programs; identify local resources in the State who may be tapped to provide the training services. Trainers or speakers may be invited to make presentations as part of the regular management staff meetings of PHE.

### Management Information System

In the immediate future, PHE should continue to keep abreast of the current initiatives to set up the MIS of the PWD (which currently focuses on capital investment monitoring for roads projects). It should take advantage of the training programs currently underway. The expanded MIS for PHE will seek to be integrated into (and be part of) the broader MIS of PWD.

- Attend the basic MIS training programs currently being organized for PWD staff.

### Preparatory Activities for Internal Re-structuring Agenda

PHE management should undertake a detailed review and plan to implement the proposed restructuring, including the movement of staff and transfer of responsibilities. The initial set of the activities involve securing the needed approvals for the restructuring.

### Preparatory Activities for the Policy and Legislative Agenda

Much of the needed institutional and managerial improvements will need to be initiated by PHE itself. With respect to the legislative and policy agenda, the Study recommends that PHE an initial paper be put together for discussion first among the PHE management team and for consideration of PWD and State officials. As presented in the Study, the key recommendations involve:

- Authorization of PHE to undertake internal restructuring;
- Authorization of PHE to use of independent financial accounting systems and other financial management guidelines, such as proper treatment of depreciation and use of external auditors and other safeguards;
- Enable PHE to retain revenues generated (plus a state subsidy indexed on revenue generated (or other performance targets) to support water and sewerage services);
- Authorization of PHE to adopt personnel rules and regulations (including, compensation enhancement schemes, incentives, sanctions, job classification, training, etc) based on ;
- Guarantee security of staff to be affected by the reforms; and
- Create mechanisms for regular dialogue with consumers and consumer groups.

The Water Sector Reform initiatives also suggest consideration of new sector policy legislation. The recommendations mentioned above are consistent with the intent and spirit of that reform. It is envisaged that all these policy recommendations will be taken up as a single policy reform action.

The Strategy will be to coordinate with the legislative agenda of ongoing sector reform

If the reform recommendations are fully accepted, the Institutional Development Plan will certainly be more challenging. The scope and scale of the Plan will be tailored to suit the policy decision made.

#### **5.10.4 Improvement of Financial Management**

##### Planning and design of independent accounting systems

The compilation of independent accounting system tailored for water supply and sanitation services shall be strongly recommended. The intent is to make available to PHE and PWD managers, timely and vital financial information affecting their internal operations as a business. The introduction of this system helps to bring PHE performances more transparent; and help sector policymakers and concerned State officials make informed decisions about tariff and service levels.

##### Meter Reading and Bill Collection Procedure

It is strongly recommended that the PHE standardize the period of meter reading for all sub-divisions. In cases where there is no enough capacity to conduct monthly meter reading, data input, bill preparation or bill delivery, the sub-division are able to conduct meter reading once every two months as described in the Chapter 7 of Volume III. By having consistent meter reading and billing periods across all divisions, the PHE will be able to identify malfunctioning water meters and data input mistakes at bill preparation, in addition to obtaining much useful management and financial information.

##### Promotion of connection to the public sewer system

Especially in Margao, low connection rate to the public sewer is one of the important problems for PHE's enterprise management. For example, by 'One Time Subsidized Sewerage Connection Scheme' that was implemented during April to August 2005, 1,508 customers were newly connected to the public sewer system. On the other hands, Rs. 3 crores public funds were required as the total cost for all the connections. As a result, it is calculated that on average Rs.19,894 was required for the sewer connection per customer. Initial burden on an applicant is one of the major constraints for PHE to increase the customers of public sewer system, since the initial construction cost to connect sewer in their own land is approximately as much as three to four times of average household income. It is necessary that state government shall establish the legal framework which obligates residents to connect to the public sewer system. Even after the development of the legal system, the initial construction cost is still heavy burden on the residents. Therefore, it is recommended to implement the installment plan for initial cost of public sewer.

### Reduction of Public Stand Post by promoting the house connection

Presently, PWD is promoting the reduction of PSP and application to the house connection. Consumption of water from PSP is usually not billed and does not generate revenue. Unbilled PSP is one of the major causes for the high NRW rate in Goa. Promotion of the reduction of PSP by PHE is appreciated in the aspect of financial management. Introduction of installment payment described above is also considered useful to promote the application to house connection, in case the initial investment cost is the hurdle for new customers. It is recommended that installment plan for water connection shall also be implemented as one of the emergency measures.

## **5.11 Need for Project Implementation**

### **5.11.1 Project Components**

The feasibility study assesses three key components of the target priority projects. The first component is the development of the water supply system. The second component is the development of the sewerage system. These two components require facility improvement and include construction work. These components can be categorized as hardware improvements. The third component is capacity building of the PWD/PHE, including reduction of NRW and asset management. This component is a fundamental part of the first and the second components because it will help to secure the sustainability of the water supply and sanitation systems.

The policy, strategy and action plan for capacity building is discussed in the feasibility study. These items are not only for discussion in the feasibility study but also represent key actions that need to be implemented to support the facility improvement.

The feasibility study recommends actions that would build the capacity of the PWD/PHE. External assistance would be required to implement these actions. A contracted management consultant would provide this assistance. The contractor would develop a detailed action plan for presentation to the PWD/PHE. The action plan would be based on the capacity building plan described in the feasibility study. The contractor would work with the PWD/PHE to assist them implement the action plan. This component would include various kinds of training (including on-the-job-training), and asset inventory surveys to help with asset management.

Utilization of JICA Expert Scheme might be one of alternative external assistances as part of the priority projects.

The technical, financial, and environmental feasibility of the three components of the priority projects have been analyzed in previous chapters. Financial feasibility is confirmed under the condition of full O/M cost recovery. This does not currently occur in India. For the water supply project to be financially feasible not only would full O/M cost recovery be required, but part of the capital investment cost would also need to be recovered.

Increases to the water and sewage tariff would be required to recover these costs. The proposed tariff increase plan is presented in the feasibility study. The proposed tariff increases have been carefully set so as not to exceed the customers' willingness to pay and affordability to pay during the design life of the project (through to 2025). The proposed rate for increasing tariffs does not to exceed the historical rate of increases.

In this context, it can be concluded that the project is feasible and that sustainable management of the water supply and sewerage system can be strengthened by undertaking capacity building (which is the third component of the project).

#### **5.11.2 Need for Project Implementation**

##### **1) Reducing water shortages and improving environmental conservation**

Water demand has been increasing as a result of population growth, improved living standards, industrial development and the increased number of tourist visiting Goa. The demand now exceeds the supply capacity and water shortages are expected in the near future. To reduce the likelihood of water shortages the development of the water supply system is required as soon as possible. Increased water usage increases wastewater generation from domestic and non-domestic customers.

Goa is a world famous beach resort. Approximately 1.8 million tourists visited Goa during 2005. The number of tourists is expected to increase to 4 million by 2025. Tourism is one of the most important industries in Goa. Improving the water supply and sanitation situation is fundamental to supporting the development of the industry. Improvements to the sewerage system will help to prevent further contamination of the beautiful natural environment in Goa.

NRW reduction is one of the main components of the capacity building program. NRW reduction will also help to avoid water shortages. JICA Expert Scheme might be applicable for

NRW reduction introducing Japanese experiences of leakage and NRW reductions.

2) Delivering a Continuous Water Supply (24 hours a day, 7 days a week)

Goa's water is currently supplied intermittently, meaning people can only access water several hours each day. The water supply master plan was developed to help move the system from providing intermittent supply to providing a continuous water supply. Currently, no water supply authority in India supplies water continuously. The measures that are needed to provide for a continuous water supply are described in the previous section. As the previous section indicates, to achieve a continuous water supply both technical changes and capacity building are required.

3) Internal Structural Reform and Independent Accounting System

To transform the PWD/PHE into a more customer oriented, accountable, and effective organization, the feasibility study proposes internal structural reform. The capacity building required for this reform will be undertaken with external assistance.

Currently, the PWD does not undertake financial management because all of the tariff revenue is transferred to the state government. Also, the annual PWD budget is provided by the state government. This situation means there are no strong incentives for the PWD to generate revenue or to reduce expenditure. Therefore, in the long term, it is recommended that the PWD operates to be financially self sufficient. The feasibility study recommends that an independent accounting system be introduced during the transition period. Introduction of an independent account system does not need any changes to the existing legislative framework. The independent accounting system will allow the PWD to improve its financial management ability gradually. As the PWD becomes aware of and responsible for its financial situation cost savings and increases in revenue will result.

These structural reforms and the introduction of an independent accounting system are recommended for implementation as part of the capacity building project.

4) Poverty Alleviation

There are very few "notified slums" in Goa, however Margao and Vasco have some small scale slums. These slum areas are covered by the priority water supply project. According to the Government of Goa's policy, new water connections to low income groups in "notified slums" will be provided by the government but the monthly tariff should be paid by the consumer.

5) Using this Project as an Example of Best Practice in India

Development indices for Goa state (such as socio-economic levels, living standard, infrastructure, culture and education) are higher than the average figures for India. Therefore Goa has significant potential capability to establish a sustainable, accountable, customer oriented, and reliable public service provider. The priority projects proposed in the feasibility study include aspects of best practice such as providing continuous water supply, capacity building including NRW reduction, asset management, cost recovery, an independent accounting system, and institutional reform. These practices have proven very difficult for India in the past. If these best practices are implemented in Goa, other states in India can learn from Goa's experiences. This will make it easier to implement similar practices in the other states in the future.

These practices can be implemented in the short and medium term without changing the existing legislative framework or the status of the PWD/PHE as a public service provider. Although the PWD/PHE will remain a public authority, outsourcing some of the services, such as meter reading/billing, operation and maintenance of plant, and sewer cleaning, should be considered as a means of improving the service efficiency.

### **5.11.3 Actions for Project Implementation**

1) Vigorous Approaches of the Government of Goa

To implement proposed projects and to attract external financial sources, the Indian side understood the importance of vigorous approaches of the Government of Goa to central government or international lending agencies.

2) Establishment of Project Implementation Unit

To implement to project smoothly, the PWD/PHU should establish the Project Implementation Unit (PIU). Roll and formation of the PIU is described in Volume III Chapter 7. The PIU shall be central control center of entire project implementation from budgetary arrangements for project implementation to handing over the facilities to PHE department concerned.

3) Reserving Land Space Required for the Projects

According to the consultation with the Government of Goa, land spaces required for the projects are owned by government or communities, therefore, land acquisition will not be required. However, to reserve the land spaces as planned in the feasibility study, coordination with other departments which have jurisdiction of the land and with communities is indispensable and such coordination should be started as soon as possible.



4) Arrangements of Organization for Operation & Maintenance of the New Facilities

Several new facilities are planned to be constructed under the projects. Organization with adequate staffing should be arranged for sustainable operation and maintenance. Details of arrangements required for the new facilities are described in Volume III Chapter 7.

5) Necessity of Detailed Design

After budgetary arrangements are completed, detailed design should be conducted before starting bidding procedures. The preliminary design conducted during the feasibility study stage of this project was based on a preliminary topographic survey and preliminary geotechnical investigations. The preliminary design was undertaken to identify possible locations and land area requirements for the proposed facilities, and potential pipe alignments. The preliminary design was also used to estimate the project costs used in the economic/financial analysis and to provide basic information for international lending agencies. The preliminary design is not suitable to inform construction work.

Construction work should be based on detailed design drawings, not the preliminary design drawings. The detailed design drawings will be prepared as part of the next stage of the project. The detailed design drawings will be based on more detailed topographic survey and further geotechnical investigations. A more detailed topographic survey may provide more accurate information about land ownership which would facilitate the land acquisition process. Further geotechnical investigations are required to locate any underground utilities such as telephone and electric cables. Depending on the location of these utilities the location of the proposed facilities, the pipe alignments, or the foundation types may need to be revised from those proposed in the preliminary design.